JCP

Consulting Engineers

Chinley Community Centre

Specification for the Electrical Engineering Services

Tender Issue

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SECTION 1

GENERAL AND STANDARD REQUIREMENTS

ELECTRICAL

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GENERAL AND STANDARD REQUIREMENTS - ELECTRICAL

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Clause **Page**

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SECTION 1

GENERAL AND STANDARD REQUIREMENTS

ELECTRICAL

PART 1 - PREAMBLE

Clause

1.1.1 Introduction

The word "shall" is mandatory.

The word "will" is informative.

The word "should" is advisory.

The word "provide" means supply and fix or install.

This section specifies the necessary standards and general quality of the Electrical Installation.

Sections 2 and 3 and the accompanying drawings specify in detail the installation to be provided.

All clauses of this section relating to content (not quality) may not apply to this project and only those relevant are applicable. Any work shown on the drawings but not described in the specification or vice versa shall be provided.

1.1.2 Compliance with Regulations

The complete installation shall comply with the following: -

a) The Seventeenth Edition of the Regulations for Electrical Installations issued by the Institute of Electrical Engineers (to be referred to as the IET Regulations or BS).

b) The Electricity Supply Regulations 1937 incorporating the latest amendment.

c) The Electricity (Factories Act) Special Regulations 1908 and 1994, incorporating the latest amendments).

d) The Health and Safety at Work etc. Act 1974 and subsequent additions, e.g. Electricity at Work Act.

1.1.3 Inspection and Testing

The whole of the installation shall be inspected and tested by the Contractor in accordance with the IET Regulations.

Preliminary testing shall be carried out by the Contractor to ensure that all faults are cleared. The Architect shall witness the final tests and shall be given the option of witnessing the preliminary tests. Seven days' notice shall be given in each case.

In addition to submitting Inspection and Completion Certificates as required by the IET Regulations, the Contractor shall provide certificates for any tests carried out to comply with this specification, e.g. fire alarm tests and commissioning, T.V. aerial signal strength tests and cable pressure testing. These shall include description, date, nature and duration, as well as results.

THE WORKS WILL NOT BE ACCEPTED UNTIL ALL CERTIFICATES ARE APPROVED BY THE ARCHITECT.

All test equipment shall be provided by the Contractor for which current (within one year) certificates of accuracy shall be made available to the Architect.

Where existing installations have been modified or extended, all systems associated or affected by the works shall be tested as stated above.

1.1.4 Routine/Witnessed Tests of Plant

Where routine tests are applied to the plant before delivery to site, two copies of the relevant test certificates shall be forwarded to the Architect.

On certain occasions the Architect may wish to witness tests carried out on plant before delivery to site. These instances will be detailed when required and the Contractor shall give at least seven days' notice, in writing, of the date of these tests. Two copies of all test certificates subsequently supplied to the Contractor by the manufacturer shall be supplied to the Architect.

1.1.5 Instruction Period

The Contractor shall allow for the instruction of personnel appointed to operate and/or maintain items of plant or system. Agreed times shall be set aside before contract completion to ensure that all systems or plant are fully understood by the occupier.

1.1.6 Spares

The following spares shall be supplied by the Contractor on or before the date of completion: -

a) **Fire Alarm - Break Glass Units**
1 Nr. spare glass for each 4 Nr. installed.

b) **HRC Fuse Links**
5 Nr. of each rating used up to 100 amps.
2 Nr. of each rating used over 100 amps.

Adjacent the main switchboard the Contractor shall provide a suitable wall mounted box to accommodate the spare fuse links.

1.1.7 Position and Neatness of Installation

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The positions of all plant shown on the drawings will be used for the purposes of tendering, but the Contractor shall not scale the drawings for actual site installation. The Contractor shall set out work involved and take all measurements and dimensions required for the erection of plant, on site, making any modifications in detail as found necessary during the progress of the work.

The Contractor shall ascertain on site that the installation will not foul other services or furniture, and any work requiring alteration due to negligence in this respect shall be at the Contractor's expense. Particular care shall be taken to obtain uniform and tidy arrangements of wall and ceiling mounted equipment. The precise position of an item of equipment shall be determined as follows: -

a) Single items of equipment which are visually remote from other electrical or mechanical equipment shall be erected at the following mounting heights, except where stated otherwise in the specification or on the tender drawings.

Item	**Height (mm) from floor level to centre line of unit**
Light switch	1100
Socket outlet (general) & telephone outlet	450
Fire alarm break glass unit	1200
Clocks	2250
Thermostats	1200
Socket outlet (over worktop) & telephone outlet	150 above worktop to centre line of unit

In accommodation specifically intended for wheelchair users, such as accessible bedrooms, operable controls should be located at a height of not more than 1.0m above floor level

b) Two or more items of equipment, whether electrical or mechanical or both, which are to be erected on the same wall or ceiling or which will be otherwise visually close to each other, shall be arranged in a neat and symmetrical group. Symmetry shall be obtained by horizontal and vertical alignment through the centre lines of the equipment and for this purpose the mounting heights may be varied slightly from those specified or on the tender drawings.

In the planning of arrangements the Contractor shall ensure that the positions of other services and outlets have been fully taken into account. Exact positions of plant and equipment shall be marked out on site and agreed with the Architect prior to installation and before any holes or chases are cut. Failure to comply with this requirement may result in disruptions to other services and the Contractor shall be held responsible for any additional expenditure involved in resolving the issue.

1.1.8 Maintenance Manual

The Contractor shall furnish to the Architect one month before practical completion of the completion installation three copies of a maintenance manual.

The manual shall be of the loose leaf type, A4 size, having stiff covers, cloth bound with sub-divisions in cardboard for each section, a ready means of reference, and a

detailed index. The manual shall contain full operating and maintenance instructions for each item of equipment and shall deal systematically with each system including the following:-

a) Switchgear
b) Contactors
c) Emergency Lighting
d) Fire Alarms
e) Communication Systems
f) Security Alarms
g) Lighting Installation
h) Wiring Diagrams
i) List of Spares

NOTE

Manufacturer's standard `hand out' cards and leaflets will NOT be accepted in the Manual. The Contractor shall fix such cards to the plant room walls adjacent each item of equipment.

Practical Completion of the project will not be accepted without this document.

1.1.9 British Standards

All British Standards referred to in this specification shall include all the latest amendments.

1.1.10 Building in Occupation

The Contractor shall allow for working in buildings which are in occupation or are part of buildings in occupation unless a statement to the contrary is made within the Main Contract Conditions.

This shall include for the maintenance of all systems at all times. If this requires temporary works, then the Contractor must allow for this. Temporary works shall not degrade the working environment in any way.

Where the works are carried out, in or as an extension to an existing building, the Contractor shall make every effort to ensure that he is fully aware of the existing systems and installations.

They shall not carry out any operation, engineering or building, without fully surveying the existing to ensure that no detrimental effect will arise.

They shall plan ahead and provide method statements for his works and submit these to the Architect for information/comment at least 14 days before carrying out such work.

1.1.11 Record Drawings

The Contractor shall provide a set of negatives on which to produce record drawings for the Employer.

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During the progress of the works the Contractor shall record on drawings in an approved manner the information necessary for preparing the installation record drawings. The marked up drawings shall be made available to the Architect for inspection and checking at any time during the Contract. Installation record drawings shall indicate:-

a) The position of all plant and apparatus.
b) The size, type and routes of all cables and conduits.
c) The size, type and date of laying of all underground cables and ductwork.
d) Schematic diagrams of distribution systems and control systems.

If requested by the Architect, the Contractor shall provide printed instructions and record drawings of plant control systems and equipment to enable the Employer to operate, maintain, dismantle, re-assemble and adjust such plant and equipment.

Record drawings shall be submitted for comment/approval one month before the date of Practical Completion or Sectional Completion.

FAILURE TO PRODUCE THESE DRAWINGS WILL RESULT IN A DELAY TO PRACTICAL COMPLETION.

The final record drawings of the installation together with any required record drawings or instructions relating to the plant and equipment shall be provided not more than ONE month later. These shall include comments made during approvals and any late changes made during the approvals period.

If the Contractor fails to produce to the Architect's approval either the marked up drawings or the record drawings within one month of the date of Practical Completion, the Client may instruct the Architect to provide these drawings with whatever assistance the Architect deems necessary, and the cost of preparing such drawings will be deducted from the outstanding payments due to the Contractor.

1.1.12 Commissioning

The Contractor shall provide attendance on commissioning of plant during the maintenance period, if requested. Costs will be met from a Provisional Sum.

1.1.13 Builder's Work

All holes through beams and columns, and holes above 150mm dia. or slots with a length of more than 150mm through all structural members, will be specified and detailed on the Contract Drawings prepared by the Architect or Structural Engineer. Holes less than 150mm dia. through structural steel or reinforced concrete, other than beams and columns, shall be detailed by the Contractor on drawings by dates to be agreed with the Architect and shall be submitted to the Architect for approval.

The provision of information on all other holes and builder's work associated with the Electrical Engineering Installations including chasing, forming of bases, building in of brackets, shall be provided by the Electrical Sub Contractor to the Contractor to suit the agreed construction programme. The Electrical Sub Contractor shall be responsible for the setting out of all such builder's work.

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The Contractor will be responsible for including for the provision of all service holes through structural components for which he is responsible for the design.

1.1.14 Supervision of Labour

The Contractor shall constantly keep upon the works a competent supervisor, satisfactory to the Architect, who has a thorough experience of the class of work covered by this specification. Details of the training and experience of the supervisor that the Contractor proposes to keep upon the Works shall be submitted to the Architect for approval. So far as possible this representative shall not be changed during the course of the Contract.

Trade custom in the employment of the appropriate grades of work people shall be followed and the Contractor shall be held responsible for ensuring that such is complied with. At least half of the total labour force employed on the site by the Contractor shall consist of journeymen.

The Contractor shall prevent his work people from trespassing beyond the limits of their work.

They shall keep a daily record of all labour on site and hand a copy to the Architect, if requested, at a minimum of weekly intervals.

1.1.15 Schedule of Prices

The Contractor shall furnish the Employer for approval three copies of the priced schedule of quantities and rates upon which the tender has been based, either:-

a) Within 7 days of being requested to do so

Or

b) The time period specified in Section 2.

The schedule shall be fully priced and totalled to the original tender price.
It shall be used only for the pricing of variations where applicable.

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1.1.16 Visits to Site

The Contractor shall visit site before submitting his tender to ensure that he is fully aware of existing conditions.

No claim can be made for lack of knowledge of the site.

1.1.17 Removal of Redundant Services

Where work is carried out in existing buildings the Contractor shall include for the disconnection and careful removal of all redundant plant in accordance with the programme.

Prior to the removal of redundant services, new plant and equipment shall be installed and fully operational or alternative supplies made available as appropriate.

Where temporary supplies are installed, ensure these are removed when the permanent works are completed.

Take care to ensure that services to other areas are not interrupted unless previously agreed with the Architect.

WARNING

All services must be assumed to be energised until effectively isolated from the supply (including standby generator supply). Include for taking any special precautions as may be necessary to prevent any danger.

Various items of redundant equipment may be selected for re-use. These will be indicated on site by the Employer's representative and stored/installed as necessary. All fittings, fixtures and plant shall be carefully removed and stored and offered to the Employer for re-stocking at no cost to the Employer.

The items not required shall be removed from site.

The Contractor must maintain a clean site at all times, especially in the Employer's working areas. The site should be checked by the Contractor's Senior Staff on a daily basis to ensure that rubbish and unwanted materials are removed.

Where drawings of existing services are included in the Tender Drawings these drawings are intended to give the general layout and extent of the existing installations. Where existing services are to be stripped out by the Contractor it is the Contractor's responsibility to fully satisfy himself as to the extent of the stripping out. Subsequent claims in respect of this item will not be considered.

1.1.18 Phasing

When phasing of the works is necessary the phasing sequencing will be given in the Contract Preliminaries. The Contractor shall ensure that all supplies are available to match this programme and also that any enabling works are carried out to allow the programme to be fulfilled.

Some variation to phasing to suit Employer's requirements may be necessary during the works. Subject to appropriate advance notice to the Contractor, such changes in phasing requirements shall be at no extra cost to the Contract.

A detailed programme of works and a Method Statement of the sequence of works to be carried out shall be submitted for approval. The Main Contractor's programme shall form the basis for the Electrical Services installation programme. Method Statements shall be submitted for all sections of the works a minimum of two weeks in advance.

Care should be taken to ensure that services to other areas are not interrupted during stripping out unless previously agreed with the Employer.

In order to ensure continuity of work and anticipate future work and possible difficulties the Contractor shall:-

i) Ensure that senior staff are available on site at all times.

ii) That they investigate work up to two weeks in advance and ensure that the programme can be met.

iii) Make any adjustments as necessary and inform the Architect of any changes.

iv) Make the necessary changes to workforce levels to match the peaks in demand without any cost to the Contract.

1.1.19 Site Records

In addition to keeping labour records (Clause 1.1.14), the Contractor shall keep records of information received from the Main Contractor. This shall include AIs, drawings and answers to queries. Drawings shall include all architectural and structural details which are deemed to be useful to his understanding of the project in addition to those essential to allow him to fulfil his contractual commitment.

The record shall be kept in such a manner that copies can be given to the Architect on request.

PART 2 - DISTRIBUTION EQUIPMENT

1.2.1 High Voltage Switchgear

High voltage switchgear shall comply with the latest edition of the British Electricity Board's specification for Standard Distribution Switchgear reference BEBS - S2, for voltages up to 11 KV and fault level rating up to 250 M.V.A. A facsimile of the A.S.T.A. certificate or evidence that the switchgear has been A.S.T.A. certified for the fault level stated in Section 2 shall be provided, system voltage fault level, type of switchgear, protective system, metering, interlocking arrangements and labelling shall be as stated in Section 2.

Switchgear shall be complete with cable boxes, glands, armour clamps, cable connectors, earthing bar, earthing connections, floor fixing bolts, compound for cable boxes and all sundries as called for in Section 2.

1.2.2 High Voltage Transformers

System Voltage, rating and type shall be as called for in Section 2.

Oil immersed, naturally cooled transformers, type ON shall be to the latest edition of the British Electricity Board's Specification for Transformers, reference BEBs - Y1, and be complete with first filling of oil.

Dry, air cooled transformers shall be to BS.171 with the same high voltage tappings and connections as those specified in BEBS - T1 for oil immersed transformers and with insulation to the class stated in Section 2. All transformers to be complete with cable glands, cable boxes, armour clamps, skids and all sundries.

1.2.3 Medium Voltage Switchgear

a) **Fused Switch and Switched Fuse Units**

Shall be of the metal enclosed dust protecting type to BS.5419 for ratings up to and including 30 amp and to BS.5419 for ratings of 60 amp to 800 amp, of the unit or cubicle type as stated in Section 2.

b) **Moulded Case Circuit Breakers & Enclosures**

Shall comply with BS.4752 Part 1, and unless specified otherwise in Section 2 their rated short circuit capacity shall be as follows:-

10KA for rated currents up to and including 100 amp.
22KA for rated currents up to and including 1200 amp.

Provision shall be made for the operating mechanism to be padlocked when in the OFF position.

Enclosures shall be as specified for DBs and shall comply with BS.5419.

c) **Switches and Isolators**

Shall be of the metal enclosed dust protecting type to BS.5419 and of the rating stated in Section 2.

d) **Bus Bar Systems**

Shall comply with BS.159.

e) **Switchboards**

Shall be complete with cable boxes, wiping glands, cable connectors, fixing bolts and all sundries.

Shakeproof washers shall be used between metalwork bolted together to ensure earth continuity.

A copper earth bar 25mm x 5mm minimum dimensions shall be provided running the length of the switchboard, bolted to the supporting framework so as to make good electrical contact. Solid copper protective conductors shall be connected between the earth bar and each incoming and outgoing cable core, armour clamp and gland plate. Any joints shall be tinned and bolted with brass nuts, bolts and steel shakeproof washers, or riveted as specified in Section 2.

All switchboards shall be capable of being extended at either end and complete with all interconnections.

Unit type switchboards shall have their bus bar system in a separate metal dust protecting enclosure having a substantial angle iron framework and covers of rustproof sheet steel of not less than No. 14 S.W.G. or 2mm U thickness.

Unit type switchboards shall be mounted on suitable 50mm x 50mm x 6mm R.S. channel framework finished with three coats of paint, namely a rust inhibiting primer, an undercoat and a finishing coat matching the colour of the units making up the switchboard. Wall mounting framework shall be securely fixed to walls by M10 x 1.5 bolts anchored in wall in an approved manner and brackets suitable for the framework. Floor mounting framework will be fixed as detailed in Section 2 and/or as detailed in tender drawings.

The use of slotted type R.S. angle shall not be permitted. Cubicle type switchboards shall have their bus bar system fully insulated so that where bus bar covers are removed accidental contact with bus bars is avoided.

1.2.4 Fuse Links (Distribution Boards)

Shall be cartridge fuses complying with BS.88 of the category of duty and class of fusing factor detailed in Section 2. Dimensions of fuse links shall comply with the following BS.88 definitions:-

BS 88 Reference Symbol	Current Rating
A.1	20 amp maximum
A.2	30 amp maximum
A.3	60 amp maximum
A.4	100 amp maximum
B.1	100 amp maximum
B.2	200 amp maximum
B.3	300 amp maximum
B.4	400 amp maximum
C.1	500 amp maximum
C.2	500 amp maximum
C.3	800 amp maximum

Unless stated otherwise in Sections 2 and 3 of this specification final distribution fuseboard fuse links shall be rated at 10 amp for lighting circuits and 30 amp for ring main circuits.

For three phase motors they shall be as follows: -

Motor Rated Output	Fuse Link DOL Starting	Fuse Link for Star Delta Starting
0.75 kW (1 hp)	10 amp	4 amp
1.1 kW (1.5 hp)	10 amp	6 amp
1.5 kW (2 hp)	15 amp	6 amp
2.2 kW (3 hp)	15 amp	10 amp
3 kW (4 hp)	20 amp	15 amp
4 kW (5.5 hp)	25 amp	15 amp
5.5 kW (7.5 hp)	30 amp	20 amp
7.5 kW (10 hp)	35 amp in 30 amp cartridge	25 amp
11 kW (15 hp)	50 amp in 30 amp cartridge	30 amp
15 kW (20 hp)	60 amp	35 amp in 30 amp cartridge

The above motor rated outputs are the preferred outputs of standardised motors to BS.4999. Where there are motors with outputs greater than that listed the rating of the fuse link will be stated on the drawings and in subsequent sections of this specification.

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1.2.5 Outdoor Distribution Pillars

Shall comprise open back distribution and isolating link units of the rating and ways detailed in Sections 2 and 3, complete with bus bar system and phase dividing fillets, all mounted on mild steel support bars in a cast iron shell.

The distribution and link units shall be complete with porcelain bases fitted with bus bar and outgoing conductor fittings.

Fuse link carriers shall be the porcelain edge blade type fitted with wedge type cartridge fuse links to BS.88 with slotted tags. Neutral links also shall be wedge type. Isolating link units shall be fitted with hinged bolted link for the phases with withdrawable bolted link for the neutral.

The shell shall be built of cast iron throughout with removable panels at the back and doors with brass hinges at the front. The door shall be fitted with a recessed barrel lock with flush brass screwed plug. The shell shall be so constructed to ensure ample ventilation, the ventilators having insect barriers and be complete with a separated cast iron root bolted to the shell.

Pillars shall be complete with insulated combined lifting handle and screwdriver suitable for removing brass plug and operating lock, circuit identification labels, circuit chart mounted in inside of door, angular type sealing boxes suitable for the cables specified in Section 2, and 65 watt ventilating heater unit with its separate circuit wiring and 2 amp single pole fuse.

Sealing boxes shall be supplied with complete compound suitable for the type of cable specified in Section 2. Cables entering pillars shall not be bent during installation to a radius smaller than the minimum bending radius detailed in the recommendations of the relevant cable BS. Plinths for the pillars shall be constructed generally as shown on the drawings.

The Contractor shall ensure that the pillar root is bolted firmly to the plinth and that the pillar shell is secure and vertical. Roots shall be fitted with sheet steel aprons as shown on the drawings and both roots and aprons shall be protected with an approved bituminous compound and the pillar shell painted with a coat of flat and two coats of good quality gloss paint.

After cabling work at pillars is completed, the void in the root within the pillar shall be filled with sand, well rammed down and the sand covered with a coating of bitumen compound to set as a damp course.

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1.2.6 Distribution Fuseboards

Shall be of the 500 volt metal enclosed, dust protecting type to BS.5486 Part 2 with fuse carriers and bases to BS.88 Part 2, designed to accommodate fuse links of reference A to D, BS.88 Part 1.

Fuseboards shall be triple pole and neutral or single pole and neutral of the rating and number of ways specified in Sections 2 and 3, and complete with isolating switch. Neutral and earth bars shall have the same number of circuit terminations as there are fuseways.

Fuseboards shall be supplied complete with cartridge fuse links rated to suit the circuit cables as detailed in Sections 2 and 3 and on the tender drawings. Doors of fuseboards shall be fitted with barrel type locks (except in plant rooms and switchboard rooms) capable of being opened or locked with a key common to all fuseboard locks. In plant rooms and switchboard rooms fuseboard doors shall be held closed by spring catches or knurled finger operated screws.

Each fuseboard shall have a chart stating location of all points controlled by each fuseway with the rating of the fuse for that way. The charts shall be typewritten, pasted on a stiff board and contained in a transparent plastic envelope fixed to the inside of the fuseboard door. The envelope to be arranged so that the chart can be removed for modification at a future date.

For all insulated wiring systems an earth bar shall be provided in each fuseboard.

1.2.7 Miniature Circuit Breakers

Shall comply with BS.3871 Part 1 and shall be of the voltage and rating stated in Sections 2 and 3. Category of duty shall be at least M.3.

1.2.8 Consumer Control Units

Shall comply with BS.5486 Part 13 and shall be fitted with cartridge fuse links to BS.1361 or miniature circuit breakers to BS.3871 Part 1 specified in Sections 2 and 3. A typed circuit chart shall be provided and fitted with each unit.

Unless stated otherwise lighting circuits shall be fused to 5A and power circuits to 30A.

Fused ways designated as spare shall be provided with fuse links of the maximum rating of the fuse carrier. MCB ways designated as blank shall be provided with blanking plates and those designated as spare shall be provided with the designated MCB.

For all insulated wiring systems an earth bar shall be provided in each unit having the same number of circuit terminations as there are fuse/MCB ways.

1.2.9 Labelling

Labels shall be of traffolyte with 5mm high black letters on white background fixed in a readily observable position by screws or nuts and bolts to the outer cover of the unit. All electrical control panels, distribution boards, starters, switch fuses and isolators shall be labelled with the legend detailed in Section 2 and/or the tender

drawings. If no legend is given in Section 2 or on the tender drawings, the Contractor shall allow in his tender price for labels to be engraved with a minimum of 10 characters per unit.

1.2.10 Treatment Notice

Adjacent the main switchboard (exact position to be decided on site) the Contractor shall provide a "Treatment for Electric Shock" notice.

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PART 3 - METAL CONDUIT INSTALLATION

1.3.1 Conduits

Conduits shall be of metric dimensions to BS.4568 and shall be black stove enamelled or galvanised welded type, Class 2 or 4. No conduit less than 20mm diameter shall be installed unless stated otherwise in Section 2. Black stove enamelled conduit (Class 2) shall be used for all work except in kitchens (surface mounted), boiler houses, plant rooms, service ducts, external works and other places as specified in Section 2 where it shall be galvanised (Class 4).

1.3.2 Conduit Fittings

All fittings shall comply with BS.4568 and shall have the same protective covering as the conduit with which they are being used.

Break joint rings shall be fitted where (1) the gap between a junction box lip and the finished wall or ceiling exceeds 2mm, and (2) on all ceiling outlet points.

Adaptable boxes shall be of steel or cast iron with overlapping lids where a flush installation is specified. Inspection or solid tees, elbows or sleeves shall not be permitted and all lids shall be fixed using brass screws. Where necessary, to segregate services, adaptable boxes shall be fitted with earthed steel barriers. Boxes for socket outlets, light switches, etc. shall be securely fixed by at least two screws and in a flush installation these shall be recessed approximately 2mm below the finished surface.

1.3.3 Installation

The installation shall be surface or concealed as specified in Section 2.

Prior to erection all burrs and sharp edges, any dirt, oil or paint shall be removed. Care shall be taken to prevent the ingress of dirt or moisture during erection and all conduits shall be swabbed through before wiring commences. Where threads are exposed or the finish is damaged the conduit shall be treated with a rust inhibiting paint after erection.

Conduits shall not be run in floor screeds unless specified, but if so shall be galvanised and provided with temporary protection until the floor screed is laid.

Conduits shall be bent on site to suit local conditions using a bending machine to ensure minimal deformation of bore. Draw in boxes shall be provided in all runs exceeding 15m in length or containing more than two right angle bends. Running couplings shall be kept to a minimum but where required they shall be fitted with milled circular locknuts at each end. On vertical runs the running thread shall be above the couplings.

Where condensation is likely the conduit shall be fitted with adequate drainage points and installed so that the relevant section is isolated by means of a compound filled conduit box.

On vertical drops or risers, a running coupler socket shall be inserted within 300mm of the ceiling or floor. Conduits shall be fixed using crampets when concealed in plaster or concrete, etc. and saddles when surface spaced as follows:-

Conduit Size	Vertical	Horizontal
20 and 25mm	1.5m	1.2m
32 and 40mm	1.75m	1.2m
50mm	2m	1.5m

A clearance of 150mm shall be maintained between electrical conduits and other services running parallel and 25mm when crossing.

Surface conduits shall be installed as neatly and unobtrusively as possible, parallel to general building lines, using distance saddles.

Concealed conduits shall be installed in such a manner that inspection and draw in boxes are accessible, using crampets where buried in plaster or concrete, or saddles in roof voids, etc.

Conduits shall be run in a straight line from point to point.

Where practical all wall chases shall be vertical.

Saddles shall be rigidly fixed to the structure by means of proprietary wall plugs and screws to a depth to suit the structure, all fixing holes being made with a masonry drill. Subject to the Architect's agreement, prior to the commencement of work, shot fired fixings may be used.

1.3.4 Continuity and Earthing

All conduits shall be screwed and butted solidly in boxes and conduit fittings, etc. and be satisfactorily mechanically continuous, before drawing in of cables commences.

The system shall also be tested for electrical continuity before plastering or screeding is done and before cabling is installed.

Where boxes without screwed spout entries are used the conduit shall be secured to the box by means of a smooth bore male brass bush and earthing coupling with compression washers used.

An insulated protective conductor shall be connected from the box to the equipment fixed to the box.

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PART 4 - PVC CONDUIT INSTALLATION

1.4.1 Conduits

Conduits shall be heavy gauge, high impact, PVC smooth inside and outside and free from imperfections. No conduit less than 20mm diameter shall be installed unless stated otherwise in Section 2. Conduits shall comply with BS.4607 and shall be type `A' (metric sizes).

While in storage and during installation, conduits shall be protected from the weather and mechanical damage, and shall be fitted with wooden or plastic plugs or plastic caps to prevent the ingress of foreign matter.

Conduits shall be suitable for jointing by compression joints, PVC solution or for screwing with standard electrical threads. Prior to erection conduits shall be reamed to remove all sharp edges and burrs after screwing or cutting. Threads shall be cut using a suitable lubricant and debris shall be removed prior to erection. Previously cut threads shall be cleaned by re-running with dies and wiping.

1.4.2 Conduit Fittings

Fittings shall be of the same manufacture as the conduit, complying with BS.4607. All boxes shall be PVC except for those to which lighting fittings will be directly fixed, which shall be metal conduit boxes complying with BS.31 or BS.4568. PVC boxes used in any other way for supporting lighting fittings shall be fitted with metal inserts for locating screw fixings. Self tapping screws for suspension purposes shall not be allowed.

1.4.3 Installation

The installation of a rigid PVC conduit system shall be generally in accordance with that specified for a metal conduit system.

Bends and sets formed on site shall be carried out using a helical spring fitted internally. The conduit shall be warmed sufficiently for it to move without deformation of the bore and without avoidable wall thinning on the outside of the bend. Couplings to equipment not having shaped or smooth conduit centres shall be by means of plastic bushes fitted inside the equipment with lock rings.

Expansion couplers shall be provided at intervals not exceeding 7.5 metres on straight runs of 11 metres and over, with clearance between the ends of the conduits and sealed with mineral jelly to prevent ingress of moisture.

The conduit system shall be installed in accordance with the manufacturer's instructions and shall contain a protective conductor. When assessing conduit capacities, which shall be in accordance with IET Regulations, protective conductors shall be taken into account.

PVC conduit shall not be installed where the ambient temperature is below 5°C. or working temperature is above 60°C.

PART 5 - FLEXIBLE CONDUIT

1.5.1 Installation

Flexible conduits shall be PVC sheathed of type `B' in BS.731 or shall be double leaded steel foil interleaved type of heavy duty grade complete with solid type couplers. The protective conductor shall run inside the conduit.

Terminations shall be made on the correct type bottled earth terminals.

Couplings and connections shall be to BS.731 and shall be cadmium plated mild steel with shakeproof accessories.

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PART 6 - METAL TRUNKING & CABLE TRAY

1.6.1 Cable Trunking

Trunking shall be manufactured from rust proofed sheet steel in the following gauges:-

1. Up to and including 50mm x 50mm or equivalent C.S.A. - 1.25mm U.

2. Above 50mm x 50mm and up to and including 100mm x 100mm or equivalent C.S.A. - 1.6mm U.

3. Above 100mm x 100mm or equivalent C.S.A. - 2mm U.

The trunking shall comply with BS.4678 Part 1 and shall be fitted with an overlapping well-fitting drip proof removable cover fixed with captive screws in such a manner that damage to cables is avoided.

Self-tapping screws or fixed bridge pieces shall not be allowed for fixing the cover.

The system shall be free from sharp edges and projections.

Internal fire barriers in accordance with IET Regulations Nr. 528-1 shall be provided by binding the cables and filling the spaces with non-asbestos fire resisting material.

Cable support pins shall be fitted at intervals of 1.2m in vertical runs of trunking exceeding 2m in length. Where the removable cover is on the underside of the trunking cable retaining straps or holders shall be provided at intervals not exceeding 1.2m.

The trunking system shall be electrically and mechanically continuous throughout, with every joint bridged by a copper bonding strap to ensure earth continuity. All trunking fittings such as elbows, tees and end plates shall be as supplied by the trunking manufacturer, unless specified otherwise. Fittings and cover plates shall be the same gauge as the trunking body wall.

Partitions in trunking for multi-compartment systems shall be of the same material and finish as the trunking and may be up to 0.5mm thinner than the trunking material with a minimum thickness of 1.0mm (20 S.W.G.). The welded edge of the partition where it is attached to the trunking shall be arranged to present a clear flat face over the full width for any conduit or supporting nuts and bolts. The exposed edge of the partition shall be turned up 12mm to present a flat face.

Electrical continuity between trunking and conduit systems shall be by means of earthing couplings and external earthing studs or terminal blocks welded to the trunking exterior at 1m intervals.

Trunking shall have 20mm knock-out points at 750mm centres on both sides.

Where the finish is removed by cutting or drilling, it shall be made good to match the original manufacturer's finish.
The trunking shall be supported from the structure with suitable metalwork, spaced to prevent undue deflection when carrying the maximum number of cables as specified

in the IET Regulations. Supporting metalwork shall be wire brushed, cleaned and painted with zinc chromate primer.

1.6.1 Cable Tray

Cable tray shall not be less that 1mm U up to 100mm width with 1.25mm U 100mm to 150mm width and 1.6mm U from 150mm to 300mm and shall be galvanised or have a rust resisting finish.

They shall be of adequate size to support the cables without undue bunching and so supported that they will carry the cable load without undue deflection of the tray.

Fixings to wall or steelwork shall be sheradized nuts and bolts with a gap of 25mm between structure and tray. All supporting angles or proprietary straps shall be galvanised. Fixing distances shall not exceed 120mm unless indicated in Section 2.

Manufacturer's bends and intersections shall be used and when sections are cut all sharp edges shall be removed and exposed metalwork painted with rust inhibiting paint. Holes through tray shall be similarly treated.

150mm, 225mm and 300mm cable tray shall be 16 SWG and the 450mm and 600mm tray shall be 14 SWG. For internal installation it shall be finished with zinc chromate paint and for external installation it shall be hot-dip galvanised to BS.729 Part 1.

Nominal Width	**Nominal Thickness of Steel**	**Finish**	**Application**
100mm	1mm (20 SWG)	Zinc chromate paint	Internal installation
150mm	1mm	Zinc chromate paint	Internal installation
225mm	2mm (16 SWG)	Zinc chromate paint	Internal installation
300mm	2mm	Zinc chromate paint	Internal installation
450mm	2mm	Zinc chromate paint	Internal installation
600mm	2mm	Zinc chromate paint	Internal installation
100mm	4mm (12 SWG)	Hot dipped galvanised complying with BS729 Part 1	External installation
150mm	4mm	Hot dipped galvanised complying with BS 729 Part 1	External installation
300mm	4mm	Hot dipped galvanised complying with BS 729 Part 1	External installation

Bends shall be of the same material, thickness and finish as the cable tray, and shall have an inner radius of 50mm and a straight length of 100mm at each end. No perforation shall be made in the circular portion of 100mm and 150mm bends. On 225mm and 300mm bends perforations shall only be along a line set at 45°.

On 450mm and 600mm bends perforations shall be made only along lines set at 30° and 60°.

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Tees shall be of the same material, thickness and finish as the cable tray. The distance measured between a point of intersection and the end of the fitting shall be 100mm.

Cable tray shall only be cut along a line of plain metal, i.e. not through the perforations. All cut edges of galvanised cable tray shall be prepared and treated with a zinc rich paint.

Site fabrication of accessories shall be kept to a minimum and manufacturer's standard items and method of installation shall be used. Where special sections are required the material, thickness and finish shall be as specified for standard items.

Where welding has been employed in the fabrication of cable tray and/or accessories the area around the joint shall be mechanically prepared, and thereafter treated with zinc chromate primer or zinc rich paint according to the original finish of the metal.

Holes cut in cable tray for the passage of PVC covered cables shall be provided with grommets complying with BS.1767. Alternatively they shall be bushed or lined to prevent damage to the PVC covering. A minimum clear space of 20mm shall be left behind all cable tray.
Support spacing's for cable tray shall be in accordance with the manufacturer's recommendations to give a minimum deflection of 4mm and shall not exceed 1200mm with supports at 225mm from bends and intersections. At each position two supports shall be provided and where the tray's width exceeds 300mm three supports shall be provided.

Additional brackets or channel as necessary shall be provided where the tray is to be supported from the underside of roofs or ceilings. Supports shall be fabricated from mild steel flat bar complying with BS.4360. When used with galvanised cable tray, fixings shall be hot-dip galvanised, unless only bending and drilling is required in the manufacture, when galvanised mild steel flat bar may be used. Hot-dip galvanising shall comply with BS.729 Part 1.

Site fabricated accessories and supports within a building shall be wire brushed and cleaned, and thereafter given a coat of zinc chromate primer brushed on. Supports shall be cleaned and painted before being fitted, and after fitting the supports shall be given a further coat of zinc chromate primer ensuring that the fixing bolts or screws are painted.

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PART 7 - PVC TRUNKING

1.7.1 Installation

Trunking shall be extruded unplasticised PVC compound of the colours specified. It shall be smooth inside and outside and free from imperfections. Gauge and type shall be as specified and it shall be fitted with a drip-proof well-fitting lid of an approved type. Where the cover is on the underside, cable retaining straps at intervals not exceeding 1.2m shall be fitted. In vertical runs exceeding 1.8m insulated cable support pins shall be fitted at intervals of 1.2m, the first pin, in cases where junctions occur, being not more than 0.3m from the junction.

Internal fire barriers shall be fitted in the trunking where it passes through floors.

All joints, tees, off-sets and other fittings shall be the manufacturer's standard items, joints being made using standard internal connectors without the use of solvent as instructed by the manufacturer. The maximum distance between either side of a joint and a fixing shall be 50mm.

Environmental conditions appertaining to the installation of PVC conduit shall also apply to PVC trunking. The trunking system shall be mechanically continuous throughout containing a separate protective conductor. The whole system shall be adequately supported and substantially fixed to the building structure using purpose made supports at not more than 1.2m centres. General conditions relating to supporting metalwork shall be as specified for metal trunking.

PART 8 - PAPER INSULATED & PVC INSULATED ARMOURED CABLES

1.8.1 General

All cables shall be of the type and voltage grade stated in Section 2 and manufactured by one of the firms listed.

Approval of the Architect to use cables manufactured by firms not listed shall be obtained. When delivered to site each drum or coil of cables shall have attached the manufacturer's labels giving details of the cable and the manufacturer's test certificate. Replacement of faulty cable shall be at the Contractor's expense.

1.8.2 Paper Insulated Lead or Aluminium Sheathed Cables

All paper insulated, lead sheathed, armoured or unarmoured served or unserved cables with conductors as specified in Section 2 are to be mass impregnated, non-draining, belted type, up to and including 11 KV having shaped cores and neutral core of the same cross section as phase cores. They shall conform to BS.6480 and unless otherwise specified are for use on an earthed system. Details of the final serving of the cables are given below.

For voltage above 11 KV screened type cables shall be used. Aluminium sheathed cables shall comply with BS.6480 Part 2, aluminium conductors shall comply with BS.6791.

1.8.3 Armoured PVC Insulated Cables

All PVC insulated armoured cables shall be to BS.6346 with shaped cores and the neutral core of the same cross section as the phase cores.

Conductors shall be copper stranded, aluminium stranded or solid aluminium as detailed in Section 2 and/or the tender drawings, PVC insulated, filled PVC taped single wire armoured and PVC sheathed overall 600/1000 volt grade. In the case of solid aluminium conductor cables the armouring may be aluminium strip.

1.8.4 Cable Routing

Paper Insulated and Armoured PVC Cables

Cables shall be run between termination points in continuous length. Joints shall not be allowed unless specified or unless agreed by the Architect.

Where cables up to and including 11 KV grade are installed in the ground, they are to be laid at a depth of 800mm and for higher voltages 1.1m on a 100mm layer of sand, covered by interlocking cable tiles marked "Electricity" of approved design. For HV cables, tiles shall be 300mm x 150mm.

Where cables are laid in the ground and follow the same route they shall be laid in horizontal formation with spacing between cables, where possible, of not less than 150mm with the exception of single core cables which shall be run in trefoil formation and touching along their entire length. Each group of cables shall be covered by additional cable tiles.

Concrete cable markers shall be used to indicate the route of buried cables at intervals of not more than 75 metres and at points where change of directions occur. Markers shall be not less than 150mm long x 800mm wide x 75mm thick, to be marked "Electric Cables" and 300mm shall be exposed above ground. Cables under roads, paths, floors, through walls or skirting buildings shall be run in self-sealing glazed earthenware conduits of minimum diameter of 100mm. Where the cable ducts terminate in buildings they shall be sealed with a permanently plastic waterproof sealing compound to prevent ingress of water, foreign matter and vermin.

Cables shall be installed only when both the cable and ambient temperatures are at or above a temperature of 5°C and have been so kept for the previous 24 hours, or when special precautions have been taken to maintain the cable at or above this temperature to avoid risk of damage during handling.

Paper insulated and armoured PVC cables run in air (including engineering service ducts) shall be fixed with aluminium alloy claw type cable cleats with galvanised back straps using galvanised bolts conforming to BS 1490 with maximum spacing between supports as detailed in Appendix II of the IET Regulations. Cables up to and including 10mm dia. shall be fixed single bolt, and above 40mm dia. by 2 bolt fixing. The correct size of cleat fixing stud must be provided to suit the cable size and to ensure that the stud does not extend below the nut. Excess pressure of cleats on PVC cables is to be avoided to prevent deformation of the plastic sheeting. Suitable supporting steelwork and/or galvanised cable tray shall be provided where cables cross open spaces of greater that 1m distance, such steelwork to be protected by a rust inhibiting paint.

Paper insulated cables installed in conduits or laid in the ground shall have a compounded jute, yarn, hessian or similar serving. The serving shall not however be used on cables which are installed in ducts, walkways, voids etc. and shall be removed from underground paper insulated cables where they enter buildings. Where the service is of the bitumastic compound impregnated type and the removal of the serving is impractical to comply with this part of the specification, the final serving shall be PVC. Unserved aluminium sheathed cables shall not be installed in contact with walls or floors.

1.8.5 Minimum Installation Radius

Cables specified in Section 2 shall not be bent during installation to a smaller radii than the following:-

Paper insulated lead sheathed cables up to and including 11 KV - 12 x dia. of cable.
Paper insulated lead sheathed cables above 11 KV to 22 KV - 15 x dia. of cable.
Paper insulated aluminium sheathed cables up to 32mm dia. - 12 x dia. of cable.
Paper insulated aluminium sheathed cables over 50mm dia. - 15 x dia. of cable.
Paper insulated aluminium sheathed cables over 50mm dia. - 18 x dia. of cable.

1.8.6 Jointing and Termination

a) **General**

The jointing and termination of all paper insulated and armoured PVC cables shall be carried out by an experienced cable jointer trained and fully conversant with modern techniques, and once the cable is cut for the purpose of making a joint or termination the work involved must be carried out and completed without interruption. If for any reason the works cannot be carried out it is essential that the cable ends are sealed immediately as follows:-

Lead sheathed cables - solder or wipe a copper or lead cap on the sheath.
Aluminium sheathed cables - solder or wipe a lead cap on the sheath.
Armoured PVC cables - seal with PVC tape.

b) **Paper Insulated Lead or Aluminium Sheathed Cables with Stranded Copper or Aluminium Conductors**

i) **Joints**

Conductors shall be sweated with ferrules not less than the cross-sectional area of the conductor for which it is designed. Only tinned aluminium ferrules shall be used with aluminium conductors.

Solder for making copper joints shall be Grade `M' or Grade `G' complying with BS 219. The flux shall be resin or other non-corrosive type.

After completion of the joint all cast iron boxes shall be given two coats of bitumastic paint to prevent rusting of the box.

Where non-metallic outer protection boxes are used with armoured cable suitable armour clamps and copper strip shall be used to provide electrical bonding.

ii) **Terminations**

Terminations shall be made in compound filled sealing boxes and no soldered ferrule or joint will be permitted inside a sealing chamber.

The cable cores shall terminate in correctly sized compression or sweating type lugs and the tails shall be wrapped with not less than two layers of impregnated cotton type tape and overwrapped with not less than two layers of bitumastic or waterproof tape. The tails shall be colour coded to indicate phase and neutral conductors. Tail-less terminations shall be completely compound filled. On medium voltage networks where connecting tails are required the cable ends shall be soldered solid and PVC insulated tails joined by suitable compression jointing sleeves, the joints being insulated with varnished cambric or other suitable insulation, and the joint and tails overwrapped with bitumastic or waterproof tape.

The lead or aluminium sheath shall be neatly plumbed to the gland on the sealing chamber.

Where armoured cable is specified the armouring should be neatly arranged and the serving cut and bonded below the plumbed joint.

c) **PVC Insulated Armoured Cables, PVC Sheathed with Stranded Copper or Aluminium Conductors**

Jointing and termination techniques may be either:

a) As for paper insulated cables (Clause 1.8.5 b) using the manufacturer's recommended joint boxes and cold pouring compound

Or

b) Compression techniques as for solid aluminium conductors (Clause 1.8.6 d) below.

Solder for making aluminium joints shall be of the cadmium type. Flux can be either organic or inorganic of a type approved by the cable manufacturer.

The insulation of the joints conductors shall be either of the following:-

a) Impregnated cotton type or paper cotton tape wrapped around each jointed conductor to build up thickness over the ferrule equal to not less than one and a half times the thickness of the cable core insulation.

b) Impregnated paper rolls of adequate dimensions as supplied by the manufacturers for use with a specific type and size of cable wrapped around each jointed conductor.

c) Impregnated cotton tape or paper cotton tape wrapped around each jointed conductor and surrounded by a tube of paper or paper mica composition.

For 3 core cables the joined cores shall have separators of impregnated cotton tape or paper inserted between the cores and the cores bound overall with impregnated cotton tape or paper binders.

The insulated joints shall be housed in a compound filled lead or tinned copper sleeve plumbed to the sheath of the cable. Solder for plumbing the sleeve to a lead sheathed cable shall be Grade `D' complying with Bs 219.

The methods and materials for plumbing of aluminium cable sheath to the sleeve shall be in accordance with the manufacturer's instructions.

Compound filling holes in the lead or copper sleeves shall have caps for plumbing over the holes after filling with compound.

The manufacturer's recommended compound complying with BS 1858 shall be used for filling the sleeve. Outer protection boxes shall be of an approved type and shall be filled with a suitable compound.

Cast iron boxes shall be provided with armour clamps where armoured cable is specified to provide efficient mechanical and electrical binding of the armour across the joint.

d) **PVC Insulated Aluminium Armoured PVC Sheathed Solid Aluminium Conductors**

All joints are to be of the indented compression type by means of a hydraulic compression ram head and suitable compression dies according to the core size of the cable with strict adherence to the cable manufacturer's recommendations on accessories, ferrules, compression pressures and jointing techniques.

Joint boxes shall be as specified in Section 2. Where cast iron or earthenware boxes are employed the box shall be filled with a bitumen compound whose pouring temperature shall not exceed 140°C.

Where plastic boxes are used an approved polyester resin shall be used to fill the joint box. Particular attention shall be paid to ensure earth continuity of the cable armouring.

Terminations shall be made using the indented compressions method with sockets of soft aluminium shaped to match the profile of the conductor core.

Suitable approved aluminium cable glands with earth lugs shall be used and shall be protected with PVC cable shrouds.

All metal to metal joints at termination points, gland to armour contact and dissimilar metal joints shall be smeared with Densal paste.

1.8.7 Pressure Testing of Paper Insulated and Armoured PVC Cables

After installation the cable shall be pressure tested by the Contractor in the presence of the Architect. The Contractor must notify the Architect in writing seven days before such tests are to be carried out and shall submit to the Architect duplicate copies of a test certificate on completion.

The Contractor shall be responsible for rectifying any faults on any part of the installation which fails or breaks down as a result of the pressure tests. Tests shall be made on each separate length of cable and for this purpose isolators and fuse switches must be in the open position and wedges in feeder pillars must be removed.

The tests shall be carried out with DC, the voltage to be applied and increased gradually to the full value and maintained for 15 minutes between conductors and between each conductor and sheath for paper insulated cables, and 5 minutes for armoured PVC cable.

Cable Voltage Designation	Between Conductors (Volts)	Between All Conductors & Sheath (Volts)
600/1000	3500	3500
1900/3300	10000	7000
3800/6000	20000	15000
6350/11000	34000	25000
8750/15000		37000
12700/22000		50000

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19000/33000		75000

PART 9 - MINERAL INSULATED METAL SHEATHED CABLES

1.9.1 General

All cables shall be of the type and voltage grade stated in Section 2, having copper conductors with copper outer sheaths. They shall be of the 1000 volt grade with the exception of single phase sub circuits where the 600 volt grade may be used.

1.9.2 Installation

Unless stated otherwise in Section 2 all cables shall be PVC served, and terminations covered with PVC shrouds.

If specified as unserved copper sheathed, cables shall not touch asphalt, stone or barium concrete in any run.

MIMS cable emerging from ground or from floor shall be adequately protected from mechanical damage up to a height of 2 metres by heavy gauged galvanised conduit or channel, and if the cable is unserved the metal guard shall be electrically bonded to the cable sheath or sheaths if more than one cable is being protected.

Unsheathed copper cables shall be secured to walls with copper clips or saddles fixed with brass screws.

PVC sheathed cables shall be secured with PVC copper covered clips or saddles fixed with brass screws.

Cable trays shall be used to support runs where several MIMS cables run together and shall be of the galvanised or PVC coated type, except that in dry non corrosive situations such as rising main ducts the tray can be of the painted type. Bitumastic based paints shall not be used where cables are of the served type. In single cable runs clips of the plastic type, either of proprietary manufacture or custom made, shall be allowed.

Spacing of supports shall be in accordance with Appendix 11 of the IET Regulations.

1.9.3 Jointing and Termination

Straight through joints shall be made using only the manufacturer's accessories and connections may be either soldered or crimped. Crimping shall only be carried out with a tool which ensures that once the crimping operation has begun it must be completed. Buried joints or joints in corrosive situations must be protected with layers of self amalgamating PVC tape.
Terminations are to be made using cold seals of the type recommended by the cable manufacturer to suit the size and type of cable or as specified in Section 2. Tails are to be protected by neoprene or PVC sleeves, colour coded as prescribed in the IET Regulations, and shall be long enough so as to connect directly to the equivalent without the need for joints. Conductors 16 sq.mm and above are to be terminated using cone grip lug type cable sockets. Cable glands are to be of the same manufacture as the cable and of the correct size to suit the cable. Where PVC served cables are used, serving removed for the purpose of making off the gland shall be replaced with PVC tape and the whole gland assembly protected with a PVC shroud.

Cables are not to be concealed in walls which are to be plastered without the consent of the Architect, but where this is unavoidable terminations shall be made using cold seals having earth leads incorporated. The earth lead is to be insulated by neoprene or PVC sleeving and shall terminate in the junction box at a 2BA or N5 tapped screw inside the box.

Where the earth lead is to be carried through to a lighting fitting a three-way connector can be used in the conduit box, the third way being used to carry the protective conductor.

1.9.4 Surge Suppression

Voltage surges of sufficient magnitude and frequency can cause damage to MICC cables. The following shall be fitted with surge suppressors (as recommended by the manufacturer) before connection of MIMS cables:-

i) Star connected 3 phase motors under 3 HP.

ii) Hold on coils of remotely switched contactors - when MICC cable forms the remote switch circuit.

iii) Fluorescent luminaires without parallel connected power factor correction capacitors.

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PART 10 - NON ARMOURED PVC & ELASTOMER INSULATED CABLES AND FLEXIBLE CORDS

1.10.1 General

To avoid the risk of damage during handling no PVC insulated cable shall be installed when both the cable and the ambient temperature is below 5°C. and has been as for the previous 24 hours, unless special precautions have been taken to maintain the cable above this temperature.

1.10.2 Cables for Conduit and Trunking

Cables to be drawn into conduits or trunking shall be PVC insulated single core 600/1000 volt grade to BS.6004 for situations where the ambient temperature does not exceed 65°C. Where conditions are such that this temperature may be exceeded the cable shall be single core of the elastomer-insulated type 600/100 volt grade to BS.6007 and shall be e.p. or butyl rubber insulated and braided for temperatures up to 80°C. and silicone rubber insulated and braided for temperatures up to 145°C.

The elastomer insulated cables shall be identified throughout the length of the cable by the legends "Heat Resisting 85" for silicone rubber insulated either printed on a tape within the cable or printed, indented or embossed externally; the gap between the end of one legend and the beginning of the next shall not exceed 300mm. The situation in which elastomer insulated cables shall be installed and the type to be installed shall be as detailed in Section 2 and/or the tender drawings.

No joints shall be allowed throughout the system except at termination points. The minimum size of cable for lighting circuits shall be 1.5mm² and for ring main circuits 2.5mm². Cables shall be colour coded in accordance with Table 52A of the IET Regulations.

The Contractor may take advantage of using the stranded 2.5mm² cable to BS.6231, now available, if he wishes.

1.10.3 PVC Insulated and Sheathed Cables

These shall be of the 600/1000 volt grade to BS.6004 of the size and type specified in Section 2.

Vertical cable runs in plastered walls in any position where the cable is liable to mechanical damage shall be protected with suitable steel channel or conduit as specified in Section 2. Protective channel or conduits shall be continuous over the length of run to be protected and all ends shall be free from burrs and rough edges. Cables shall be supported by suitable clips or saddles within the limits specified in Appendix 11 of the IET Regulations.

Insulated junction boxes as specified in Section 2 shall be used for jointing and looping cables.

Entries to accessory boxes and fittings shall be fitted with suitable grommets to prevent damage to the cable sheath. Cables shall not be buried in floor screeds without the written approval of the Architect, but when this is authorised they shall be protected throughout their entire length by conduit having a minimum of 35mm cover

of screed. Conduit and channel buried in plaster shall have a minimum cover of 13mm. Cables on walls shall be run vertically or horizontally, and in ceiling spaces and on ceilings shall be run parallel to the external walls.

Diagonally run cables shall not be allowed. Cables shall be fixed using suitable clips or saddles without the limits specified in Appendix 11 of the IET Regulations. Fixings shall not be more than 70mm on either side of a fitting, accessory or bend.

Cables running along joists shall be run on a level clear of ceiling boards and as near as possible to the centre of the joist. Cables shall be installed only when both the cable and ambient temperatures are not less than 5°C. and have been so for the previous 24 hours, or when special precautions have been taken to maintain the cable at or above this temperature.

1.10.4 Flexible Cords

These shall be of the 300/100 volt grade or 300/500 volt grade to BS.6500. The type of insulation, number of cores, size of conductors, braiding and sheathing will depend on the service for which the cable is specified and shall be as detailed in Section 2 and/or the tender drawings.

1.10.5 Call System Cables

These shall be single or multi core flexible type to BS.6500 having a minimum conductor cross sectional area of 1.5mm² (32/0.2mm). They may be screened or unscreened. Insulation screening and sheathing shall be as detailed in Section 2.

Cables shall be coded to facilitate installation as detailed in Section 2. When cables are run in trunking they shall be neatly strapped together by flexible PVC straps along the entire length of the run of the trunking.

1.10.6 Radio Distribution Cables

Shall be Single Star Quad polythene insulated polythene sheathed, copper screen and polythene sheathed overall, of minimum cross section area 1/036".

For four programme working the Contractor shall run two single quad cables side by side, one of which will have its conductors arranged in short lay, the other shall have the conductors arranged in long lay.

Where cables are installed in unmade ground they shall be protected with glazed earthenware pipes, washed sand and cable tiles, in a similar manner to the armoured cables as detailed in Clause 1.8.4.

In the positions indicated on the drawings the cables shall be terminated at adaptable boxes fitted with suitable type compression glands for the cables. The boxes shall be fitted with a puncheon screw connector block of sufficient capacity to enable all cores and screens on cables to be connected.
The wiring inside the building from the adaptable boxes shall be single quad cable, as above, minimum cross section.

Where the cable is to be concealed in walls it shall be run in a separate screwed conduit of minimum diameter 20mm. Conduit shall be installed in accordance with this specification and such conduits shall be as far as possible spaced at least

150mm from conduits carrying mains or telephone cables.

If the cables are in trunking they shall be separated from other services by the maximum possible distance.

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PART 11 - EARTHING AND BONDING

1.11.1 Sub Station Earthing Arrangements

A main earthing bar of hard drawn copper shall be installed in all sub stations and shall be of minimum size (for mechanical strength) of 25mm x 5mm.

The size of the earth bars for prospective fault currents shall be:-

Up to 14 KA	25mm x 5mm copper
Up to 30 KA	40mm x 5mm copper
Up to 33 KA	50mm x 7mm copper

The earth bar shall be mounted on the substation wall by means of porcelain insulators. Connections to the earth bar shall be by means of conductors of cross sectional area not less than the main earth bars. The following shall be provided:-

i) Bare conductors to transformer frame.
ii) Bare conductors to H.V. switchgear frame.
iii) Bare conductors to M.V. switchgear frame.
iv) Insulated stranded cables to earth electrodes.
v) Insulated stranded cable to transformer(s) neutral(s).

Where a transformer neutral is brought out from a transformer and run direct to a switchboard or fuseboard a separate insulated cable shall be used to connect the neutral bar to the substation main earth bar.

1.11.2 Earth Electrodes

The earthing electrodes shall be either copper rods, copper tubes, copper or cast iron plates as specified in Section 2.

A minimum of two earth electrodes shall be provided for each main earthing system and the conductor brought back to the main earth busbar for each electrode. A test link shall be provided in each conductor so that the individual electrodes can be isolated and tested in turn while the other is still connected.

Connections to the earth electrodes shall be protected against mechanical damage and corrosion.

1.11.3 Bonding

Frames of motors, generators, metal cases of switchgear and all metal clad or enclosed apparatus, metal sheathing and armouring of cables and conduits shall be electrically continuous and connected to the main earth system. The electrical continuity of the earthing system shall be such that the electrical impedance between the main switch and any other part of the works shall not exceed 1 ohm. All earth tapes and conductors run underground or through walls must be PVC served with corrosion resisting compound.

The IET Regulations with respect to bonding of gas and water services pipework shall be adhered to. In existing buildings requirements for bonding gas and water services pipework shall be as detailed in Section 2 of this specification. For compliance with IET Regulations the Contractor shall bond other services where the

metalwork is less than 75mm apart.

1.11.4 Extension and Alterations to Existing Installations

For extensions or alterations to the existing installations the Contractor shall ensure that the existing protective conductors meet with the IET Regulations. It is not sufficient for the Contractor to connect to the nearest protective conductor of the existing installation. If the existing earthing system is found not to comply with IET. Regulations the Contractor shall inform the Architect immediately so that remedial action can be taken.

Where a connection is made to another protective conductor or earthing lead a permanent label indelibly marked with the words "SAFETY ELECTRICAL EARTH – DO NOT REMOVE" shall be supplied and affixed thereto.

PART 12 - LIGHTING

1.12.1 Fittings

The Contractor shall provide all luminaires which shall comply with BS.2318, BS.4533 and BS.5225 Part 1 as listed in the lighting schedule as shown on the drawings.

1.12.2 Connection of Luminaires

Luminaires shall be connected as specified in Section 2 in one of the ways detailed below:-

i) The cabling or conduit system shall terminate in a B.S. conduit box mounted on the structure in the ceiling void. A 3-pin plug in type ceiling rose shall be fitted to this box. A 3-core (one core being the protective conductor) 1.0mm² flexible cord shall pass through a brass stuffing gland fixed in the wall of the luminaire. The luminaires shall be suspended from the structure, unless otherwise stated in Section 2, using rod or conduit suspensions. The requirements of the IET Regulations should be strictly applied when suspending from PVC conduit boxes.

ii) The cabling or conduit system shall terminate in a B.S. conduit box mounted on the structure. A ceiling rose to BS.67 incorporating an earthing terminal shall be fitted to this box. A 3-core (one core being the protective conductor) 1.0mm² flexible cord (insulation and sheath as specified in Section 2) shall be run to the terminals of the luminaire which shall be fitted with a brass stuffing gland for cable entry. Suspension of luminaires shall be as in i) above.

iii) The cabling or conduit system shall terminate in a metal conduit box to BS.31 or BS.4568 mounted flush with the ceiling and supported from the structure.

Wiring shall terminate in a porcelain connector from which a 3 core 0.75mm² or 1mm glass fibre insulated flexible cord for 5 amp and 10 amp circuits respectively shall be run to the fitting which shall be mounted directly beneath the box. Boxes shall be fitted with break joint rings when the luminaire does not overlap the box.

Luminaires shall be suitably supported directly from the structure unless stated otherwise in Section 2.

When terminating the PVC sub circuit cables in a B.S. conduit box to which a close ceiling tungsten luminaire is to be attached, care should be taken to ensure that the PVC tails are as short as possible and that the extra length on tails required to install the fitting is left on the heat resisting tails specified. This is to prevent the PVC tails coming into contact with the luminaire and subsequently resulting in insulation failure due to the excessive heat.

iv) For pendant fittings the cabling or conduit system shall terminate at ceiling height in a flush mounted conduit box supported from the structure to which shall be fitted a ceiling rose to BS.67 incorporating

an earth terminal. A length of 1mm heat resisting flexible cord shall be provided from the ceiling rose to the luminaire. (The length of cord or alternatively the mounting height of the luminaire shall be specified in Section 2).

At the luminaire the flexible cord shall terminate in a heat resisting bayonet cap lampholder to BS.52H. For rod-type pendant fittings the wiring system shall terminate in a porcelain connector housed within the conduit box. A heat resisting flexible cord (0.75mm or 1mm for 5 amp and 10 amp circuits respectively), shall be connected between the connector and the fitting lampholder.

Break-joint rings shall be fitted between the conduit box and the fitting which shall be mounted at the height stated in Section 2.

The Contractor shall allow for cutting and making good rod pendants where non-standard lengths are specified.

v) For surface installations the conduit or cable installation shall terminate in a metal BS.31 conduit box fixed to the structure.

Wiring shall terminate in a porcelain connector from which a 3 core 0.75mm or 1mm or 5 amp and 10 amp circuits respectively shall be run to the luminaire which shall be supported from the structure directly beneath the box.

vi) For wall mounted luminaires connected to concealed cable or conduit systems the conduit or cable installation shall terminate in a recessed junction box accommodating a porcelain connector as described previously. However the Contractor shall ensure that the junction box employed is small enough to be completely covered by the luminaire. Luminaires with tube suspensions shall be fitted with non-rigid joints of ball and socket type which shall be provided with an earth connection independent of the ball joint.

1.12.3 Lampholders

Lampholders for use with tungsten filament lamps (up to 150W) shall be white finish, heat resisting, bayonet cap, to BS 52H, having cord grip facility and shade carrier ring when used in conjunction with a flexible cord. Lampholders incorporated in weatherproof fittings shall be porcelain or brass.

Lampholders for use with tubular fluorescent lamps shall be bi-pin to BS 1875.

1.12.4 Lamps

All lighting fittings shall be provided with the appropriate lamps which must suit the supply voltage. Fluorescent lamps shall comply with BS 1853. Tungsten lamps shall be of the pearl type and for 100 watt rating and below shall be of the coiled coil pattern. Tungsten lamps above 150 watts shall be of the clear type and shall have an Edison screw cap. Tungsten lamps shall comply with BS 1853. Extra low voltage lamps for emergency lighting shall have small bayonet caps.

1.12.5 Lighting Switches - Normal Industrial and Domestic Types

Flush mounting switches shall be of 5 or 15 amp rating for use on AC only unless otherwise specified in Section 2, mounted in flush cast iron pressed steel boxes with cover plates as specified in Section 2.

Switch ratings shall be as shown in the Lighting Circuit Schedule.

Where lighting switches supplied from different phases are situated adjacent to each other, the switch boxes shall be divided by a metal fillet, and each section shall have its own cover plate with suitable engraving.

The swing of all doors shall be checked on site before marking out any chases for switch positions.

Where surface conduits are specified the switches shall be as above but mounted in cast malleable iron industrial boxes with cast malleable iron covers or as otherwise specified in Section 2 giving protection to the dollies. Finishes shall be galvanised or black enamelled to suit the conduit installation.

Water tight switches shall be in cast malleable iron boxes finished galvanised with spout nipple entries. Switches for duct lighting shall be of the 15A rating, weatherproof type.

Ceiling switches shall be fixed to circular B.S. boxes using break joint rings. The switches shall be of the underslung type, white or ivory coloured fitted with silent interiors.

Wall switches shall be mounted in multi-gang boxes where there is more than one switch and fixed at a height of 1350mm to the centre of the switch assembly, unless stated otherwise.

The multi-gang switches are to be horizontally or vertically connected to match the relative positions of the lights they control.

1.12.6 Street Lighting

i) **General**

Street lighting shall comply with BS. CP 1004.

ii) **Columns or Standards**

Columns or standards shall be as specified in Section 2. Lighting columns shall be set 900mm deep in the ground. The bottom 300mm of the setting shall consist of 600mm square concrete plinth poured insitu around the column. 50mm dia. ducts shall pass through the concrete base to provide access for the cables going to the column. The number of the ducts through the base into the column shall be two.

Above the concrete plinth the pole shall be secured by well tamped earth. Poles shall be erected by the Contractor vertically and in alignment with one another. The inspection doors in the columns shall

be positioned so that anyone maintaining the control equipment shall be facing the oncoming traffic. The Contractor shall be entirely responsible for ensuring the true setting and alignment of the poles and ducts. Cables serving standards must loop into and out of standards except where otherwise stated. The cables shall be laid on sand 600mm below ground level with a 100mm layer of sand over the top, then covered by 150mm wide interlocking cable tiles to the route shown on the drawing.

The wiring between the fusebox and fittings shall be carried out using 1.5mm² PVC cable by the Contractor. The concrete foundation shall be provided by the Contractor.

The Contractor shall be responsible for the accuracy of the column erection. Column cut-outs shall be as specified in Section 2 complete with armour clamps having S.P. & N. fuseways, and incorporate the sealing chambers. Where three cables terminate in a lighting column the Contractor shall allow for underground joint boxes to suit the underground cable specified in Section 2.

Large door openings to cable termination chamber must be provided at all lighting columns.

iii) **Fittings**

Fittings and control gear shall be as specified in Section 2.

PART 13 - SOCKET OUTLETS

1.13.1 Industrial and Domestic Type

i) **30 amp**

30 amp switch socket outlets shall have quick make and break switches with separate shutter B.S. gauge socket and be mounted in cast iron case. The overlapping cover plate shall be not less than 2.5mm thick brass, finished as specified in Section 2.

ii) **15, 13 and 5 amp**

Flush mounted switched socket outlets shall have shuttered type sockets and AC only switches mounted in cast iron or pressed steel boxes with cover plates as specified in Section 2. Where multi-gang units are shown they shall be mounted in the same box with a common cover plate. Surface mounted switched socket outlets connected to surface conduits shall be fitted with either malleable cast iron or pressed steel box with cover plates. The finish of the box and plate shall be black enamel or galvanised as specified in Section 2. Boxes shall be fitted with brass earthing terminals.

The Contractor shall provide one high impact plug for each surface mounted socket outlet and a white plug for each flush mounted socket outlet installed under the contract. These plug heads shall be handed over to the Client at the completion of the contract and a receipt shall be obtained. A copy of this receipt shall be submitted to the Architect by the Contractor.

1.13.2 Socket Outlet Wiring

13 Amp Sockets

30 amp ring main circuits shall be wired using a minimum of 2.5mm² cables or as specified in Section 2. Cables running between spur units and the apparatus controlled shall be a minimum of 1.5mm².

X-Ray Sockets

Switch socket outlets for mobile X-Ray equipment shall be wired so that the impedance of the circuit does not exceed 0.34 ohms. The method of wiring and size of cable shall be as detailed in Section 2.

15 Amp Sockets

The minimum size wiring to be used for 15 amp socket outlets is to be a minimum of 4.0mm² and where more than one socket outlet from a 30 amp circuit occurs the wiring shall be determined on the assumed load of 15 amps per socket outlet.

5 Amp Sockets

The minimum size of cables to be used in wiring 5 amp socket outlets shall be

1.5mm².

PART 14

1.14.1 Single Phase and Three Phase Equipment

Plant not associated with lighting and single phase power ring main circuits shall be wired in accordance with Section 2 and the tender drawings.

The minimum cable sizes for three phase motors shall be as follows:-

C A B L E S I Z E S

Motor of Output	Fuseboard to Starter		D.O.L. Starter to Motor		Start to Delta Star to Motor	
	PVC Insulated in Conduit sq.mm	Min. sq. mm	PVC Insulated in Conduit sq. mm	Min. sq. mm.	PVC Insulated in Conduit sq. mm	Min. sq. mm
Up to 3 kW	1.5	1.5	1.5	1.5	1.5	1.5
3 kW to 5.5 kW	2.5	2.5	2.5	1.5	1.5	1.5
5.5 kW to 7.5 kW	2.5	4.0	2.5	4.0	1.5	1.5
7.5 kW to 11 kW	4.0	4.0	4.0	4.0	2.5	2.5
11 kW to 15 kW	6.0	6.0	6.0	6.0	2.5	2.5

For motors larger than 15 kW (20 h.p.) the cable size shall be as detailed in the drawings.

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SECTION 2

PARTICULAR REQUIREMENTS

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Contents

2.1 Introduction

This section gives details of the works as applicable to this project. The minimum standard of installation is stated in Section 1 and General Conditions given in the Main Contract documents.

The Contractor shall carry out the work as described herein and as shown on the tender drawings.

The Contractor shall include for the whole of the work involved and the supply of materials necessary for the satisfactory completion of the electrical installation, as set down in this specification, schedules of accompanying drawings and for the supply, delivery to site, off-loading, storing, protecting, taking out of store, putting into position, installation, fixing, including any fixings brackets for items of electrical equipment, inspecting, testing, attendance on other trades, commissioning of the system and removal from site of waste materials, described in detail herein, and as specified on the accompanying Tender drawings.

The position of equipment, fittings, accessories etc, on the drawings are approximate, final positions shall be established during the Engineers review of the Contractor's working drawings.

2.2 Project Description

The works included under this contract are for the provision of new electrical services to a Chinley Community Centre new build project. The new community centre is being built as detailed on the drawings and includes new changing facilities, a large community hall for a wide variety of functions, WC's, kitchen, circulation spaces, and ancillary areas.

2.3 Definitions

1. Where the work is to be undertaken as a sub-contract, Contractor shall mean "Sub Contractor".

2. "Approval" means approval in writing by the Client or his appointed representative.

2. "Provide" or "Supply" means unless otherwise stated, the supply, delivery, installation,
testing and commissioning of plant and equipment.

3. The "Engineer" means the person who the Client appoints or designates to supervise
the work.

2.4 Scope of works

The following list is a brief description of the works included under this Contract. The Contractor shall include for the provision and installation of the following services as described in this specification and as indicated upon the drawings.

1. Incoming mains electricity supplies

2. LV distribution
3. General Power Installations
4. General Internal & External Lighting Installations
5. Emergency Lighting Installations
6. Fire Alarm Installations
7. Data Installation
8. AV
9. Communications
10. TV
11. Disabled Alarms
12. Access Control
13. Containment
14. Lightning protection
15. PV System
16. Electrical connections to mechanical equipment, including space and water heaters
17. The provision of all plant, materials and labour for testing and commissioning of the complete installation
18. Provision of all As Installed Drawings, Maintenance Manuals, Test Certificates

This specification shall be read in conjunction with Section 1, design drawings and is for a complete installation. None of the aforementioned documents or drawings shall be read in isolation.

2.5 Programme of Works

The contract start date shall be in accordance with the main contract documents. The Contractor shall provide all test certification and as fitted drawings, manuals etc. **1 week prior to handover for checking**. The Contractor shall also complete their installation in sufficient time to allow for the Contractor's snagging and Design Team's snagging to be carried out and for any remedial works to be resolved. **Any tender related queries shall be raised during the tender period to enable a full tender price.**

2.6 Off Loading and Positioning

The Contractor shall be responsible for and shall provide all of the necessary equipment for the off-loading, site transport and hoisting to the required level of all materials and equipment supplied under this Contract.

Plant and materials shall not be deposited on roadways, footpaths, corridors or floors unless prior permission has been obtained in writing. The Contractor will be held responsible for any damage caused by the off-loading and movement of materials supplied under this Contract.

2.7 Queries

Any technical queries in respect of this specification or drawings shall be addressed to Philip Fairbairn Tel: 0191 217 0888 at:

JCP Consulting Engineers Ltd
1-2 Brenkley Way

Blezard Business Park
Seaton Burn
Newcastle upon Tyne
NE13 6DS

philip.fairbairn@jcpce.com

2.8 Tender Drawings

The extent of the Electrical Services Installations is shown on the following drawings.

3001_(6-)_001	Proposed Lightning Protection
3001_(6-)_002	Proposed PV Layout
3001_(61)_001	Proposed LV Schematic
3001_(62)_001	Proposed Small Power & Data Layout
3001_(63)_001	Proposed Lighting Layout
3001_(65)_001	Proposed Fire Alarm & Security Layout
3001_(69)_001	Proposed Containment Layout
3001_(96)_001	Proposed External Services Layout

2.9 Builders works

The Contractor shall carry out all builders work as agreed with the main contractor necessary to complete the works to the satisfaction of the Engineer and Client.

Builder's work includes the cutting and forming of any holes in the structure, boxing out, making good to all holes after the installation of conduits/cables and sealing where necessary.

All internal fire barriers in accordance with IET Wiring Regulations shall be provided. All penetrations shall be suitably fire stopped where it passes through fire barriers with a fire resisting material.

2.10 Type of Building Construction

The Contractor shall ensure that they are fully aware of the building construction. They shall obtain all necessary details before work commences. They shall ensure that they have access to all information before they proceed, e.g. they must have a ceiling layout before commencing the installation of luminaires to ensure correct position of suspended, surface and recessed units. If no RCP is produced the contractor shall issue one for comment.

2.11 Testing

The new installations shall be tested by the Contractor in accordance with the testing procedures set out in BS 7671:2018 and any subsequent amendments.

2.12 Earthing and Bonding

The installation shall be efficiently earthed in accordance with BS 7671:2018 and any subsequent amendments.

The Contractor shall provide and install earthing and bonding arrangements, which comply with BS 7671, BS 7430, this specification and the layout drawings. Where

bonding conductors interconnect two items of equipment then the conductor shall be looped through the bonding termination and not cut, i.e. the bonding conductor shall be completed in its entirety from the earth bar to the piece of equipment.

All main equipotential bonding connections shall be complete with a permanent warning notice indelibly marked with the wording **SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE**. This shall be a proprietary label or purpose maybe traffolyte label. All bonding connections shall be made accessible for inspection/testing.

Supplementary equipotential bonding conductors shall be sized in accordance with BS7671. Install necessary earthing arrangements as required.

2.13 Main Distribution Switchgear

The new electrical distribution system shall comprise of the incoming district network operators cut out and utility providers metering supply arrangement within store 10. The supply shall feed a new LV distribution board to fixed supplies throughout the community centre.

The new distribution board shall supply all LV sub-circuits around the community centre as shown on the drawings.

The new board shall be wall mounted front access only, with cable entry and cable exit from the top and bottom.

Appropriately sized cable lugs and terminals shall be provided, or equipment shall be modified by the manufacturer to accept larger cables than standard.

Equipment within the switch boards shall comply with the following British Standards;

- BSEN60898 MCBs.
- BS5424 and BS EN 60947-4 Contactors.
- BS3938 Current Transformers
- BS142 Protection Relays.

The new LV panel board shall be complete with all necessary labels, manufactured from white traffolyte with black lettering.

Rubber matting (600/1000 volt grade) shall be provided in front of the panel board. The rubber mat shall be not less than 6mm thick and 600mm wide.

The panel board shall have surge protection devices for all external incoming and outgoing cables.

Metering in accordance with CIBSE TM39 Instrumentation on the incoming isolator and outgoing units to include:

- Voltage phase to neutral.
- Voltage phase to phase.
- Phase current.
- Frequency.

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- Real Power kW.
- Power factor.
- Reactive power kVAr.
- Apparent power kVA.
- Real Energy kWh.
- Reactive energy kVArh.
- Apparent energy kVAh.
- Communication port and volt free contacts for kW pulses.

The new distribution board shall have a chart stating locations and type of all points controlled by each way, the rating of that way and the installation details. The charts shall be type-written and contained in a transparent plastic laminate or sealed envelope fixed to the inside of the distribution board door. The envelope shall be arranged so that the chart can be removed for modifications at a future date. Space shall be left (blank) on the chart for all spare and blank ways. A second typed circuit schedule shall be supplied within a loose wallet for the purposes of removal in order that future alterations and additions can be made. Distribution board schedules shall contain the following information:

Where each distribution board requires a cut out section to accommodate the incoming cable a rubber gasket shall be installed around the lip in order to protect the cables against shearing.

All distribution boards shall be complete with a full complement of type ‘B’ (small power) and ‘C’ (lighting) RCBOs and RCBOs as indicated on the tender drawings or schedules.

All panel boards and distribution boards shall be provided with labels stating: -

a) DANGER 400V (or 230V as applicable).

b) The type of service lighting or power distribution board or both.

c) The size and type of sub main cable connected to it.

d) The source of supply to the board.

e) Reference number if applicable.

The Client shall be asked to approve the labelling before installation. All labelling shall be complete before testing.

Facilities for local isolation of the distribution boards shall be provided by an integral isolating switch. For surface mounting, trunking shall be fixed between the board and ceiling level, or conduits run directly into the board. Adequate earth continuity connection shall be made between the various components.

Each distribution board shall be complete with multi-way neutral and earth bars complete with labelling to allow each neutral and earth cable to be identified with its associated phase conductor. All unused ways shall be fitted with blanks and all distribution boards shall have gasketed covers.

All fused switch units, switch fuses, switches, bus-bar chambers, distribution boards, etc. and all items of equipment on the main panel shall be identified in

accordance with section 514 of the IET Regulations and shall have securely fitted externally a white "formica" or "traffolyte" label engraved with 6mm high black letters detailing the function of the equipment, any reference numbers and the size of incoming and outgoing cables and types. Brown, grey, black "Formica" phase discs shall be fixed inside all switchgear and distribution boards to indicate to which phase of the supply the various circuits are connected. The colourings shall comply with the IET Regulations.

Each TP or TP & N item of switchgear shall have fitted on the cover a yellow "Formica" or "Traffolyte" label having "CAUTION - 400 VOLTS" engraved in 10mm high black lettering.

New distribution board shall be Schneider Acti9 Isobar Type B Split Metered TP&N distribution boards or equal and approved; the new distribution boards shall supply all new LV sub-circuits as indicated on the proposed drawings

2.14 Circuit Identification

The Contractor shall engrave all electrical accessory front plates. New identification engraving shall give the supply circuit reference, e.g. DB1/LP/1L1. **Hand-written labels will not be acceptable.**

Where electrical accessories supply fixed equipment the equipment details will be included on the label e.g. extract fan.

2.15 Type of Installation

The installation shall be carried out as described in the following clauses and as detailed on the drawings.

General Lighting and Power

Generally, all new sub-circuit wiring shall be carried out utilising multi-core RE LSZH insulated cables non-armoured to BS6242B which shall be fixed to containment cable basket in ceiling voids. All basket, trays, conduits, and cables etc. shall be concealed in ceiling voids and within galvanised conduits flush fixed within the building fabric for a plastered wall finish. No conduits shall be run in the floor, unless shown specifically otherwise.

All accessories shall be provided with pressed steel back boxes or propriety back boxes, where installed in UPVC containment systems. Conduits routed from the back boxes to the circulation area ceiling void containment systems shall be provided with a bushed end. Cables routed from the conduit to the cable basket containment shall be clipped to the building structure using propriety fixings.

The loop-in system shall be used throughout with joints occurring at control or equipment positions only.

No phase sub-circuit wiring less than 1.5mm² shall be used.

Communication containment shall be pressed steel back boxes and high impact concealed PVC conduit routed to the ceiling void containment systems terminating directly above the containment and provided with a bushed end.

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2.16 Accessory Boxes

All new accessories shall be supplied with accessory boxes, complete with earth terminal.

The separate earth conductors shall be connected to the accessory and to the box by means of an earth terminal. Surface units shall have surface boxes. The Contractor shall ensure that all boxes are fitted level, securely fixed and inclusive of **acoustic putty pads** to reduce sound transfer.

2.17 General Power

The Contractor shall supply and install the small power requirements as detailed within this specification and on the drawings all to BS 7671 (IET Wiring Regulations).

Circuits used to supply IT equipment shall be accordance with Earthing Requirements for Installation of Equipment having High Protective Conductor currents.

The Contractor shall include for the final connection between the isolators and all plant and equipment to suit the environment the plant/equipment is located, provide heat resistant and LSZH final connections.

Wiring for small power throughout the building shall be carried out utilising multi-core RE LSZH insulated non-armoured to 6242B using galvanised cable tray in ceiling voids. Supplies shall be derived from local distribution board.

All cables shall be zero halogen low smoke fume and shall be BASEC approved. No power cable with a cross-sectional area of less than 1.5mm² shall be used unless otherwise stated. Final circuits shall be run in conduits separate from main or sub-main cables. All cables in a conduit shall be drawn in simultaneously. The minimum length of spare cable to be left at each accessory shall generally be 150mm per conductor to enable terminations to be remade.

Cables shall be terminated by one of the following methods:

- The cable conductors shall be sweated into lugs of the appropriate size for the cable and equipment terminal.
- The cable conductors shall be secured by compression type lugs of the correct size or the cable and equipment terminal;
- The cable conductors shall be secured in pinch screw terminals;
- The cable conductors shall be secured by means of clamps.

Where cables are required to terminate at connectors, as at lighting points. Connectors shall receive two layers of PVC self-adhesive tape.

The cross-sectional area of cable conductors shall not be reduced at terminations, and connections shall secure all the strands of stranded cables. Care shall be taken to ensure that cables are not damaged during preparation for termination.

All external supplies will be via XLPE /SWA/LSOH-Cu cables.

All accessories are to be generally plastic; metal clad within the plant areas and IP65/66 externally. Accessories to be fully DDA compliant and contrast in colour

from the background they are installed. DDA flanges to be installed on dado trunking. Final electrical finishes to be confirmed by Architect (Design North).

The plates of all sockets, accessories feeding fixed equipment, etc. shall be engraved to denote a circuit / function, i.e. fan etc. Self-adhesive labels will not be allowed. The accessory plate shall be engraved in either black or red, capital letters 5mm high detailing circuit, the appliance or equipment being supplied by the accessory e.g. "EXTRACT FAN", "WATER HEATER", "EXTERNAL LIGHTING" etc.

The Contractor shall provide warning labels to any switching enclosure containing 400 Volts stating the voltage present within. The Contractor shall provide an appropriate number of engraved descriptive labels above each gird switch were a grid contains more than three switches.

The Contractor shall allow for all necessary contactors and enclosures linked to the local distribution board for isolation purposes.

Cleaner's sockets shall be engraved to denote that they are for the purpose of cleaning.

Data Cabinet Power Supplies

Data cabinets shall be provided from a dedicated 16A SP&N MCB that shall be terminated at a dedicated 13A single unswitched connection unit or to suit the data cabinets requirements.

Indicator Switches

Indicator switch units shall be of the ratings shown on the drawings and comprise of a switch assembly incorporating a red coloured plastic lens housing a neon indicator lamp to show when the switch is in the "ON" position. Front plates shall be engraved to indicate the equipment served and circuit.

Switched Fused Connection Unit

All fused connection units shall be complete with steel box with earthing terminal. Units shall be flush or surface mounted, switched or unswitched with or without neon indicator and flex outlet as required. Front plates shall be engraved to indicate the equipment served and circuit. Switched fused connection units shall comply with BS816 and shall be of the type which does not expose live metal parts when the fuse holder is opened for replacement of the fuse. The units shall be fitted with a fuse of the correct rating to protect the appliance and wiring served.

Socket Outlets

All socket outlets and plugs shall be supplied and installed in accordance with the manufacturer's recommendations. All socket outlets shall be of the screened shutter type unless otherwise stated. 13A sockets shall comply with BS1363. All round pin 2A, 5A, 15A and 30A socket outlets shall comply with the requirements of BS546. All socket outlets shall be switched, unless otherwise stated in the specification and drawings. All switched socket outlets shall be complete with steel boxes of the same manufacture, complete with earth terminal.

Assemblies shall comply fully with the requirements of the IET Regulations concerning the bonding of the protective conductor terminals. Where the assembly does not provide a reliable electrical contact between the cover plate and box with effective connection of metal operating bars and toggles, then an insulating earthing lead shall be provided, solidly connecting the metal plate operating box or toggle and terminating at the fixed earthing terminal incorporated in the associated box.

Assemblies installed in the plant rooms and where specified shall be of the surface mounted metal clad type comprising a socket and switch. Boxes and cover plates shall be galvanised.

All accessories shall be DDA compliant.

2.18 General Lighting

The Contractor shall supply and install the complete lighting installation and switching/control system as detailed in this specification and indicated on the lighting drawings.

The contractor shall be responsible for providing and co-ordinating all necessary power supplies, control cabling and containment, together with all necessary commissioning of the following electrical systems: -

- Lighting and emergency lighting.
- External Lighting.
- Presence detectors & controls.

Fixing Methods

The following general fixing methods will not include every area or ceiling type to which the various lighting fittings will be installed in/to and the exact methods, where applicable, will be agreed on site with the Engineer. The Contractor is reminded of their responsibilities with respect to the secure fixing of lighting fittings and any other equipment.

The Contractor shall ensure that the methods of suspension for luminaires are electrically and mechanically sound.

Luminaires shall be provided with a minimum of two fixings, except in the case of recessed modular luminaires or surface mounting luminaires exceeding 300mm in width, where four number fixings (one from each corner) shall be provided by means of conduit drops or threaded rods.

All luminaires shall be solidly mounted with all assembly nuts, bolts and accessories made tight to prevent vibrations and noise. Anti-vibration packing shall be fitted where necessary. Luminaires mounted directly to trunking shall be fixed by means of the manufacturer's recommended fixing assemblies.

Unless otherwise stated, luminaire supports shall be fixed to the building primary structure. Luminaires shall not be supported from suspended ceilings unless detailed in the specification. The Contractor shall be responsible for mounting and fixing arrangements.

All fixing screws and/or bolts are to be complete with flat washers and are to be of suitable size and type to suit the application. Any deviations from the following methods of fixing shall be agreed with the Engineer and/or his Inspector of Works.

Luminaires must not be suspended/fixed to PVC conduits or PVC accessory outlet boxes.

Surface Mounted Downlights/Linear Luminaires to Suspended Grid Ceilings

The luminaires shall be fixed in a minimum of 2 No. positions to the 'T' grid of the ceiling system using suitable 'ERICO-CADDY' fasteners. Additional wire supports for the ceiling shall be provided by the Building Services Contractor at each luminaire position. The luminaire shall also be provided with an additional support wire/rod fixed to the ceiling slab/beams suitable to support the weight of the luminaires in the event of damage to the ceiling.

LED to plasterboard ceilings shall be fixed in the centre to a 20mm galvanised steel conduit box which in turn shall be fixed to a timber noggin installed within the ceiling void and at each end to the ceiling timber support battens/joists or timber noggin. There shall be a minimum of 2 No. fixings to the conduit box and 2 No. fixings to the timber noggin. Woodscrews shall be 38mm long No 8 brass complete with flat washers.

Recessed luminaires to suspended grid ceilings 600x600mm shall be suspended using the manufacturer's proprietary fixing brackets onto the 600 x 600mm suspended ceiling grid. The luminaire shall also be provided with an additional support wire/rod fixed to the ceiling slab/beams suitable to support the weight of the luminaire. The Building Services Contractor shall co-ordinate with the main contractor to confirm final suspended ceiling T bar sizes, relevant to fittings fixing types. The Contractor shall coordinate with the Suspended Ceiling Sub-Contractor. The Contractor shall coordinate with the suspended ceiling sub-contractor to provide additional suspension wires.

Surface luminaires to suspended ceilings shall be fixed to the suspended ceiling tile with the appropriate proprietary attachments. The Building Services Contractor shall also provide plywood sheets (600 x 600mm) to lie on top of the ceiling tile to prevent damage occurring to the ceiling tile and providing additional support for fixing the luminaire. The Building Services Contractor shall allow for coordination with the suspended ceiling sub-contractor. The Contractor shall confirm final luminaire positions within an assembled grid at site. The Contractor shall arrange with the suspended ceiling sub-contractor to provide additional suspension wires if necessary.

Recessed luminaires within plasterboard or wood ceilings shall be provided with proprietary fixings and brackets. Where necessary, the Main Contractor shall provide/form site specific boxings or recesses within the ceiling in which to suitably house the luminaire. Where possible, luminaires shall be securely fixed to the ceiling joist network. The Building Services Contractor shall identify all necessary positions at construction stage.

Lighting Points for Fittings Fixed to and Recessed in Suspended Ceilings

Where luminaires are not suspended from the structural ceiling but fixed to the suspended ceiling.

Wiring to the luminaires shall terminate into a plug-in ceiling rose mounted on a conduit box fixed and adjacent to the fitting. Final connections shall be made using 3 core heat resisting 1.0mm^2 flexible cable of minimum length. Where the flex enters the luminaire a cable gland shall be fitted.

Luminaire Suspensions

Where luminaires are detailed as being suspended the suspensions shall be either chain, rod or conduit.

Chain suspensions shall be black for general areas and galvanised for industrial areas or areas where the general trunking and/or conduit is galvanised.

The conduit boxes above the luminaire shall be fitted with hook plates and the wiring connected to 3 core 1.0mm^2 heat resisting flexible cable with porcelain connectors within the conduit box. The flexible cable shall be fixed to the chain with PVC cable ties and enter the fitting through a conduit hook. Conduit hooks shall be fixed to luminaires by means of 2 lock nuts, one fitted above the luminaire and one below.

Conduit suspensions shall comprise a ball and socket, conduit and flanged coupling with brass bush and scraper washer.

Conduit shall be either black enamel or galvanised to match the general conduit installation.

Erection of Luminaires

Luminaires shall be erected complete with all necessary diffusers, louvres and lamps.

Before erection each diffuser shall be cleaned with an anti-static cleaning solution. All louvres shall be carefully erected using gloves where necessary to prevent finger marks on polished surfaces.

Earthing and Supplementary Bonding

The metalwork of all luminaires shall be effectively bonded to the earthing system in accordance with IET Regulations. Every lighting point shall be provided with an earthing terminal comprising a 2BA round head brass bolt and 2 No flat washers fitted into a tapped hole in the box. To facilitate the connections of continuity conductors a 1.0mm^2 green/yellow insulated copper conductor flexible cable shall be secured to the earth terminal and to one of the connectors in a 10 amp connector block.

Where extraneous conductive parts are simultaneously accessible with either exposed or other conductive parts the Contractor shall allow all costs for bonding them together in accordance with the current edition of the IET Regulations.

Wiring

The minimum conductor size for lighting circuits shall be stranded 1.5mm^2. Solid conductors shall not be used.

The general installation shall be carried out using galvanised basket utilising multi-core RE LSZH insulated non-armoured to 6242B. Supplies shall be derived from

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local distribution board. External lighting circuits (including building mounted external lighting) shall be wired in XLPE /SWA/LSZH-Cu cables.

Cables terminating at pinch screw terminals shall be twisted together and single cables shall have the conductor doubled back to ensure adequate purchase for pinching screws. Cables connected to lamp holders or other compartments where heat is produced shall be insulated with heat resistant material capable of withstanding, without detriment, the temperature encountered.

All final circuit cables so installed shall be provided with heat resistant sleeves from the connection point within the luminaires for the distance of 300mm.

2.19 Light Fittings

Provide, install and connect the luminaires shown on the drawings. On the drawing the letter or symbol within a light point indicates the type of fitting required for that point, as detailed in the Schedule of Luminaires.

Luminaires shall be complete with a first fixing of all lamps, as indicated on the Schedule of Fittings.

The Contractor shall request confirmation from the Engineer that all luminaires have been approved by the Client prior to placing an order.

All luminaires shall be earthed. A protective conductor shall be installed within each conduit.

Provide additional fire boxes/caps to luminaires penetrating fire barriers to maintain the integrity of the fire compartment.

2.20 Lighting Switches

These shall be MK ‘Gridplus’ assemblies with white 20A rated interiors, one way, two way, retractive dimmable or intermediate, as shown on the drawings.

At multiple switch positions the unit shall be mounted onto a common plate.

Switches shall generally be installed at 1100mm AFFL.

Socket outlets and switches shall be engraved or coloured to suit DDA requirements, where located on walls without contrasting coloured paint. Switches shall be fully DDA compliant.

2.21 Lighting Controls

The Contractor shall provide, install and connect lighting controls as shown on the proposed drawings. The areas in general will be controlled via presence detection and as follows further in this specification.

Offices/Multi-Purpose Room/

Control Type – Manual On, Automatic Off.

- Enter area – Luminaires are off, manual switch on and luminaires energise.
- Luminaires remain energised for pre-set timed period (21 minutes)
- Each and every time presence is detected, timed period reset (i.e. 21-minute timed period begins again)
- After a sustained period of absence (i.e. >21 minutes) the luminaires are switched off

Plant Rooms/Main Hall/

Control Type - Manual On / Off

- Plant Room will be furnished with metal gang switches, white plastic elsewhere. Control will be of the manual type

Corridors, Public Circulation, Stores, WC's, Lobbies, Changing Areas, etc

Control Type – Presence/Absence/PIR sensor

- Enter area – luminaires are off, presence detector senses occupancy and luminaires energise
- Luminaires remain energised for pre-set timed period (up to 15 minutes)
- Every time presence is detected, timed period reset (i.e. Timed period begins again)
- After a sustained period of absence (i.e. >15 minutes) the luminaires are switched off
- Time delay to be selectable

2.22 External Lighting

The contractor shall ensure the external lighting distribution shall be controlled via contactor arrangements with photocell and digital 24/7 time clock facilities and shall be provided with a 3 position ON/OFF/AUTO switch located adjacent to the distribution boards. The photocell shall not be affected by the external lighting illumination and shall be carefully located.

Luminaires shall be wired using XLPE/SWA/LSZH type cable BASEC approved.

No surface wiring will be allowed.

2.23 Emergency Lighting

The emergency lighting installation shall be installed in accordance with the following current documents:

- This specification.
- Electricity at Work Act 1989.
- Health and Safety at Work Act.
- CDM Regulations 2007.
- BS 5266 Emergency Lighting.
- CIBSE Technical Memorandum TM12 Emergency Lighting.
- BS 7671 IET Wiring Regulations.
- All relevant British Standards.
- All relevant Building Regulations.
- BS EN 1838.

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- BS EN 50172.
- DfE Building Bulletins 87, 90 & 100.
- Lighting Guide 12.

The emergency lighting shall comprise a combination of self-contained separate emergency final exit luminaires, standalone LED luminaries and general luminaires incorporating self-contained integral emergency conversion.

The emergency lighting units shall be as shown on the Schedule of Luminaires and shall be wired from the local lighting circuits on an unswitched live and neutral supply via light points as described previously.

The battery units shall be positioned within the luminaires away from the control gear to limit the ambient temperature of 50°C.

The remote LED charge indicator shall be fitted in position visible from below.

Each emergency luminaire will be activated either on local circuit failure or building power outage.

2.24 Fire Alarm Detection System

The Contractor shall design, supply, install test and commission an addressable Fire Alarm and Detection system to provide signals for automatic plant shutdown in the event of a fire activation.

The design shall be in full compliance with the following standards:

- Electricity at Work Act 1989
- Health and Safety at Work Act 2014
- BS 7671:2018. IET Wiring Regulations
- BS5839 Parts 1:2017, Fire Detection and Alarm Systems in Building
- BS EN 54-23
- All relevant British Standards
- All relevant Building Regulations
- LPCB Requirements 2014

The entire fire detection and alarm installation / system shall be designed, installed and commissioned by a specialist installer / provider who must be BAFE SP203 accredited installer. This includes all void detection that may be required for compliance with BS5839. Confirmation of this shall be provided by the contractor.

The Contractor shall, supply and install the complete fire detection and alarm installation and to manage and co-ordinate the requirements with all parties to ensure satisfactory completion of the installation.

Short circuit isolators to be incorporated with-in all devices, the system shall have battery backup facility for a minimum of 72 hours with capacity to sound the alarms for a further 30 minutes.

A dedicated main supply direct from the main L.V. panel board shall be provided to the fire alarm panel and shall terminate via a local tool operated compliant isolation unit adjacent to the fire alarm control panel. The dedicated supply shall be red and padlocked in the on position and clearly labelled with a red traffolyte label indicating

that a fire alarm system is derived from this device. Adjacent the main panel boards main isolator a red traffolyte label shall be installed indicating that a fire alarm system is derived from this panel and should not be isolated.

Cabling for the system shall be carried out in FP200 Gold or an approved equivalent with a red LSF sheath. Cables fixed directly to the building structure or upon an inverted cable tray shall be securely fastened using metallic restraints to suit the manufacturers and British Standard requirements with intermediate support being provided using plastic clips. The containment/support system shall be continuous as such that cables are contained/supported to within 500mm of their termination points.

Visual notification shall generally be provided throughout the building for occupants/staff with impaired hearing. Visual Alarm Devices shall be BS EN 54-23 compliant and the required illuminance levels shall be achieved. Number of VAD's required will be determined by the manufacturer's equipment performance.

Sounders shall be designed to achieve audibility levels as required by Annex B of the British Standard which states typical noise levels.

Manual call points shall be provided at each external door and within buildings as may be necessary to achieve compliance with B.S. 5839-1:2017.

Manual call points shall also be installed within the internal areas and include plant structures. Protective clear Perspex covers shall be provided.

The Fire Detection and Alarm system shall include interfaces for the following systems as well as any other deemed necessary to form a complete system:

- Mechanical Services Control Panels – cease operation in the event of a fire condition.
- Electrically operated doors forming part of the escape route.
- Door Holders / Locks.
- Kitchen ventilation interlock.
- Gas Control Panel.
- Gas Solenoid Valve.
- Lifts

The Contractor shall ensure that when the fire alarm is in test, the above interfaces are not activated.

The Contractor shall carry out all testing and commissioning on completion of the system in accordance with all the relevant Regulations, Standards and this specification.

On completion the following is required:

- System description.
- Checklist of equipment and components.
- Installation instructions.
- Equipment connection diagrams showing wiring detail of Addressable Device positions with addresses.
- Final testing instructions.
- Commissioning instructions.

- Certification documents.
- Log book.
- System operating instructions.
- Routine maintenance instructions and schedules.
- Five no spare break glasses and MCP test keys.

As a minimum, the following drawings shall be provided by the Contractor for the proposed system:

- System schematic diagram.
- Cabling and wiring diagram.
- Detailed equipment connection diagrams.
- Cause and effect diagram.
- Building plan showing zoning and location of detectors, call points, sounders and ancillary devices.
- Encapsulated drawings shall be provided adjacent to the Fire Alarm Panels providing building plan showing zoning and location of detectors, call points, sounders and ancillary devices.
- Full layout drawings for the installation at a scale of not more than 1:100, to be agreed during the design phase.

The Contractor shall provide a zonal diagram at the fire alarm panels located in the building to suit the site fire alarm system. The Contractor shall also be expected to produce on site drawings at the end of the works so there are a FULL set of comprehensive as built drawings that clearly identify the interfaces and system extent.

The contractor shall include for the system to be provided with communication equipment via a digital communicator to an approved alarm receiving centre (arc) approved by the client. The communications equipment shall automatically carry out a static test every 24 hours to confirm the integrity of the digital communicator and telephone line. The telephone line shall be the same line as used for the Fire Alarm system. The installation of the broadband line shall be organised by the client and be the responsibility of the client for ordering the incoming telecommunication lines; it is the responsibility of the contractor to ensure that the client is aware of the system requirements prior to the lines being ordered.

2.25 Data Systems

The Contractor shall supply, install test and commission all cabling, including fibre, patch panels, data cabinets and support systems for the Clients data system installation as detailed within this specification and the associated drawings.

The design shall be in full compliance with the following standards:

- Electricity at Work Act 1989.
- Health and Safety at Work Act.
- BS 7671. IET Wiring Regulations (latest edition and amendments).
- All relevant British Standards.
- REC’s requirements and standards.
- All relevant Building Regulations.
- EIA/TIA 568, TSB-36 and TSB 40A for data installations.

The Contractor shall provide a system of cable basket and conduits for use by the specialist data contractor between the comms cabinet and the data/voice outlet locations throughout the building as indicated on the drawings.

The Contractor shall provide a structured data cabling network to support the ICT systems that will be required within the community centre. The data cabling network will be used to support wireless connectivity and is also to be used for voice.

The scope of the provision will include all ICT data and telecommunications cabling systems and containment, from connection to the statutory undertaker to connection point within the community centre equipment relating specifically to the:

- data system (to be a minimum CAT 6 specification) (hubs routers, switches and all other active devices provided by client) and incoming Services connections.
- Comms end connectivity via patch panels mounted in server cabinets;
- telecommunications system capable of working with 'Voice over IP' equipment (telecommunications system and equipment to be provided by client)
- All telephones shall be provided by the client.
- The Contractor is required to provide appropriate data cabling systems and containment to the community centre to provide the data points as required.
- The Contractor shall inform the client of all communication lines that are necessary for security, fire systems, lifts etc. It shall be the responsibility of the contractor to inform the client when the lines need to be ordered and within enough time to suit the programme.

Cabinets

The Contractor shall supply and install all cabinets required to deliver the complete data and security infrastructure. Main cabinets shall be wall mounted complete with all power, patching, and cable management systems in place. Active equipment such as network switches and routers shall be provided and installed by the Client's I.T specialist.

All should be fitted with a lockable door and incorporate a fan tray, located at the top of the cabinet to assist ventilation if required.

Cabinets should have all cables entering from above and below as required.

Copper patch panels will consist of forward facing modular RJ45 sockets fully wired at the rear to Insulation Displacement Connectors (IDC). All cabling at the rear of patch panels should be neatly formed and tied.

Copper patching will be accomplished via flexible patch cords fitted with RJ45 connectors at both ends. Patch cords will be straight wired in accordance with EIA/TIA 568A. The IT / Data and Security Wiring Services Contractor is to include within their tender for Cat6e 1 metre patched leads.

Fibre optic patch panels will be equipped with ST type uniters (couplers) which have permanent cabling connected at the rear and present STII sockets forward facing allowing patching with cords fitted with STII connectors at one or both ends.

Cabinets should be equipped with adequate cable management rings to enable all patching cables to be supported along their whole length.

Cabinets should be equipped with fixed power distribution to serve active hardware with a minimum of 6 outlets at the rear.

All cabinets must be installed with an adequate electrical safety earth (minimum. 4mm diameter) to comply with BS 6701 and BS 7430.

Labelling

A clear and concise labelling scheme must be deployed and approved by the client. This must provide unique identification of each port to each patch panel and cabinet / transition point.

Each data point will be allocated a unique reference number and therefore readily identified back to the correct patch panel port in the correct cabinet as follows:.

CAT 6

Category 6 LSZH UTP 4-pair cable should be used in all cases, terminating to suitably rated patch panels and data outlets. Full testing should be carried out within the last 2 weeks of the construction period and appropriate certification provided at time of handover. One cable should serve one RJ45 data socket; e.g. if a quad outlet is required then 4 cables (each being 4 Pair Cat 6) should be used. Cat 6 cables must not exceed 90 metres in length.

Provide all power supplies, containment, attendance, builders work required to complete the installation.

2.26 Door Access Control and Call System

The Contractor shall supply, install and commission a new door access system as indicted on the drawings and as described herein.

These points shall be interfaced with the fire alarm system to fail open on the event of a fire alarm activation.

The following systems/access control are to be provided:

- Access control to main front door, push to open/exit.

Containment installations shall be provided by the contractor to provide a concealed installation throughout.

Allow for all costs, attendance, builder’s work and all the specialist’s requirements to present a fully operational system, including all maintenance information, record drawings and any hardware/software required.

The system shall be wired using concealed LSF cables in accordance with the system devices manufacturers' recommendations. Containment to be allowed in accordance with specialist requirements. Wiring shall be concealed throughout.

The Contractor shall allow for all devices, additional supplies, additional interfaces, fixing, devices, 230V 3amp un-switched fused spurs etc to ensure a full and working system as required.

The system shall generally consist of the following;

- Push to Open Button
- Request to exit button.
- Electro-magnetic locks.
- Door Loop control modules.
- Fire alarm interfaces, (doors release in the event of fire alarm).
- Green, Emergency Break Glass units.

Provide full training to the client's selected staff. Provide 500 cards for programming and use with access control.

Provide all power supplies, containment, attendance, builders work required to complete the installation.

2.27 CCTV System

The Contractor shall employ a CCTV specialist to provide an IP network based closed circuit television installation to monitor the following area:

- External Perimeter.
- As shown on the drawings

The system shall comprise of external IP rated fixed cameras.

These definitions shall be as per the Home Office guidelines for CCTV installations. The system shall meet the requirements of the Secured by Design guidance published by the ACPO Crime Prevention Initiative.

Signage in accordance with GDPR 2018 shall be provided to all external facades to advise staff and visitors that images are being recorded. The signage shall be clearly placed.

Recording / control hardware, connection racks and patch panels shall be accommodated within the data cabinet.

The contractor shall allow for a system that is capable of being remotely controlled/viewed.

The CCTV system shall comprise of external colour cameras. All cameras shall be connected to an 8TB Network Video Recorder (NVR) to allow all camera pictures to be recorded.

Cameras shall be high resolution colour in daylight defaulting to monochrome in darkness hours. Minimum light level to be 0.1 lux, using ½" CCD imaging chip with lenses selected to suit the performance requirement described in this specification.

The entire camera system shall be digital using hard drive recording and storage. The system shall be developed by a CCTV specialist to meet the specification

requirements, with equipment and lens selections being issued to the engineer for review prior to procurement.

The Contractor shall allow for training of client and operator representatives in the operation of the system.

Cameras

All cameras shall be IP type and the system shall be wired using category 6 UTP structured cabling, with minimal use of co-axial to network wiring interfaces.

Housings shall be conventional with anti-condensation heaters.

All flexible connections shall be provided between the camera enclosures and connections enclosure.

CCTV Cabling installation

CCTV cabling shall be category 6 cabling for the IP system.

Cabling shall be provided on cable trays / baskets. Wiring to cameras shall be continuous, without terminals or connectors between the camera positions and the hub location. The cable shall be Category 6e.

Provide all power supplies, containment, attendance, builders work required to complete the installation.

2.28 Intruder Alarm System

The Contractor shall provide, install, test and commission a complete intruder alarm system. The system devices shall comply with PD6662:2004 and shall be as indicated on the drawings and as described herein to provide a complete and fully operational intruder alarm system.

The design shall be in full compliance with the following standards:

- Electricity at Work Act 1989
- Health and Safety at Work Act 2014
- BS 7671:2018. 18th Edition IET Wiring Regulations
- All relevant British Standards
- All relevant Building Regulations
- DD243:2004
- EN50131.
- ACPOS
- PD 6662
- BS6799

The contractor shall include for a security specialist to supply, install, test and commission a security alarm system generally consisting of standard door contacts, external sounders and dual tech 15m presence detectors etc.

The system shall be wired using concealed LSF insulated and served LSF Cu 8 core stranded cables in accordance with the system devices manufacturers' recommendations routed on the communications containment surface mounted throughout the building.

The control panel shall be programmable to provide confirmed sequential signalling to comply with ACPOS Policy and DD243:2004.

The contractor shall include for the system to be provided with communication equipment via a digital communicator to an approved alarm receiving centre (arc) approved by the client. The communications equipment shall automatically carry out a static test every 24 hours to confirm the integrity of the digital communicator and telephone line. The telephone line shall be the same line as used for the Fire Alarm system. The installation of the broadband line shall be organised by the client and be the responsibility of the client for ordering the incoming telecommunication lines; it is the responsibility of the contractor to ensure that the client is aware of the system requirements prior to the lines being ordered.

The contractor shall include for providing a full training regime to educate the end user as to the use of all the equipment located in the contract areas.

2.29 Containment

The Contractor shall provide, test and install a complete cable containment system complete with sub dividers as indicated on the drawings and described herein which will include the cable support systems. The primary containment is shown only on the drawings. The Contractor shall adjust as necessary to suit the electrical installation. The contractor shall allow for all galvanised secondary containment to be installed as necessary. Secondary conduits/trunking not indicated on the drawing however shall be included within the contractor's tender return so all cables are fully supported in their entirety.

All containment shall fully comply with BS EN 10346: 2009, BS EN 61537: 2007 and in accordance with the containment manufacturer's recommendations. All secondary cable containment shall be installed within the building fabric, a surface mounted installation will not be accepted by the client.

Main LV Sub-Circuit & ELV Communication Cable Basket Containment

The contractor shall supply, install and connect a new cable galvanised cable basket system for LV & ELV cables as shown on the drawings.

Where support rods are required, they shall be a minimum size M8.

All cable baskets shown on the drawings are those deemed as a minimum requirement. Any additional containment the contractor wishes to install shall be included for in their tender and co-ordination with other services. The cable basket system shall be complete with all propriety couplings, suspension brackets, support channel, pendant brackets, dividers and fixings, purpose made bends, tees, etc., to provide a complete containment system. The cable basket shall be suitably fire stopped where it passes through fire barriers.

Cable trunking shall comply with the relevant Clause of the Standard Specification and BS EN 50085-1:2005, BS EN 50085-2-1:2006, ISO 9001-2008.

The trunking shall be galvanised finish unless detailed elsewhere in this specification or on the drawings.

Where support rods are required, they shall be a minimum size M8. Where necessary the Electrical Building Services Contractor shall supply and install channel "strappers" across purlins in order to fix the trunking in the prescribed position.

No conduit smaller than 20mm diameter or larger than 32mm diameter shall be used. Conduits which are more than slightly damaged shall be rejected.

The containment system shall be linked to switchgear, DB's and control/equipment positions with drops of trunking or conduits.

The containment shall be fixed to the building structure using unistrut, suspended as required to avoid new services and the support spacing as recommended by the manufacturer.

The cable basket shall be suitably fire stopped where it passes through fire barriers.

2.30 Accessible Call System

The Contractor shall design, install and commission a complete accessible call system as shown on the drawings. The system shall be in accordance with BS5839 Part 9, BS7671, BS5588, Disability Discrimination Act, Building Regulation Approved Document Part M and BS8300.

The system shall be suitable to extend.

The Accessible Alarm system shall incorporate the following:

Ceiling mounted pull cord switches with neon indicator fixed to ceiling of Accessible W.C's.
1No. combined Lamp and buzzer unit engraved "Assistance Required in Accessible W.C" mounted in a flush mounting box and located above each respective door for each call system location.
1No. reset unit complete with reassurance lamp mounted in Accessible W.C's.
All other cabling shall be 300/500V LSF/LSF flexible cable concealed in conduit installed and with csa and number of cores in accordance with the manufacturers wiring instructions.

Central panel to be located behind Reception Desk. All alarms to sound locally in the room, area and outside the room/area in the circulation space.

Provide all power supplies, containment, attendance, builders work required to complete the installation.

2.31 TV Distribution Network Provision

A television aerial network will be provided. The system will comprise all aerials, amplification, distribution equipment and cabling for a minimum Freeview digital signal. Outlets will be provided as shown on the drawings.

The contractor shall provide, install, test and commission a TV reception and distribution network for the building, provided by suitable and approved specialist suppliers.

Provide a complete TV array system comprising:

- Head end equipment.
- Aerials.
- Cabling.
- Splitters and amplifiers.
- Terminal connection plates.

Power all head end equipment at 230 volts except where line powering of multi-switches etc. is required.

Provide aerials compliant with the CAI Code of practice. The aerial support structure must be connected to the common earthing reference point. The aerial system, mounts, support structures etc. must be capable of withstanding winds of 100mph/160kph.

Provide all cables manufactured to the relevant parts of Specification BS EN 50117. Provide all cables having passed the benchmarking approval test and have a certificate issued by the Confederation of Aerials Ltd. that the cable meets with the benchmarking approvals. Provide all coaxial cable having a nominal characteristic of 75 ohms and suitable for the application concerned. Consider any requirements for special cable constructions such as LSZH (only LSZH cables may be installed within risers).

Within the head-end and network, the connection of the coaxial cable will be via 'F' type and IEC connectors only. All 'F' connectors must be crimped and IEC connectors of a professional design and correctly made off. Provide all connectors of the correct size for the cable used.

Fully screen all socket outlets, surface or flush mount type, and have a minimum of four connecting points. Provide individual sockets for TV, Satellite1, Satellite 2, and Audio (covering both FM and DAB frequencies).

Prove the system prior to handover. Provide any required general-purpose power outlets needed for head end equipment etc.

2.32 Music System

The contractor shall include for a Music System Specialist to design, supply, install and commission a new music system. The music system shall comprise of 4no recessed speakers, and a cd / mp3 /sd usb player with dab / fm digital tuner and wireless bluetooth receiver, mixer and amplifier. the system shall have the facility to interface with the fire alarm system to mute in the event of an activation of the fire alarm system.

The system shall be wired using concealed lsf cables in accordance with the system devices manufacturers' recommendations routed on suitable concealed communications containment. containment to be allowed in accordance with specialist requirements. wiring to be concealed.

The contractor shall allow for all devices, supplies, interfaces, etc to ensure a full and working system as required by specialist. include all items e.g. power supplies, interfaces etc that may not be particularly specified or indicated on the drawings but are essential to the correct operation and safety requirements of the installation.

2.33 Electric Vehicle Charging Installation

The contractor shall allow for a specialist to provide, install, test and commission the new floor mounted intelligent dual outlet EV charging outlet as shown on the drawing and described herein.

The contractor shall allow for all ancillary equipment to provide a fully functioning system.

The following standards shall apply to the installation of the new charging point:

- IEC 61851 – Electric vehicle charging station.
- IEC 60950 – Low Voltage Directive.
- BS7671 – IET Wiring Regulations – 18th Edition.
- BS6164:2001 Code of practice for tunnelling in the construction industry (where a supply feed is required to be drawn).
- BS7375 – Code of practice for the distribution of electricity on building sites.
- BS6423 – Maintenance of electrical switchgear up to 1kV.
- IET Code of Practice for Electric Vehicle Charging Equipment Installation.
- HS(G)141 – Health and Safety guidelines for electrical safety on construction sites.
- Health and safety guidelines concerned with the COSHH of materials, including but not limited to:
    - o Building materials – concrete, cement, shuttering timber.
    - o Installation materials – wire, charging post base, charging post.
    - o Materials used in construction tooling – Electrical generators, fuel.
    - o Control and use of PPE in the installation process.
- Manual handling requirements associated with the materials or plant used in the installation process.
- Any additional Health and Safety rules presented by the civil engineering contractors.
- Method statement and Risk Assessments
- Permit and Open Notice Numbers

2.34 Lightning Protection

Provide a complete Lightning Protection System to the project building to fully comply with the requirements of BS EN 62305-2:2011 protection against lightning.

The Contractor shall employ a specialist Lightning Protection Systems Ltd or equal and approved to supply, install and commission a complete Lightning Protection System to fully comply with BS EN 62305:2011 protection against lightning.

Soil resistivity/finished ground conditions shall be taken into consideration in the system design to ensure full compliance

Exposed down conductors shall be PVC covered aluminium tapes fixed with PVC clips using stainless steel screws. Any exposed down tapes need to be coordinated with the Architect. Connections between Copper and Aluminium conductors shall be fitted with a Bi-Metallic connector. Suitable protective covers shall be installed over the exposed PVC down tapes as a level of protection.

The system shall be bonded to the buildings main electrical system via the main earth bar located at the main switchboard. The connection shall be clearly identified and shall be suitable for disconnection to allow the periodic electrical testing to be carried out.

All external extraneous and exposed metalwork and equipment shall be bonded to the LPS.

The following list is not exhaustive;

- TV Aerials.
- Boiler Flues.
- Guttering (where conductive).
- External plant.
- External ductwork.
- External pipe work.
- Handrails/man safe systems.

All penetrations through the roof such as flues shall be bonded to the air termination network using an appropriate type of connection.

At each down tape termination, the Contractor shall provide a test link (exposed) and an earth rod or rods with BICC concrete/plastic cover. The Contractor shall include for excavation and backfilling and siting of the Inspection Pits. Test link may be provided within the pit for aesthetic reasons.

The Contractor shall be responsible for verifying the positions of underground services to liaise with the Utilities if necessary, before the driving of Earth Rods (for safety), to excavate, backfill and site the inspection pits and inform the Sub-Contractor of site progress.

The completed installation shall be commissioned by the installer to ensure Test Readings satisfy the requirements of the British Standards.

On completion of the project the resistance to earth of the complete installation and of each earth termination shall be separately measured and the electrical continuity of all bonds, joints and conductors verified.

The tests shall be carried out before any metal work is bonded to the system. Tests shall comprise the following;

- Each earth electrode resistance measure in accordance with BS7430: 1991 Section 16.
- It should be ascertained that the resistance of each metallic conducting path, including joints does not exceed the calculated resistance of the tape by more and that the resistance from the test clamp to the adjacent electrode does not exceed 0.2 ohms.
- All excavations for earth inspection housings shall be the responsibility of the main contractor. The nominated lightning protection installer shall supply either a concrete or plastic type inspection housing for installation.

All incoming and outgoing cables, services and the like to be protected by surge protection devices. The devices shall be coordinated throughout the installation.

Where down tape is provided on the external façade of the building, suitable protection shall be provided around the down tape to protect against vandalism etc.

2.35 Testing & Commissioning

The whole of the work carried out under this contract shall be tested on completion in the presence of the Engineer in the manner prescribed in the IET Regulations for the Electrical Equipment in Buildings, 18th Edition. The Contractor shall provide the necessary labour, material and instruments for carrying out these tests and shall give the Engineer ten working days' notice of the date it is proposed to carry out the test.

The Contractor shall check the availability of water, fuel, gas, electricity etc, as appropriate and where necessary shall range with other parties concerned for the testing to be carried out jointly.

The Contractor shall then commence testing the installation and shall notify the engineer that the systems are operating according to the intent of the contract.

Testing and inspection shall be carried out in the following sequences:

i) Continuity of protective conductors, including main and supplementary equipotential bonding.
ii) Continuity of ring final circuit conductors.
iii) Insulation resistance.
iv) Insulation of site-built assemblies.
v) Protection of electrical separation.
vi) Protection by barriers or enclosures provided during erection.
vii) Insulation of non-conducting floor and walls.
viii) Polarity.
ix) Earth fault loop impedance.
x) Earth electrodes resistance.
xi) Operation of residual current devices and fault voltage operated protective devices.

The Contractor shall submit the results of the test to the Engineer on an Inspection Certificate of the type described in the Regulations with seven days of the date of testing.

The Contractor shall also check the labelling of circuits in the distribution boards and switchboards, check that there are no crossed circuits and that all fuse and MCB/RCBOs sizes are correct.

Visual checks are to be made of the overload setting of all starters which should be set in relation to the full load rating of the motors they control.

The Contractor shall also allow for testing the installation whilst work is in progress or as instructed by the Architect and Engineer, and in particular, the following tests must be carried out:

i) In the case of concealed sections of the installation, these shall be inspected and tested before being concealed.

ii) Where cables are run behind `pinned' ceilings, test must be carried out immediately after the ceiling is fixed and before decorations commence.

iii) Inspection and testing of conduits and trunking as previously specified.

2.36 Operating and Maintenance Instructions

JCP Consulting Engineers
1-2 Brenkley Way, Blezard Business Park, Seaton Burn, Newcastle upon Tyne, NE13 6DS

No later than two weeks prior to the commencement of commissioning provide two draft copies of the manual for comment.

Issue the final version of the manuals on completion of the works.

Each manual to be A4 size, in plastic covered loose leaf four ring binders with hard covers, indexed, divided and appropriately titled.

Ensure each manual contains the following information:

- Index.
- A full technical description of each system written to ensure that the Employer's staff fully understands
- The scope and facilities provided.
- A description of the mode of operation of each system.
- A list of record drawings with a brief description of each.
- A legend for all colour coded services.
- Schedules, system by system, of plant and equipment stating their locations, duties and performance figures.
- The manufacturers name, address and telephone number for each item of plant and equipment together with catalogue list numbers.
- Manufacturer's technical literature for all items of plant and equipment.
- A copy of all test certificates.
- A copy of all completion certificates.
- A copy of all manufacturers' guarantees and warranties.
- A schedule of all equipment settings established during commissioning.
- Procedures for seasonal changeovers.
- Recommendations as to the preventative maintenance frequency and procedures to be carried out to ensure efficient operation.
- Recommended lubricants.
- A list of normal consumables.
- A list of recommended spares.
- A guide to fault finding.
- Starting up, operating and shutting down procedures for all equipment and systems.
- A copy of each record drawing.
- A list of emergency telephone numbers

Edit manufacturers' standard operating and maintenance instructions to ensure only that information relevant and pertaining to the works is used.

2.37 Provisional Sums

Allow the following provisional sums:

Contingency	£5,000.00

JCP Consulting Engineers
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2.38 Tender Summary

The Tenderer shall enter in this schedule the prices for the following constituent parts of the work. The following costs shall include all set up costs including Storage, accommodation and utilities etc.

£ : p

1. Preliminaries, plant hire, etc.

2. Builder's works in connection.

3. Distribution LV Infrastructure.

4. Small Power Installation.

5. Internal General and Emergency Lighting Installation.

6. Data and Telecoms Installation.

7. Door Access Control Installation.

8. External General Lighting Installation.

9. Containment Installation.

10. CCTV Installation.

11. Intruder Alarm Installation

12. Fire Alarm.

13. Television System.

14. Accessible Call System

15. Induction Loop

16. Intruder Alarm System

17. EV Charging

18. Earthing and Bonding.

19. Electrical Services Associated with Mechanical Equipment.

20. Lightning and Surge Protection.

21.	Provisional sums.	£5,000.00
22.	Testing and Commissioning of M&E works.	
23.	Provision of all As Installed Drawings, Maintenance Manuals, Test Certificates.	
	SUB-TOTAL	**£**

Any additional works not listed above but deemed necessary to be noted below.

……..	……..
……..	……..
……..	……..
TOTAL FOR ELECTRICAL SERVICES	**£**

Company:

Signature:

Date: