

#### Audit sheet

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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## **SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING**

### **MEP ENGINEERING SYSTEMS**

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

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  - 2650 Fire alarm system
  - 2660 Lightning protection system
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- 2700 OPERATING AND MAINTENANCE MANUALS
  - 2710 Low voltage distribution system
  - 2720 Fire alarm system
  - 2730 Lightning protection system
- 2800 DIVISION OF RESPONSIBILITIES

## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 100 INTRODUCTION

This Specification confirms the requirements for the Sainsburys staff accommodation relocation works associated with Victoria Square project, Woking. The Contractor shall provide new mechanical systems to suit the new 'temporary' Sainsburys accommodation and final fit-out of the existing Sainsburys demise.

This scope includes installing new systems inside an existing building and making necessary connections to existing systems within the building. The Contractor shall survey and verify those connections prior to confirming their installation drawings.

##### 110 Detail Coordination

Agree all proposed methods of fixing the system(s) to structure, roof, cladding, chimneys, equipment, etc with the Contract Administrator.

Agree the colours and finishes of all exposed materials of the system(s) with the Contract Administrator.

##### 200 REFERENCE DOCUMENTS

This specification is written based on legislation, standards and guidance in force in the UK generally, and within England by default. For projects in Scotland, Wales, Northern Ireland, the Channel Islands and the Isle of Man, give appropriate consideration to any locally applicable legislation, standards and guidance that deviates from or is additional to those in force within England. Similarly for projects outside the UK comply with the corresponding national legislation, standards and guidance.

Comply fully with the edition (including amendments, replacements and associated normative references) of each of the following, current at the time of tender:

The Building Regulations, Approved Documents and associated second tier documentation including both the Domestic and Non-Domestic Building Services Compliance Guide as applicable.

|               |  |
|---------------|--|
| HM Government | The Construction (Design and Management) Regulations   |
| HM Government | The Construction (Design and Management) Regulations   |
| HM Government | The Dangerous Substances and Explosive Atmospheres Regulations   |
| HM Government | General Data Protection Regulations, the Data Protection Act 1998, and any replacement legislation.    |
| HM Government | The Disability Discrimination Act  |
| HM Government | The Electrical Equipment (Safety) Regulations  |
| HM Government | The Electricity Act (As amended by the Utilities Act)  |
| HM Government | The Electricity at Work Regulations  |
| HM Government | The Electricity Safety, Quality and Continuity Regulations   |
| HM Government | The Electromagnetic Compatibility Regulations  |
| HM Government | The Equality Act   |
| HM Government | The Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations |
| HM Government | The Fire Safety and Safety of Places of Sport Act (As amended)   |
| HM Government | The Health and Safety (Safety Signs and Signals) Regulations   |
| HM Government | The Health and Safety at Work etc. Act   |
| HM Government | The Meters (Certification) Regulations   |
| HM Government | The Offices, Shops and Railway Premises Act  |
| HM Government | The Supply of Machinery (Safety) Regulations   |

## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

|               |  |
|---------------|--|
| HM Government | The Smoke and Carbon Monoxide Alarm (England) Regulations  |
| HM Government | Health and Safety (Display Screen Equipment) Regulations   |
|               | Local Authority Acts and Bylaws  |
|               | Local Authority Standing Orders and Bylaws   |
| 2000/55/EC    | Directive of the European Council - Energy efficiency requirements for ballasts for fluorescent lighting   |
| 93/68/EEC     | Directive of the European Council - Low Voltage Directive 73/23/EEC and amendment  |
| 89/106/EEC    | Directive of the European Council - Construction Products Directive  |
| BS 67         | Specification for ceiling roses  |
| BS 88-2       | Low-voltage fuses. Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application). Examples of standardized systems of fuses A to K            |
| BS 88-3       | Low-voltage fuses. Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications). Examples of standardized systems of fuses A to F |
| BS EN 60051-1 | Direct acting indicating analogue electrical measuring instruments and their accessories. Definitions and general requirements common to all parts   |
| BS 89-2       | Direct acting indicating analogue electrical measuring instruments and their accessories. Specification for special requirements for ammeters and voltmeters                                 |
| BS 89-3       | Direct acting indicating analogue electrical measuring instruments and their accessories. Specification for special requirements for wattmeters and varmeters                                |
| BS 89-4       | Direct acting indicating analogue electrical measuring instruments and their accessories. Specification for special requirements for frequency meters  |
| BS 89-5       | Direct acting indicating analogue electrical measuring instruments and their accessories. Specification for special requirements for phase meters, power factor meters and synchroscopes     |
| BS 89-7       | Direct acting indicating analogue electrical measuring instruments and their accessories. Specification for special requirements for multi-function instruments                              |
| BS 90         | Specification for direct-acting electrical recording instruments and their accessories   |
| BS 476-20     | Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)  |
| BS 476-6      | Fire tests on building materials and structures. Method of test for fire propagation for products  |
| BS 476-7      | Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products   |
| BS 546        | Specification. Two-pole and earthing-pin plugs, socket-outlets and socket-outlet adaptors  |
| BS 559        | Specification for the design and construction of signs for publicity, decorative and general purposes  |

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

|                |  |
|----------------|--|
| BS 951         | Electrical earthing. Clamps for earthing and bonding. Specification  |
| BS 1362        | Specification for general purpose fuse links for domestic and similar purposes (primarily for use in plugs)  |
| BS 1363-1      | 13 A plugs, socket-outlets, adaptors and connection units. Specification for rewirable and non-rewirable 13 A fused plugs  |
| BS 1363-2      | 13 A plugs, socket-outlets, adaptors and connection units. Specification for 13 A switched and unswitched socket-outlets   |
| BS 1363-4      | 13 A plugs, socket-outlets, adaptors and connection units. Specification for 13 A fused connection units switched and unswitched   |
| BS 1377-9      | Methods for test for soils for civil engineering purposes. In-situ tests (Partially superseded but remains current)  |
| BS 1449-1.1    | Steel plate, sheet and strip. Carbon and carbon-manganese plate, sheet and strip. General specification  |
| BS 1710        | Specification for identification of pipelines and services   |
| BS 1853-2      | Tubular fluorescent lamps for general lighting service. Specification for lamps used in the United Kingdom not included in BS EN 60081, BS EN 60901, BS EN 61195 and BS EN 61199 |
| BS 2950        | Specification. Cartridge fuse-links for telecommunication and light electrical apparatus   |
| BS 3036        | Specification. Semi-enclosed electric fuses (ratings up to 100 amperes and 240 volts to earth)   |
| BS 3858        | Specification for binding and identification sleeves for use on electric cables and wires  |
| BS 4177        | Specification for cooker control units   |
| BS 4444        | Guide to electrical earth monitoring and protective conductor proving  |
| BS 4533-102.19 | Luminaires. Particular requirements. Specification for air-handling luminaires (safety requirements)   |
| BS 4573        | Specification for 2-pin reversible plugs and shaver socket-outlets   |
| BS 4607-1      | Non-metallic conduits and fittings for electrical installations. Specification for fittings and components of insulating material  |
| BS 4607-5      | Non-metallic conduit fittings for electrical installations. Specification for rigid conduits, fittings and boxes of insulating material  |
| BS 4662        | Boxes for flush mounting of electrical accessories. Requirements, test methods and dimensions  |
| BS 4678-2      | Cable Trunking Steel underfloor (duct) trunking  |
| BS 4678-4      | Cable trunking. Specification for cable trunking made of insulating material   |
| BS 4781        | Specification for pressure-sensitive adhesive plastics labels for permanent use  |
| BS 4800        | Schedule of paint colours for building purposes  |
| BS 5070-1      | Engineering diagram drawing practice. Recommendations for general principles   |
| BS 5266-1      | Emergency lighting. Code of practice for the emergency lighting of premises  |
| BS 5424-2      | Low-voltage controlgear. Specification for semiconductor contactors (solid state contactors)   |

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS 5424-3  | Specification for controlgear for voltages up to and including 1000 V a.c. and 1200 V d.c. Additional requirements for contactors subject to certification  |
| BS 5446-2  | Fire detection and fire alarm devices for dwellings. Specification for heat alarms  |
| BS 5446-3  | Detection and alarm devices for dwellings. Specification for fire alarm and carbon monoxide alarm systems for deaf and hard of hearing people   |
| BS 5467    | Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1 000 V and 1 900/3 300 V for fixed installations. Specification   |
| BS 5472    | Specification for low voltage switchgear and controlgear for industrial use. Terminal marking and distinctive number. General rules   |
| BS 5489-1  | Code of practice for the design of road lighting. Lighting of roads and public amenity areas  |
| BS 5080    | Structural fixings in concrete and masonry. Method of test for tensile loading  |
| BS 5499-10 | Guidance for the selection and use of safety signs and fire safety notices  |
| BS 5499-4  | Safety signs. Code of practice for escape route signing   |
| BS 5733    | General requirements for electrical accessories. Specification  |
| BS 5839-1  | Fire detection and fire alarm systems for buildings. Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises   |
| BS 5839-3  | Fire detection and alarm systems for buildings. Specification for automatic release mechanisms for certain fire protection equipment  |
| BS 5839-6  | Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises commissioning and maintenance of fire detection and fire alarm systems in domestic premises |
| BS 5839-9  | Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems commissioning and maintenance of emergency voice communication systems   |
| BS 5972    | Specification for photoelectric control units for road lighting   |
| BS 6004    | Electric cables. PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting  |
| BS 6121-1  | Mechanical cable glands. Armour glands. Requirements and test methods   |
| BS 6121-5  | Mechanical cable glands. Code of practice for selection, installation and inspection of cable glands and armour glands  |
| BS 6231    | Electric cables. Single core PVC insulated flexible cables of rated voltage 600/1000 V for switchgear and controlgear wiring  |
| BS 6259    | Code of practice for the design, planning, installation, testing and maintenance of sound systems   |
| BS 6266    | Fire protection for electronic equipment installations. Code of practice  |
| BS 6272    | Specification for low voltage switchgear and controlgear for industrial use. Terminal marking. Terminals for external associated electronic circuit components and contacts   |
| BS 6290-2  | Lead-acid stationary cells and batteries. Specification for the high-performance Plante positive type   |

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS 6290-3 | Lead-acid stationary cells and batteries. Specification for the flat positive plate type   |
| BS 6387   | Test method for resistance to fire of cables required to maintain circuit integrity under fire conditions  |
| BS 6396   | Electrical systems in office furniture and educational furniture. Specification  |
| BS 6423   | Code of practice for maintenance of low-voltage switchgear and controlgear   |
| BS 646    | Specification for Cartridge fuse-links (rated up to 5 amperes) for a.c. and d.c. service   |
| BS 6701   | Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance   |
| BS 6724   | Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1 000 V and 1 900/3 300 V for fixed installations, having low emission of smoke and corrosive gases when affected by fire. Specification      |
| BS 6946   | Specification for metal channel cable support systems for electrical installations   |
| BS 6972   | Specification for general requirements for luminaire supporting couplers for domestic, light industrial and commercial use   |
| BS 6991   | Specification for 6/10 A, two-pole weather-resistant couplers for household, commercial and light industrial equipment   |
| BS 7071   | Specification for portable residual current devices  |
| BS 7194   | Specification for direct-current and low-frequency electronic measuring instruments with a digital display   |
| BS 7211   | Electric cables. Thermosetting insulated and thermoplastic sheathed cables for voltages up to and including 450/750 V for electric power and lighting and having low emission of smoke and corrosive gases when affected by fire |
| BS 7273-4 | Code of practice for the operation of fire protection measures. Actuation of release mechanisms for doors  |
| BS 7288   | Specification for residual current devices with or without overcurrent protection for socket-outlets for household and similar uses  |
| BS 7430   | Code of practice for protective earthing of electrical installations   |
| BS 7594   | Code of practice for audio-frequency induction-loop systems (AFILS)  |
| BS 7629-1 | Electric cables. Specification for 300/500 V fire resistant, screened, fixed installation cables having low emission of smoke and corrosive gases when affected by fire. Multicore cables  |
| BS 7657   | Specification for cut-out assemblies up to 100 A rating, for power supply to buildings   |
| BS 7671   | Requirements for electrical installations. IET wiring regulations  |
| BS 7693   | Guide to uses of infra-red transmission and the prevention or control of interference between systems  |
| BS 7846   | Electric cables. Thermosetting insulated, armoured, fire-resistant cables of rated voltage 600/1 000 V for fixed installations, having low emission of smoke and corrosive gases when affected by fire. Specification            |
| BS 7889   | Electric cables. Thermosetting insulated, non-armoured cables with a voltage of 600/1 000 V, for fixed installations   |
| BS 7895   | Specification for bayonet lampholders with enhanced safety   |



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS 8300     | Design of buildings and their approaches to meet the needs of disabled people. Code of practice   |
| BS 8313     | Code of practice for accommodation of building services in ducts  |
| BS 842      | Specification for a.c. voltage-operated earth-leakage circuit breakers  |
| BS 8431     | Electrical static meters for secondary metering and sub-metering. Specification   |
| BS 8434-2   | Methods of test for assessment of the fire integrity of electric cables. Test for unprotected small cables for use in emergency circuits. BS EN 50200 with a 930° flame and with water spray                    |
| BS 8436     | Electric cables. Specification for 300/500 V screened electric cables having low emission of smoke and corrosive gases when affected by fire, for use in walls, partitions and building voids. Multicore cables |
| BS 8491     | Method for assessment of fire integrity of large diameter power cables for use as components for smoke and heat control systems and certain other active fire safety systems                                    |
| BS 8519     | Selection and installation of fire-resistant power and control cable systems for life safety and fire-fighting applications. Code of practice   |
| BS 8539     | Code of practice for the selection and installation of post-installed anchors in concrete and masonry   |
| BS 9991     | Fire safety in the design, management and use of residential buildings. Code of practice  |
| BS 9999     | Fire safety in the design, management and use of buildings. Code of practice  |
| BS EN 40-4  | Lighting columns. Requirements for reinforced and prestressed concrete lighting columns   |
| BS EN 40-5  | Lighting columns. Requirements for steel lighting columns   |
| BS EN 40-6  | Lighting columns. Requirements for aluminium lighting columns   |
| BS EN 54-1  | Fire detection and fire alarm systems. Introduction   |
| BS EN 54-10 | Fire detection and fire alarm systems. Flame detectors. Point detectors   |
| BS EN 54-11 | Fire detection and fire alarm systems. Manual call points   |
| BS EN 54-12 | Fire detection and fire alarm systems. Smoke detectors. Line detectors using an optical beam  |
| BS EN 54-13 | Fire detection and fire alarm systems. Compatibility and connectability assessment of system components   |
| BS EN 54-17 | Fire detection and fire alarm systems. Short-circuit isolators  |
| BS EN 54-18 | Fire detection and fire alarm systems. Input/output devices   |
| BS EN 54-2  | Fire detection and fire alarm systems . Control and indicating equipment  |
| BS EN 54-20 | Fire detection and fire alarm systems. Aspirating smoke detectors   |
| BS EN 54-21 | Fire detection and fire alarm systems. Alarm transmission and fault warning routing equipment   |
| BS EN 54-23 | Fire detection and fire alarm systems. Fire alarm devices. Visual alarm devices   |
| BS EN 54-25 | Fire detection and fire alarm systems. Components using radio links   |
| BS EN 54-3  | Fire detection and fire alarm systems. Fire alarm devices. Sounders   |
| BS EN 54-4  | Fire detection and fire alarm systems. Power supply equipment   |

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS EN 54-5      | Fire detection and fire alarm systems. Heat detectors. Point heat detectors  |
| BS EN 54-7      | Fire detection and fire alarm systems. Smoke detectors. Point detectors using scattered light, transmitted light or ionization   |
| BS EN 81-20     | Safety rules for the construction and installation of lifts. Lifts for the transport of persons and goods. Passenger and goods passenger lifts   |
| BS EN 1838      | Lighting applications. Emergency lighting  |
| BS EN 10346     | Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions  |
| BS EN 10088-3   | Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes  |
| BS EN 10244-1   | Steel wire and wire products. Non-ferrous metallic coatings on steel wire. General principles  |
| BS EN 12193     | Light and lighting. Sports lighting  |
| BS EN 12464-1   | Light and lighting. Lighting of work places. Indoor work places  |
| BS EN 12464-2   | Light and lighting. Lighting of work places. Outdoor work places   |
| BS EN 13032     | Light and lighting. Measurement and presentation of photometric data of lamps and luminaires. LED lamps, modules and luminaires  |
| BS EN 13501-6   | Fire classification of construction products and building elements. Classification using data from reaction to fire tests on electric cables   |
| BS EN 13599     | Copper and copper alloys. Copper plate, sheet and strip for electrical purposes  |
| BS EN 13601     | Copper and copper alloys. Copper rod, bar and wire for general electrical purposes   |
| BS EN 13602     | Copper and copper alloys. Drawn, round copper wire for the manufacture of electrical conductors  |
| BS EN 14604     | Smoke alarm devices  |
| BS EN 28877     | Information technology. Telecommunications and information exchange between systems. Interface connector and contact assignments for ISDN Basic Access Interface located at reference points S and T                 |
| BS EN 41003     | Particular safety requirements for equipment to be connected to telecommunication networks and/or a cable distribution system  |
| BS EN 50085-1   | Cable trunking systems and cable ducting systems for electrical installations. General requirements  |
| BS EN 50085-2-1 | Cable trunking systems and cable ducting systems for electrical installations. Cable trunking systems and cable ducting systems intended for mounting on walls and ceilings  |
| BS EN 50085-2-2 | Cable trunking systems and cable ducting systems for electrical installations. Particular requirements for cable trunking systems and cable ducting systems intended for mounting underfloor, flushfloor, or onfloor |
| BS EN 50085-2-3 | Cable trunking systems and cable ducting systems for electrical installations. Particular requirements for slotted cable trunking systems intended for installation in cabinets                                      |
| BS EN 50107-1   | Signs and luminous-discharge-tube installations operating from a no-load rated output voltage exceeding 1 kV but not exceeding 10 kV. General requirements   |



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS EN 50109-1    | Hand crimping tools. Tools for the crimp termination of electric cables and wires for low frequency and radio frequency applications. General requirements and tests   |
| BS EN 50131-1    | Alarm systems. Intrusion and hold-up systems. System requirements  |
| BS EN 50131-3    | Alarm systems. Intrusion and hold-up systems. Control and indicating equipment   |
| BS EN 50131-6    | Alarm systems. Intrusion and hold-up systems. Power supplies   |
| BS EN 50172      | Emergency escape lighting systems  |
| BS EN 50174-1    | Information technology. Cabling installation. Installation specification and quality assurance   |
| BS EN 50174-2    | Information technology. Cabling installation. Installation planning and practices inside buildings   |
| BS EN 50174-3    | Information technology. Cabling installation. Installation planning and practices outside buildings  |
| BS EN 50200      | Method of test for resistance to fire of unprotected small cables for use in emergency circuits  |
| BS EN 50272-1    | Safety requirements for secondary batteries and battery installations. General safety information  |
| BS EN 50310      | Telecommunications bonding networks for buildings and other structures   |
| BS EN 50393      | Test methods and requirements for accessories for use on distribution cables of rated voltage 0,6/1,0 (1,2) kV   |
| BS EN 50399      | Common test methods for cables under fire conditions. Heat release and smoke production measurement on cables during flame spread test. Test apparatus, procedures, results  |
| BS EN 50525-1    | Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). General requirements  |
| BS EN 50525-2-31 | Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core non-sheathed cables with thermoplastic PVC insulation  |
| BS EN 50525-2-41 | Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core cables with crosslinked silicone rubber insulation   |
| BS EN 50525-2-42 | Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core non-sheathed cables with crosslinked EVA insulation  |
| BS EN 50525-2-81 | Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Cables with crosslinked elastomeric covering for arc welding   |
| BS EN 50525-3-41 | Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables with special fire performance. Single core non-sheathed cables with halogen-free crosslinked insulation, and low emission of smoke |
| BS EN 50565-1    | Electric cables. Guide to use for cables with a rated voltage not exceeding 450/750 V (U0/U). General guidance   |
| BS EN 50565-2    | Electric cables. Guide to use for cables with a rated voltage not exceeding 450/750 V (U0/U). Specific guidance related to EN 50525 cable types  |

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS EN 50575     | Power, control and communication cables. Cables for general applications in construction works subject to reaction to fire requirements  |
| BS EN 55014-1   | Electromagnetic compatibility. Requirements for household appliances, electric tools and similar apparatus. Emission   |
| BS EN 55014-2   | Electromagnetic compatibility. Requirements for household appliances, electric tools and similar apparatus. Immunity. Product family standard                                  |
| BS EN 55015     | Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment  |
| BS EN 60061-1   | Lamp caps and holders together with gauges for the control of interchangeability and safety. Lamp caps   |
| BS EN 60061-2   | Lamp caps and holders together with gauges for the control of interchangeability and safety. Lampholders   |
| BS EN 60064     | Tungsten filament lamps for domestic and similar general lighting purposes. Performance requirements   |
| BS EN 60073     | Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators  |
| BS EN 60079-17  | Explosive atmospheres. Electrical installations inspection and maintenance   |
| BS EN 60079-0   | Explosive atmospheres. Equipment. General requirements   |
| BS EN 60081     | Double-capped fluorescent lamps. Performance specifications  |
| BS EN 60118-4   | Electroacoustics. Hearing aids. Induction loop systems for hearing aid purposes. Magnetic field strength   |
| BS EN 60188     | High-pressure mercury vapour lamps. Performance specifications   |
| BS EN 60192     | Low pressure sodium vapour lamps. Performance specification  |
| BS EN 60228     | Conductors of insulated cables   |
| BS EN 60238     | Edison screw lampholders   |
| BS EN 60255-1   | Measuring relays and protection equipment. Common requirements   |
| BS EN 60268-3   | Sound system equipment. Amplifiers   |
| BS EN 60268-4   | Sound system equipment. Microphones  |
| BS EN 60268-5   | Sound system equipment. Loudspeakers   |
| BS EN 60269-1   | Low-voltage fuses. General requirements  |
| BS EN 60269-4   | Low-voltage fuses. Supplementary requirements for fuse-links for the protection of semiconductor devices   |
| BS EN 60309-1   | Plugs, socket-outlets and couplers for industrial purposes. General requirements   |
| BS EN 60309-2   | Plugs, socket-outlets and couplers for industrial purposes . Dimensional interchangeability requirements for pin and contact-tube accessories                                  |
| BS EN 60320-1   | Appliance couplers for household and similar general purposes. General requirements  |
| BS EN 60332-1-2 | Tests on electric and optical fibre cables under fire conditions. Test for vertical flame propagation for a single insulated wire or cable. Procedure for 1 kW pre-mixed flame |
| BS EN 60335-1   | Household and similar electrical appliances. Safety. General requirements  |
| BS EN 60357     | Tungsten halogen lamps (non-vehicle). Performance specifications   |

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS EN 60400      | Lampholders for tubular fluorescent lamps and starterholders  |
| BS EN 60423      | Conduit systems for cable management. Outside diameters of conduits for electrical installations and threads for conduits and fittings                                |
| BS EN 60432-1    | Incandescent lamps. Safety specifications. Tungsten filament lamps for domestic and similar general lighting purposes   |
| BS EN 60432-2    | Incandescent lamps. Safety specifications. Tungsten halogen lamps for domestic and similar general lighting purposes  |
| BS EN 60445      | Basic and safety principles for man-machine interface, marking and identification. Identification of equipment terminals, conductor terminations and conductors       |
| BS EN 60447      | Basic and safety principles for man-machine interface, marking and identification. Actuating principles   |
| BS EN 60529      | Degrees of protection provided by enclosures (IP code)  |
| BS EN 60570      | Electrical supply track systems for luminaires  |
| BS EN 60598-1    | Luminaires. General requirements and tests  |
| BS EN 60598-2-2  | Luminaires. Particular requirements. Recessed luminaires  |
| BS EN 60598-2-13 | Luminaires. Particular requirements. Ground recessed luminaires   |
| BS EN 60598-2-23 | Luminaires. Particular requirements. Extra low voltage lighting systems for filament lamps  |
| BS EN 60598-2-24 | Luminaires. Particular requirements. Luminaires with limited surface temperatures   |
| BS EN 60598-2-22 | Luminaires. Particular requirements. Luminaires for emergency lighting  |
| BS EN 60598-2-3  | Luminaires. Particular requirements. Luminaires for road and street lighting  |
| BS EN 60598-2-5  | Luminaires. Particular requirements. Floodlights  |
| BS EN 60622      | Secondary cells and batteries containing alkaline or other non-acid electrolytes. Sealed nickel-cadmium prismatic rechargeable single cells                           |
| BS EN 60630      | Maximum lamp outliners for incandescent lamps   |
| BS EN 60669-1    | Switches for household and similar fixed-electrical installations. General requirements   |
| BS EN 60670-22   | Boxes and enclosures for electrical accessories for household and similar fixed electrical installations. Particular requirements for connecting boxes and enclosures |
| BS EN 60684-1    | Flexible insulating sleeving. Definitions and general requirements  |
| BS EN 60702-1    | Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V. Cables  |
| BS EN 60702-2    | Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V. Terminations  |
| BS EN 60728-11   | Cable networks for television signals, sound signals and interactive services. Safety   |
| BS EN 60730-1    | Automatic electrical controls. General requirements   |
| BS EN 60730-2-3  | Automatic electrical controls for household and similar use. Particular requirements for thermal protectors for ballasts for tubular fluorescent lamps                |
| BS EN 60754-1    | Test on gases evolved during combustion of materials from cables. Determination of the halogen acid gas content   |

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS EN 60793      | Optical fibres. Product specifications. General  |
| BS EN 60794-1-1  | Optical fibre cables. Generic specification. General   |
| BS EN 60794-1-2  | Optical fibre cables. Generic specification. Basic optical cable test procedures. General guidance   |
| BS EN 60831-1    | Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1 000 V. General. Performance, testing and rating. Safety requirements. Guide for installation and operation |
| BS EN 60838-1    | Miscellaneous lampholders. General requirements and tests  |
| BS EN 60839-11-1 | Alarm and electronic security systems. Electronic access control systems. System and components requirements   |
| BS EN 60839-11-2 | Alarm and electronic security systems. Electronic access control systems. Application guidelines   |
| BS EN 60871-1    | Shunt capacitors for a.c. power systems having a rated voltage above 100 0 V. General  |
| BS EN 60896-11   | Stationary lead-acid batteries. General requirements and methods of test. Vented types. General requirements and methods of tests  |
| BS EN 60896-21   | Stationary lead-acid batteries. Valve regulated types. Methods of test   |
| BS EN 60896-22   | Stationary lead-acid batteries. Valve regulated types. Requirements  |
| BS EN 60898-1    | Electrical accessories ± Circuit breakers for overcurrent protection for household and similar installations . Circuit-breakers for a.c. operation   |
| BS EN 60898-2    | Electrical accessories. Circuit-breakers for overcurrent protection for household and similar installations. Circuit-breakers for a.c and d.c. operation   |
| BS EN 60901      | Single-capped fluorescent lamps. Performance specifications  |
| BS EN 60909-0    | Short-circuit currents in three-phase a.c. systems. Calculation of currents  |
| BS EN 60921      | Ballasts for tubular fluorescent lamps. Performance requirements   |
| BS EN 60923      | Auxiliaries for lamps. Ballasts for discharge lamps (excluding tubular fluorescent lamps). Performance requirements  |
| BS EN 60927      | Auxiliaries for lamps. Starting devices (other than glow starters). Performance requirements   |
| BS EN 60929      | AC and/or DC-supplied electronic control gear for tubular fluorescent lamps. Performance requirements  |
| BS EN 60947-1    | Low-voltage switchgear and controlgear. General rules  |
| BS EN 60947-2    | Low-voltage switchgear and controlgear. Circuit-breakers   |
| BS EN 60947-3    | Low-voltage switchgear and controlgear. Switches, disconnectors, switch-disconnectors and fuse-combination units   |
| BS EN 60947-4-1  | Low-voltage switchgear and controlgear. Contactors and motor-starters. Electromechanical contactors and motor-starters   |
| BS EN 60947-4-3  | Low-voltage switchgear and controlgear. Contactors and motor-starters. AC semiconductor controllers and contactors for non-motor loads   |
| BS EN 60947-6-1  | Low-voltage switchgear and controlgear. Multiple function equipment. Transfer switching equipment  |
| BS EN 60968      | Self-ballasted fluorescent lamps for general lighting services. Safety requirements  |
| BS EN 60969      | Self-ballasted lamps for general lighting services. Performance requirements   |

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS EN 61000-3-2 | Electromagnetic compatibility (EMC). Limits. Limits for harmonic current emissions (equipment input current $\leq 16$ A per phase)  |
| BS EN 61000-4-5 | Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test  |
| BS EN 61008-1   | Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs). General rules  |
| BS EN 61009     | Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs). General rules   |
| BS EN 61034     | Measurement of smoke density of cables burning under defined conditions. Test apparatus   |
| BS EN 61047     | D.C. or A.C. supplied electronic step-down convertors for filament lamps. Performance requirements  |
| BS EN 61048     | Auxiliaries for lamps. Capacitors for use in tubular fluorescent and other discharge lamp circuits. General and safety requirements   |
| BS EN 61049     | Specification for capacitors for use in tubular fluorescent and other discharge lamp circuits. Performance requirements   |
| BS EN 61050     | Specification for transformers for tubular discharge lamps having a no-load output voltage exceeding 1000 V (generally called neon-transformers). General and safety requirements |
| BS EN 61058     | Switches for appliances. Particular requirements for switches used in electric motor-operated hand-held tools, transportable tools and lawn and garden machinery                  |
| BS EN 61082-1   | Preparation of documents used in electrotechnology. Rules   |
| BS EN 61111     | Live working. Electrical insulating matting   |
| BS EN 61140     | Protection against electric shock. Common aspects for installation and equipment  |
| BS EN 61180     | High-voltage test techniques for low-voltage equipment. Definitions, test and procedure requirements, test equipment  |
| BS EN 61184     | Bayonet lampholders   |
| BS EN 61195     | Double-capped fluorescent lamps. Safety specifications  |
| BS EN 61199     | Single-capped fluorescent lamps. Safety specifications  |
| BS EN 61347     | Lamp control gear   |
| BS EN 61386-1   | Conduit systems for cable management. General requirements  |
| BS EN 61386-21  | Conduit systems for cable management. Particular requirements. Rigid conduit systems  |
| BS EN 61386-23  | Conduit systems for cable management. Particular requirements. Flexible conduit systems   |
| BS EN 61386-24  | Conduit systems for cable management. Particular requirements. Conduit systems buried underground   |
| BS EN 61386-25  | Conduit systems for cable management. Particular requirements. Conduit fixing devices   |
| BS EN 61439-1   | Low-voltage switchgear and controlgear assemblies. General rules  |
| BS EN 61439-2   | Low-voltage switchgear and controlgear assemblies. Power switchgear and controlgear assemblies  |

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS EN 61439-3   | Low-voltage switchgear and controlgear assemblies. Distribution boards intended to be operated by ordinary persons (DBO)   |
| BS EN 61439-6   | Low-voltage switchgear and controlgear assemblies. Busbar trunking systems (busways)   |
| BS EN 61534-1   | Powertrack systems. General requirements   |
| BS EN 61534-22  | Powertrack systems. Particular requirements for powertrack systems intended for onfloor or underfloor installation   |
| BS EN 61535     | Installation couplers intended for permanent connection in fixed installations   |
| BS EN 61537     | Cable management. Cable tray systems and cable ladder systems  |
| BS EN 61547     | Equipment for general lighting purposes. EMC immunity requirements   |
| BS EN 61557-4   | Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. Equipment for testing, measuring or monitoring of protective measures. Resistance of earth connection and equipotential bonding      |
| BS EN 61558-2-1 | Safety of power transformers, power supplies, reactors and similar products. Particular requirements and tests for separating transformers and power supplies incorporating separating transformers for general applications |
| BS EN 61642     | Industrial a.c. networks affected by harmonics. Application of filters and shunt capacitors  |
| BS EN 61643-11  | Low-voltage surge protective devices. Surge protective devices connected to low-voltage power systems. Requirements and test methods   |
| BS EN 61643-21  | Low voltage surge protective devices. Surge protective devices connected to telecommunications and signalling networks. Performance requirements and testing methods   |
| BS EN 61869-2   | Instrument transformers. Additional requirements for current transformers  |
| BS EN 61869-6   | Instrument transformers. Additional general requirements for low-power instrument transformers   |
| BS EN 61914     | Cable cleats for electrical installations  |
| BS EN 61921     | Power capacitors. Low-voltage power factor correction banks  |
| BS EN 61951-1   | Secondary cells and batteries containing alkaline or other non-acid electrolytes. Portable sealed rechargeable single cells. Nickel-cadmium  |
| BS EN 61951-2   | Secondary cells and batteries containing alkaline or other non-acid electrolytes. Portable sealed rechargeable single cells. Nickel-metal hydride  |
| BS EN 61984     | Connectors. Safety requirements and tests  |
| BS EN 62031     | LED modules for general lighting. Safety specifications  |
| BS EN 62035     | Discharge lamps (excluding fluorescent lamps). Safety specifications   |
| BS EN 62040-1   | Uninterruptible power systems (UPS). General and safety requirements for UPS   |
| BS EN 62053-11  | BS EN 62053-11/Amd1 Electricity metering equipment (AC)- Particular requirements. Part 11: Electromechanical meters for active energy (classes 0,5, 1 and 2)   |
| BS EN 62053-21  | Electricity metering equipment (a.c.). Particular requirements. Static meters for active energy (classes 1 and 2)  |
| BS EN 62053-23  | Electricity metering equipment (a.c.). Particular requirements. Static meters for reactive energy (classes 2 and 3)  |



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| BS EN 62196-2     | Plugs, socket-outlets, vehicle connectors and vehicle inlets. Conductive charging of electric vehicles. Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories |
| BS EN 62208       | Empty enclosures for low-voltage switchgear and controlgear assemblies. General requirements  |
| BS EN 62262       | Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)   |
| BS EN 62275       | Cable management systems. Cable ties for electrical installations   |
| BS EN 62305-1     | Protection against lightning. General principles  |
| BS EN 62305-2     | Protection against lightning. Risk management   |
| BS EN 62305-3     | Protection against lightning. Physical damage to structures and life hazard   |
| BS EN 62305-4     | Protection against lightning. Electrical and electronic systems within structures   |
| BS EN 62384       | DC or AC supplied electronic control gear for LED modules. Performance requirements   |
| BS EN 62444       | Cable glands for electrical installations   |
| BS EN 62471       | Photobiological safety of lamps and lamp systems  |
| BS EN 62560       | Self-ballasted LED-lamps for general lighting services by voltage 50 V. Safety specifications   |
| BS EN 62561-2     | Lightning Protection System Components (LPSC). Requirements for conductors and earth electrodes   |
| BS EN 62612       | Self-ballasted LED lamps for general lighting services with supply voltages 50 V. Performance requirements  |
| BS EN 62676-1-1   | Video surveillance systems for use in security applications. System requirements. General   |
| BS EN 62676-3     | Video surveillance systems for use in security applications. Analog and digital video interfaces  |
| BS EN 62676-4     | Video surveillance systems for use in security applications. Application guidelines   |
| BS EN ISO 12683   | Mechanically deposited coatings of zinc. Specification and test methods   |
| BS EN ISO 1461    | Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods  |
| BS EN ISO 14713-1 | Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. General principles of design and corrosion resistance                                       |
| BS EN ISO 17668   | Zinc diffusion coatings on ferrous products. Sherardizing. Specification  |
| BS EN ISO 2081    | Metallic and other inorganic coatings. Electroplated coatings of zinc with supplementary treatments on iron or steel  |
| BS EN ISO 9241-6  | Ergonomic requirements for office work with visual display terminals (VDTs). Guidance on the work environment   |
| BS ISO 7240-8     | Fire detection and alarm systems. Point-type fire detectors using a carbon monoxide sensor in combination with a heat sensor  |
| BS IEC 60287-1-1  | Electric cables. Calculation of the current rating. Current rating equations (100 % load factor) and calculation of losses. General   |

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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| IEC 60331-1   | Tests for electric cables under fire conditions - Circuit integrity - Part 1: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm     |
| IEC 60331-2   | Tests for electric cables under fire conditions - Circuit integrity - Part 2: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter not exceeding 20 mm |
| IEC 60331-3   | Tests for electric cables under fire conditions - Circuit integrity - Part 3: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV tested in a metal enclosure                      |
| IEC 62717   | LED Modules for general lighting – Performance Requirements   |
| IEC 62722-2-1   | Luminaire performance – Part 2-1: Particular requirements for LED luminaires  |
| EN 300330   | Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Short Range Devices(SRD); Radio Equipment in the Frequency Range 9 kHz to 25 MHz and Inductive Loop Systems in the Frequency Range 9 kHz to 30 MHz  |
| EN 300422   | Electromagnetic Compatibility and Radio Spectrum Matters (ERM); wireless microphones in the 25 MHz to 3 GHz frequency range   |
| BS ISO/IEC 11801  | Information technology. generic cabling for customer premises   |
| BS ISO/IEC 14443-2  | Identification cards. Contactless integrated circuit cards. Proximity cards. Radio frequency power and signal interface   |
| IESNA LM-79-08  | IES Approved Method for the Electrical and Photometric Measurement of Solid-State Lighting Products   |
| IESNA LM-80-08  | IES Approved Method: Measuring Lumen Maintenance of Light Emitting Diode Light Sources  |
| IESNA TM-21-11  | IES Approved Method: Making Useful LED Lifetime Projections   |
| ICEL 1001   | Scheme of Product and Authenticated Photometric Data Registration for Emergency Luminaires and Conversion Modules   |
| ICEL 1004   | Requirements for the Re-Engineering of Luminaires for Emergency Lighting Use  |
| BS PD 6662  | Scheme for the application of European standards for intrusion and hold-up alarm systems  |
| CIBSE   | Guide E: Fire Safety Engineering  |
| CIBSE / SLL   | Lighting Guides and Codes   |
| IET   | Guidance Notes  |
| ILP GN01  | Guidance Notes for the Reduction of Obtrusive Light   |
| SLL   | Commissioning Code L  |
| Defence Estates Specification 034: Electrical Installations |   |
| DoH HTM 02-01   | NHS estates guidance for medical gas pipeline systems   |
| DoH HTM 05-03   | Fire safety measures for health sector buildings  |
| DoH HTM 06-01   | Electrical services supply and distribution   |
| DoH HTM 06-02   | Electrical safety guidance for low voltage systems  |
| DoH HTM 08-03   | Management of bedhead services in the health sector   |
|   | NHS Estates, Health Building Notes  |



## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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|--|--|
| ENA ER G12   | Requirements for the application of protective multiple earthing to low voltage networks   |
| ENA ER G5  | Engineering recommendation. Planning levels for harmonic voltage distribution and non-linear equipment for transmission systems and distribution networks in the UK  |
| ENA ER G59   | Recommendations for the connection of embedded generating plant to the Public Electricity Supplier's distribution systems  |
| ENA ER G83   | Recommendations for the connection of small-scale embedded generators [up to 16A per phase] in parallel with public LV distribution networks   |
| ENA ER P20/1   | Earthing policy in relation to the customers installations   |
| ENA ER P23/1   | Consumer's earth fault protection for compliance with IEE Wiring Regulations for Electrical Installations  |
| ENA ETR 122  | Guide to the application of Engineering Recommendation G5/4 in the assessment of harmonic voltage distortion and connection of non-linear equipment to the electricity supply in the UK                    |
| ENA TS 43-94   | Earth rods and their connectors  |
| HSE L64  | Safety signs and signals. The Health and Safety (Safety Signs and Signals) Regulations. Guidance on Regulations  |
| HSE L26  | Work with display screen equipment. Health and Safety (Display Screen Equipment) Regulations 1992 as amended by the Health and Safety (Miscellaneous Amendments) Regulations 2002. Guidance on Regulations |
| Loss Prevention Council publications   |  |
| NJUG Guidelines on the positioning and colour coding of utilities' apparatus |  |
| CAI COP 01   | Code of practice. Installation of terrestrial and satellite TV reception systems (MDU and commercial)  |
| DD CLC/TS 50131-7  | Alarm systems. Intrusion and hold-up systems. Application guidelines   |
| Secure by Design   | Lighting Against Crime   |
| Secured by Design  | New Homes  |
| Park Mark Assessment Guidelines for Parking Facility Owners / Operators      |  |
| CAE & RIBA Designing for Accessibility                                       |  |
| BREEAM Scheme Documents & Requirements                                       |  |
| British Approvals for Fire Equipment publications                            |  |
| Specified requirements of Client/insurers                                    |  |
| Specific requirements of the local Building Control Officer and Fire Officer |  |
| Open Network Video Interface Forum (ONVIF) specifications and protocols      |  |
| FIA  | Code of Practice for Design, Installation, Commissioning & Maintenance of Aspiring Smoke Detector (ASD) Systems  |

## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### **300 LV DISTRIBUTION (V20)**

##### **310 PERFORMANCE OBJECTIVES**

To distribute low voltage (LV) electrical power, safely and reliably, around the site starting with the cables connecting the main LV switchboard(s) and finishing at the output terminals of all site distribution boards, power distribution units, mechanical systems' supply points and/or the main switch input terminals of all items of equipment that have their own integral isolator.

To ensure that full selectivity is achieved using devices supplied by your chosen manufacturer.

To enable the landlord to measure and record individually, the electricity supplied to the proposed fit-out area.

To ensure that none of the electricity supplies to the existing buildings on the site are interrupted at any time in normal working hours, during the Works except where planned well in advance and agreed in writing with the Contract Administrator.

##### **320 DESIGN PARAMETERS**

##### **321 Electric supply characteristics**

Electrical supply characteristics are to be measured on site by the Contractor to confirm the values.

##### **322 Earthing installation**

Provide earthing for the project in accordance with the requirements of the existing earthing arrangement. The contractor is to survey and confirm the existing arrangement;

TN-C-S system - with the neutral and protective functions combined in a single conductor as far as the consumer's terminals. Normally referred to as protective multiple earthing (PME), the supply itself is TN-C and the arrangement within the building installation is TN-S.

TN-C system - with neutral and protective functions combined in a single conductor throughout the system.

TT system – with the extraneous conductive parts of the installation are connected to a local earth electrode system that is electrically independent of the source earth(s).

An IT system – with the source, either unearthed or earthed through a high impedance, and the exposed-conductive-parts of the installation connected to an electrically independent earth electrode system.

##### **330 SYSTEM DESCRIPTION**

The LV distribution system for this installation extends from the existing Export House Landlord Switchboard to the outgoing terminals of all final distribution boards, power distribution units and local isolating switches.

Provide a new meter on the new supply to the temporary Sainsburys canteen/office Distribution Board. All electrical meters forming part of the LV distribution system are specified here in V20.

##### **340 CONTROL REQUIREMENTS**

Arrange for the main switchboard manufacturer to supply and install all interlinking wiring between current transformers and the check meters installed in the main switchboard, fully in accordance with specification section Y71.

Arrange for the main switchboard manufacturer to supply and install ammeters, voltmeters, power factor indicators, energy meters, combination meters together with the matching current transformers as required, and as detailed in the switchboard schedule, and specification section Y71.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 350 SYSTEM COMPONENTS

##### 351 General distribution system

Design, construct and install all switchgear and control gear assemblies in accordance with BS EN 61439. Submit BS EN 61439 verification documentation to the Contract Administrator when the panel and assembly drawings are submitted for comment.

Contractor to survey the existing Landlord electrical distribution equipment to confirm the supply connection details for the new supply to the new distribution board in the fit-out area.

The Contractor shall survey the existing Sainsburys LV distribution prior to demolition / strip out of the Sainsburys demise, and prior to the completing the installation drawings for the Sainsburys demise fit-out. Contractor to confirm the source of supplies in the Sainsburys demise from the Sainsburys LV distribution system.

Ensure all LV distribution equipment, built-in components and circuits within distribution assemblies are fully rated at the following service conditions:

- ~ Maximum ambient daily temperature 40°C
- ~ Minimum ambient daily temperature 5°C

Provide only equipment and components not foreseeably identified for withdrawal from either manufacture or continuing manufacturer support with a view to maintaining a supported operational life of fifteen years. Do not use any equipment or components identified as end of line or otherwise not expected to have manufacturer continuing support and spares availability.

Fit each assembly with a durable legible label located in a clearly visible place. Provide the following information:

- ~ manufacturer's name or trademark
- ~ type designation or identification number or other means of identification
- ~ date of manufacture
- ~ IEC 61439-X (the specific part "X" shall be identified)

Provide all doors, covers and lids with robust earth tags with an expected life equivalent to that of the assembly or enclosure to which it attaches.

Ensure all power and control cables are LSZH/LSF.

Ensure all threaded electrical conductor terminations are tightened to the correct torque in accordance with the equipment manufacturer's recommendations. Provide all torqued connections with a torque mark seal. Provide details of all torque settings in the O&M manual and inside all panels.

##### **Rated diversity factor**

Provide all distribution assemblies with rated diversity factor (assumed loading) in accordance with BS EN 61439-2.

Ensure each individual circuit is capable of carrying the full rated current assigned to them.

##### **Lamp indications**

Ensure all indicator lamps use LED technology and have uniform luminance with a viewing angle in excess of 120 degrees.

Ensure LED indicator lamps are powered by extra-low voltage drivers with integral current-limiting functionality and reverse-polarity protection. Provide a push-to-test facility. Ensure LED indicator lamps are replaceable without the use of special tools and are of an industry-standard size and fitting.

##### **Panel labels for information and warning**

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Fix permanent engraved labels to all panels to provide information and warning to suitably qualified persons carrying out operation and maintenance: Include the following:

- ~ a label indicating the function of each switch and indicator lamp
- ~ a label on each openable panel door reading: "WARNING - ISOLATE PANEL BEFORE MAINTENANCE"
- ~ a self-adhesive warning label to each door giving access to 400-Volt circuits
- ~ a key diagram showing the source and identification of all power supplies entering a panel, their function and means of isolation

#### Device locking

Provide all protection devices complete with all necessary lockable fittings and padlocks, and supply complete with a minimum of three keys for each padlock.

#### 352 Escape routes

Support all wiring systems in accordance BS 7671 such that they are not liable to premature collapse in the event of fire. Do not use non-metallic cable clips, cable ties or cable trunking as the sole means of support. Use fire-resistant means of support designed to prevent cables from falling out into escape routes in the event of fire.

#### 353 Incoming supply

NOT APPLICABLE

#### 354 Sub mains distribution

##### Sub mains cable

Supply, install and connect sub mains cables from the main switchboard to the distribution boards, isolating switches and other plant as detailed on the drawings or in the schedules.

- ~ type of cable: armoured multicore
- ~ insulation: XLPE, etc
- ~ armouring: SWA
- ~ No. of cores: 4, full-size neutral
- ~ conductors: stranded copper

##### Containment and support for sub mains cable

Supply and install sub mains cable containment and support as detailed on the drawings or in the schedules.

- ~ type: cable tray
- ~ material: steel
- ~ finish: galvanized
- ~ size: as required with spare capacity

Provide all necessary top boxes for all cable ways unless otherwise specified.

#### 355 Final distribution boards, isolating switches, motor control panel and power distribution units

Supply and install the following components in accordance with specification section Y71 and the following requirements:

**Distribution boards** - Supply and install distribution boards as detailed in the distribution board schedule.

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

**Isolating switches** - Supply and install isolating switches for large plant as specified in the distribution board schedules or shown on the drawings.

**Motor control panels** - Connect, in accordance with specification section Y61, the sub mains cable direct into the main switch of every such panel where a separate isolating switch is not specified.

**Manufacturers** - Unless agreed otherwise by the Contract Administrator in writing ensure that all switchgear is made and supplied by one manufacturer and to reflect the equipment within the existing electrical distribution system.

#### 400 GENERAL LIGHTING (V21)

##### 410 PERFORMANCE OBJECTIVES

To provide a complete internal artificial lighting system throughout the fit-out areas that will meet the design criteria and reflect the architectural and aesthetic requirements of each area and location respectively.

To ensure the internal lighting system solution and installation provides a safe, comfortable, balanced and interesting visual environment. To consider the vertical illuminance of surfaces within an environment, in conjunction with, the recommended horizontal working plane illuminance.

To achieve good quality colour appearance and colour rendering by ensuring that light source colour is within a range of three MacAdam ellipses or less, and has a minimum colour rendering index of 85.

To achieve the recommended levels of illuminance, luminance, uniformity and glare control by selection of particular luminaire, lamp source and optical control, together with the selection and recommendation of the associated environmental reflectance properties.

To ensure that all luminaires and ancillary controls are suitably selected to be compatible with the environment in which they are installed.

#### 420 DESIGN PARAMETERS

##### 421 Design criteria

Achieve the average maintained illuminance values for the particular areas of the building, as specified below:

| Area                           | Illuminance  | Comment                                 |
|--------------------------------|--|---|
| Offices                        | 300 to 500 lux   | Luminance limit – 500 cd/m <sup>2</sup> |
| Staffroom                      | 300 lux  | 400 lux localised lighting              |
| Lamp replacement interval      | 3 years (planned maintenance) / Not applicable [select the latter option for LED luminaires]   |   |
| Lamp cleaning interval         | 1 year (assuming a typical operation of 14 hours/day for 6 days/week within a clean office environment)  |   |
| Final lighting circuit ratings | 230V 50Hz SP&N – 6A/10A/16A circuit protective device (CPD) dedicated radial circuits.   |   |
| Lighting Circuits Protection   | Include RCD protection for domestic installations on lighting circuits, as per BS 7671 and ensure that the design reduces the chance of nuisance tripping. |   |

Ensure the lighting system provides a uniformity of illuminance of not less than 0.8, over the task area and a diversity of illuminance, over the core area, not exceeding 5:1.

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Where lighting systems are designed for areas with display screen use, ensure the luminance limitation of luminaires and bright room surfaces comply with the following CIBSE SLL Lighting Guide 7 recommendations:

| Screen high state luminance   | High luminance screen<br>( $L > 200 \text{ cd/m}^2$ ) | Medium luminance screen<br>( $L < 200 \text{ cd/m}^2$ ) |
|---|---|---|
| Positive polarity and normal requirements concerning colour and detail of the displayed information.  | $<3000 \text{ cd/m}^2$                                | $<1500 \text{ cd/m}^2$                                  |
| Negative polarity and/or higher requirements concerning colour and detail of the displayed information as used for CAD, colour inspection, etc. | $<1500 \text{ cd/m}^2$                                | $<1000 \text{ cd/m}^2$                                  |

For lighting system installations complying with CIBSE SLL Lighting Guide 7, ensure the designer duly completes the Certificate of Conformity to Lighting Guide 7.

#### 430 SYSTEM DESCRIPTION

##### 431 Office areas

Office area lighting comprises recessed LED luminaires, each with prismatic or opal diffusers and a CIBSE SLL Lighting Guide 7 luminance limiting optical louvre of the appropriate type.

##### 432 Staffroom

Staffroom lighting comprises recessed LED luminaires, each with prismatic or opal diffusers and a CIBSE SLL Lighting Guide 7 luminance limiting optical louvre of the appropriate type.

Under cupboard lighting comprises pld point luminaires or continuous LED strip to provide lighting to the entire worktop

#### 440 CONTROL REQUIREMENTS

##### 441 General

Supply and install the lighting system controls and control equipment as indicated on the drawings

Install lighting controls and equipment within the locations and at the positions indicated on the drawings.

Ensure the lighting control system(s) provide(s) selective and variable switching via manual or automatic means to enable illuminance and luminance levels to be adjusted, to facilitate an energy efficient mode of control and operation and to enable luminaires to be systematically switched off during periods of non-occupancy of the space(s) or during periods outside of the normal core operating hours of the building.

Provide the lighting control in accordance with the following requirements:

## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### **442 Office areas**

Provide lighting control to the office areas comprising automatic occupancy controls (absence detection).

##### **443 Staff room**

Ensure that all such switches are located at every entry and exit door of such rooms, and wired and connected as one-way, two-way or intermediate lighting control circuits as appropriate.

##### **450 SYSTEM COMPONENTS**

##### **451 General**

Install all components in accordance with the relevant clauses of the appropriate 'Y' Sections of this specification.

##### **452 Conduit system**

Comply with Section Y60 of this specification.

Install a conduit cable containment system for all unarmoured insulated lighting final circuit cables and where applicable for the fixing of luminaires.

Provide throughout the various areas of the building a surface or concealed, class 4 galvanised steel, to soffits of structural slabs, within service ducts and shafts, within ceiling voids, and in prepared chases as applicable.

Install sections of conduit from the lighting distribution cable trunking and extend to luminaire outlet positions or wall accessory outlet positions and terminate at a conduit outlet box of the appropriate type.

##### **453 Cable trunking system**

Comply with Section Y60 of this specification.

Install a trunking cable containment system for all unarmoured insulated, and all insulated and sheathed, lighting final circuit cables.

Supply and install, as indicated on the drawings, a surface, or concealed cable trunking containment system for the lighting final circuit cables and where applicable for the fixing of luminaires.

Provide the distribution cable trunking comprising galvanised steel, single compartment distribution, or multiple compartment distribution sized in multiples of 50 mm x 50 mm, and as particularly detailed on the drawings.

Install a cable trunking containment system to avoid multiple runs of conduit, comprising either a dedicated or shared (ie lighting and small power supplies) single compartment system, or a multi-compartment trunking for the distribution of various cable supplies and cable systems.

Install the cable trunking containment system concealed throughout the proposed work areas, run within ceiling voids and rising ducts.

##### **454 Cable tray/basket system**

Comply with Section Y63 of this specification.

Install cable tray/basket systems for fixing all single and multi-core insulated and sheathed, armoured and screened soft skin lighting final circuit cables.

Provide the cable tray/basket comprising steel galvanised finish, medium, with a 25 mm or 50 mm return flange or as particularly indicated on the drawings.



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Install the cable tray/basket containment system, concealed within suspended ceiling voids, along the routes indicated on the drawings.

#### **455 Wiring system**

Comply with Section Y61 of this specification.

Wire and connect all luminaires to final radial circuits emanating from local distribution boards in accordance with the lighting circuits references detailed in the schedules and indicated on the drawings.

Use single core 6491B (XLPE-LSZH) insulated cables with stranded copper conductors to BS 7211, rated at 450/750V, with minimum conductor size of 1.5mm<sup>2</sup>.

Run cables enclosed within a ceiling void mounted galvanised cable trunking with conduit extending to luminaire, controls and switch locations.

Make final connections to luminaires using 6A (minimum) 3- or 4-pin plug-in ceiling roses, with self-retaining plug and socket as appropriate, with 3- or 4-core 1.5mm<sup>2</sup> insulated and sheathed LSF heat resisting 85°C high-temperature flexible cable.

Mount such plug-in ceiling roses direct to the associated trunking or conduit box.

Ensure all cables and cores of cables connected within a luminaire or passing through will not suffer damage or deterioration due to heat or UV radiation generated by the luminaire or its lamps.

Locate every such ceiling rose above the associated luminaire position, within the suspended ceiling void, and provide sufficient length of flexible cable over and above the nominal length, to enable the luminaires to be relocated up to 1500 mm horizontally from its installed position.

Ensure containment and accessories are installed at a suitable height, within the ceiling void, to facilitate future access for maintenance, from the office floor.

Within plant rooms and certain semi-exposed and external locations, install the lighting system using surface-mounted galvanised conduit, weatherproof luminaires and accessories (minimum IP44 for semi-exposed and IP55 for fully exposed).

Where indicated on the drawings for plant room / loading bay areas, suspend linear fluorescent luminaires, using galvanised steel suspension chains fixed to the containment system by hook backplates, to a level approximately 2.5m AFFL, and provide the final connection to every such luminaire using a plug-in ceiling rose with heat-resistant flexible cable of the appropriate grade and rating.

#### **460 EQUIPMENT**

##### **461 General**

Ensure that unless specified otherwise in the Particular Specification that all the luminaires are of the LED type and are the most recent generation available.

##### **462 Luminaires**

Refer to luminaire schedule for details.

##### **463 Lamps**

Comply with Section Y73 of this specification.

Ensure that all lamps provided on the project are of the same colour temperature and have a stable colour over the lamp life.

Provide all LED luminaires rated a 4000K.



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### **470 Control devices**

##### **471 Switches**

Comply with Section Y74 of this specification.

Supply and install all lighting control switches, including wall-mounted type and ceiling-mounted pull-cord type, at the positions shown and connect to the lighting switch control circuits shown on the drawings.

Ensure switches are of the appropriate 'way' type and grouped into ganged switch plates.

Install flush-mounted switches throughout the main internal areas of the building. Within plant rooms, stores and semi-exposed locations install surface-mounted switches.

Install all lighting control switches at a height between 900 mm to the bottom edge and 1200 mm to the top edge as measured from finished floor level, unless otherwise indicated on the drawings, or as particularly detailed elsewhere in this specification.

Ensure local manually-operated switches are positioned adjacent to all respective access doors to and from each area.

Supply and install manually-operated lighting control switches, rated at 20A per pole, of the grid switch assembly construction, surface or flush mounting to suit, of the appropriate 'way' type, and complete with rocker or key-pattern switch inserts.

Install white moulded finish faceplates within flush-mounted installations and metal-clad style switches for surface-mounted installations within plant rooms, etc.

Provide each switch complete with white insert, cover plate, pressed steel box and earth fly lead, together with neon indicator insert where particularly detailed. Use pressed steel / PVC / pressed steel and PVC boxes as specified elsewhere.

Provide 16A single-pole pull-cord switches, of the appropriate 'way' type, complete with neon indicator and of white moulded finish.

Where different supply phases are present within multi-gang switches, provide voltage warning labels (eg "Danger 400V"). Ensure warning labels are permanently fixed internally and externally to every such switch.

Select lighting control switches from the manufacturers' ranges to match socket outlets and other accessories.

##### **472 Time switches**

Ensure that all time switches comply with BS EN 60730.

##### **473 Photoelectric control units**

Ensure that all photoelectric control units comply with BS 5972.

##### **474 Mains voltage occupancy sensors**

Sensors provided with adjustable time delay (5-60min); initially set at 20mins. To be adjusted during commissioning as necessary.

##### **480 INSTALLATION**

##### **481 General**

When interconnecting sensors, controllers and luminaires, only use the manufacturers' recommended cable types.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### **482 Installing occupancy sensors**

Locate occupancy sensors in a position to suit the occupancy pattern and occupant density of the area under control. Shield the sensors from erroneous influences.

##### **483 Cleaning and cable inspection**

Upon completion of the installation, clean all detector lenses using anti-static cleaning fluid.

Check that all cable connections are secure.

##### **484 Labelling**

Provide identification labels for all equipment and sensors. Label the central controller and its output circuits, describing each item's purpose.

##### **500 GENERAL LV POWER (V22)**

##### **510 PERFORMANCE OBJECTIVES**

To provide distributed power supplies throughout the building using 400-V three-phase 50-Hz circuits and 230-V single-phase 50-Hz circuits and any other voltages/frequencies within the definition of LV.

To provide a system of sufficient capacity to adequately meet the load characteristics of all individual circuits whilst remaining within equipment voltage and frequency tolerances.

To provide a means of fault clearance and isolation on every circuit and coordinated protection of cables and switchgear.

To provide a system designed to provide complete selectivity under fault conditions. To ensure that circuit design makes allowances for anticipated fault levels, installed cable length, environmental influences, diversity, installation methods, and that circuit disconnection is achieved safely within periods prescribed in BS 7671.

To provide outlets that are suitable for the connected equipment and the environment in which they are installed.

To ensure that all appliances are fused for the corresponding load, taking into account the manufacturer's recommendation and any inrush current.

##### **520 DESIGN PARAMETERS**

##### **521 Design Criteria**

Design distributed power fully in accordance with BS 7671, taking into consideration, amongst other applicable design criteria, the following in respect of BS 7671:

- ~ The requirements of Chapter 52 in respect of the general design and selection of wiring systems.
- ~ The requirements of Chapter 43 in respect of protection provided against overcurrent.
- ~ The requirements of Chapter 41 in respect of protection against electric shock.

Adopt a grouping factor not exceeding 0.8, ambient temperature of 30°C, XLPE insulated conductors, and equally sized phase, neutral and CPC conductors.

Configure ring and radial final circuit arrangements in accordance with BS 7671 as detailed in Regulation 433.1 and informed in Appendix 15. Ensure main and radial final circuits are designed to minimise disruption on failure of a circuit or operation of a protective device.

Size circuit components to achieve disconnection times as described in BS 7671.

Provide RCD protection on power circuits to meet the requirements of BS 7671 and of the rating indicated by the distribution board schedules.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Space outlets on different phases not less than 2 m / 3 m apart.

Allow 20% spare capacity in all final containment routes to enable additional outlets to be added.

Design the general power distribution system to provide:

- ~ distribution sized for 50 W/m<sup>2</sup>.

#### 530 SYSTEM DESCRIPTION

##### 531 General

##### Wiring types

Take responsibility for the final cable selection.

Provide internal cabling in accordance with the following:

- ~ BS 7211, 6491B LSZH, insulated only, single-core cable, 450/750-volt grade, contained in steel trunking and/or conduit

Provide copper/LSZH singles in trunking and/or conduit for the final circuits from the distribution boards.

Provide external cabling in accordance with the following:

- ~ BS 5467, XLPE insulated, single wire armoured, pre-sheathed cable, 600/1000-volt grade.

##### Installation methods and containment

Use single core cables within conduit to feed final socket outlets, unless otherwise specified, to allow re-wiring.

Provide final circuit wiring installed in a system of containment throughout its length. Run containment generally within the fabric of the building, within ceiling or raised access floor voids, providing concealed drops to items of equipment and socket outlets. In all areas other than service voids, roof areas, risers and plant rooms, conceal all cabling behind dry-lining, chased into walls etc, and flush-mount all outlets ie switches, socket outlets, connection units, etc.

Provide galvanized steel cable trays and ladders where several cables are installed in close proximity and in accordance with the layout drawings. Ensure that the tray and ladder are medium-duty grade and post-dipped galvanized unless otherwise specified. Ensure that tray and ladder routes are continuous and arranged to provide horizontal cable ways between panels and distribution boards, and vertical cable ways in risers to interconnect to the floors, switchpanels, basement and rooftop plant rooms.

Paint exposed threads with rust-resisting paint. Ensure that conduit and trunking installations are completed prior to pulling in any circuit cables.

Ensure that the trunking is galvanized unless otherwise specified.

Ensure that the insulation of the cabling system selected is equal to the maximum circuit voltage present within the trunking compartment and that the cable can operate satisfactorily within the electromagnetic environment prevailing in the trunking compartment, ie twisted pair and screened cabling, to provide maximum immunity and to minimise emissions.

Where SWA cabling terminates in enclosures/isolators, provide “banjo” type connections to an earth lug to the respective earth terminal.

Provide PIN racks in accordance with specification section Y60. Wrap cables around these PIN rack to avoid unnecessary stress being exerted onto the cables.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Support cables located in escape routes in accordance with BS 7671 such that they are not liable to premature collapse in the event of fire. Do not use non-metallic cable clips, cable ties or cable trunking as the sole means of support. Use fire-resistant means of support designed to prevent cables from falling into escape routes in the event of fire.

Segregate power and data wiring by spacing the systems apart where they run in parallel, containing power within screened cables or containment. Ensure that power and data cables cross each other at right angles.

Segregate the containment systems into the following categories, where possible:

- ~ 230/400 volt
- ~ extra-low voltage systems, IT systems, security systems, TV systems
- ~ fire alarms
- ~ utility main supplies

For data processing applications, segregate cable terminals in distribution boards and /power distribution units.

Do not use junction boxes as part of the project work; except in situations where it is proven to be wholly unavoidable and only then with the acceptance of the Contract Administrator.

Provide a multi-compartment dado trunking system (with minimum 50 mm deep back box) for the power data outlets where indicated on the drawings. Ensure that the dado trunking systems are suitable for Cat-6 data structural cabling.

#### **Mounting heights and accessory finishes**

Be responsible for the layout of the final installed distribution boards/panels, allowing for all extension boxes, control devices etc for the complete installation.

As far as practically possible, ensure that all small power accessories are procured from the same manufacturer.

Refer to finishes and mounting height schedules, and any wall elevation drawings provided by the architect.

Prior to installation of all electrical items, obtain agreement from the architect for the installed locations.

Comply with Approved Document M and specification section Y89.

Provide accessory finishes generally as follows, ensuring coordination between other accessories, eg lighting control switches, within these specific areas:

- ~ Office areas                      White plastic on dado trunking with contrast colour identifiers at outlet locations
- ~ Staff room:                      white plastic to walls, brushed stainless steel to kitchen area

#### **RCD protection**

Provide RCD protection on power circuits to all socket-outlets up to 32 A rating to meet the requirements of BS 7671.

Provide RCD protection to all cables concealed in a wall or partition at depth of less than 50 mm unless sufficient mechanical protection is provided as defined by BS 7671.

## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Provide RCD protection to all cables concealed in a wall or partition where construction includes metallic parts other than fixings unless sufficient mechanical protection is provided as defined by BS 7671.

Provide mechanical protection / earthed conduit to all circuits as required by BS 7671.

Select the RCD and the electrical circuit it serves such that any protective conductor current that may be expected to occur during normal operation of the connected load will be unlikely to cause unnecessary tripping of the RCD.

Provide protection at distribution boards in the form of composite MCB/RCDs (RCBOs) with a maximum tripping current rating of 30 mA.

#### **Supplies and connections to equipment**

Provide low voltage dedicated power supplies for the following ancillary equipment from local sub-mains switch panels and/or LV distribution boards:

- ~ security systems identified by Sainsburys
- ~ access control systems
- ~ vending machines
- ~ drinking water machines
- ~ small kitchen equipment
- ~ fixed network components of automatic control systems

Wire and connect all items of fixed equipment to a permanent supply, and not into the general service or computer sockets unless otherwise specified.

Provide surface- or flush-mounted switched fused connection units and/or isolators for ancillary equipment. Provide circuit wiring installed in a system of dedicated containment throughout its length.

Run containment generally within the fabric of the building, within ceiling or raised access floor voids, providing concealed drops to items of equipment and socket outlets.

Connect and functionally test all items of equipment supplied and installed under this contract.

Liaise with other suppliers or installers to ensure the equipment is fully operational and safe.

#### **540 CONTROL REQUIREMENTS**

##### **541 Circuit control**

Provide each final circuit with a protective device to allow automatic disconnection of the supply in the event of a downstream fault. This device may also act as a means of manually isolating the circuit. Provide a means of locking-off this device.

Select protective devices to suit the load characteristics and the prospective short-circuit current. Use one or more of the following devices:

- ~ MCCBs conforming to BS EN 60947-2
- ~ MCBs conforming to BS EN 60898, Type B, C or D, or BS EN 60947-2 as appropriate; minimum fault rating 9 kA
- ~ RCDs – either combined with MCB, or protecting part or whole of a distribution board, or located at the load; 30 mA sensitivity

##### **542 Local isolation**

Provide local isolation of each LV power supply integral to an outlet or local to equipment positions by:

- ~ unplugging

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ fuse removal
- ~ isolating switch
- ~ isolator
- ~ isolating switch breaking remote control circuit only if the installer complies with BS EN 60947-3 and is suitable and marked with the symbol for isolation.

#### 550 SYSTEM COMPONENTS

##### 551 Standard 13 amp socket outlets and fused connection units

Provide low voltage power socket outlet installations for general service throughout the building. Install twin / single-gang, BS 1363, 13 A switched socket outlets for tasks such as cleaning and maintenance, either wall-mounted or column-mounted or in raised floors such that:

- ~ no area is more than 10 m from a socket outlet
- ~ socket outlets are spaced at not more than 15 m centres along a wall
- ~ each floor level within a stair core has a socket outlet

Supply these sockets from separate distribution board circuit ways from those for computer power or fixed equipment.

Fit socket outlets and connection units into a back-box of sufficient depth to prevent damage to wiring tails.

Use pressed steel boxes.

Where steel back-boxes are used, fit a manufactured fly lead of 1.5mm<sup>2</sup> with green/yellow PVC insulation between the back-box earthing terminal and the socket outlet's earthing terminal.

Connect each socket outlet and fused connection unit on the ring or radial principle. Do not spur off ring circuits.

Configure fused connection units and flexible cable outlets as indicated on layout drawings, or as appropriate to the design intent, from the following options:

- ~ switched / unswitched
- ~ with or without neon indicator
- ~ flex outlet through faceplate
- ~ flex outlet at remote plate
- ~ remote outlet directly behind wall mounted equipment

Connect to equipment with white-coloured three-core flexible cable. Use heat-resisting cable with minimum 85°C rating insulated conductors, and provide a fixed base terminal block in the outlet plate box if it is located more than 2 m from the fused connection unit.

For direct fixed wiring connections into equipment use heat-resisting cable with minimum 85°C rating insulated single-core LSF cables between the terminals of the connection unit and the equipment terminals. Do not introduce unnecessary terminal blocks.

For mounting heights refer to architects details.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 552 Isolating switches

In areas with flush-mounted installations, use flush-mounting, double-pole, 20 A isolating switches, with cable outlets where necessary, and cover plates finished to match lighting switches and socket outlets.

In plant rooms and other areas with surface-mounted installations, use surface-mounting cover plates with metal clad finish.

Fit isolating switches into a back-box of sufficient depth to prevent damage to wiring tails.

Use pressed steel boxes.

Where steel back-boxes are used, fit a manufactured fly lead of 1.5mm<sup>2</sup> with green/yellow PVC insulation between the back-box earthing terminal and the isolating switch's earthing terminal.

Connect each isolating switch on the ring or radial principle. Do not spur off ring circuits.

Connect to equipment with white-coloured three-core flexible cable. Use heat-resisting cable with minimum 85°C rating insulated conductors, and provide a fixed base terminal block in outlet plate box if it is located more than 2 m from the isolating switch.

For direct fixed wiring connections into equipment use heat-resisting with minimum 85°C rating insulated single-core LSF cables between the terminals of the isolating switch and the equipment terminals. Do not introduce unnecessary terminal blocks.

For mounting heights refer to architects details.

##### 553 Isolators

Provide isolators for three-phase power supplies to equipment within the building.

Generally, make final connections to the items of equipment with rigid steel conduit installed either flush or surface, as appropriate, to a position adjacent to the equipment terminal box terminating in a standard conduit box with fixed connector block. Make final connections to the equipment with multicore heat-resistant cable enclosed in flexible conduit, terminating directly on to the terminal box of the equipment.

Fit a label to the front cover of each isolator. Use melamine identification labels, having a white background with 3.5 mm high uppercase black engraved lettering, to identify the item of equipment served.

For mounting heights refer to architects details.

##### 554 Industrial plugs and socket outlets

Provide surface-mounted industrial plugs and sockets outlets.

Connect each socket outlet on the radial principle.

Configure socket outlets as indicated on layout drawings, or as appropriate to the design intent, from the following options:

- ~ switched / unswitched
- ~ with or without neon indicator
- ~ minimum IP44 ingress protection rating (indoor use)
- ~ minimum IP67 ingress protection rating (outdoor use)

Use heat-resisting cable with minimum 85°C rating insulated conductors and provide a fixed base terminal block in outlet plate box if it is located more than 2 m from the isolator.



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

For direct fixed wiring connections into equipment use heat-resisting cable of minimum 85°C rating insulated single-core LSF cables between the terminals of the isolator and the equipment terminals. Do not introduce unnecessary terminal blocks.

#### 600 EMERGENCY LIGHTING (V40)

##### 610 PERFORMANCE OBJECTIVES

The intention of the system is to provide sufficient illumination to allow people to evacuate a building safely when the normal lighting has failed in an emergency situation.

To provide throughout all areas, including external escape routes and open areas, as detailed on the drawings and in the specification, a complete emergency lighting installation to allow safe egress from the building and provide anti-panic lighting in the event of circuit(s) failure or total mains failure.

To provide emergency lighting in areas where the use of the space creates an inherent hazard to safe and easy escape.

To provide an emergency lighting system that clearly and unambiguously indicates all escape routes, internally and externally as required; and provides illumination along such routes and the immediate external areas of escape routes, so as to allow safe movement towards and through all exits.

To provide emergency lighting coverage to all fire alarm call-points and fire-fighting equipment provided along escape routes in order they can be located when the normal lighting has failed.

To provide escape route directional signs, where a direct line of sight to an exit is not possible, to direct persons towards a final escape exit.

##### 620 DESIGN PARAMETERS

For the purpose of this specification the following emergency luminaire definitions apply:

i) **Defined escape route lighting**

This enables the safe exit by the occupants from buildings and immediate external areas by providing them with appropriate visual conditions and direction-finding on escape routes and special locations. It ensures that the fire alarm call-points, fire-fighting equipment and safety equipment can be located and used.

Design standard: 1 lux (min), operation in 5 seconds.

ii) **Open area (anti-panic area) lighting**

This is provided to reduce the chances of panic and enable the building occupants to move safely towards exit routes by providing them with appropriate visual conditions and direction-finding.

Design standard: 0.5 lux (min), to defined areas, which excludes a border of 0.5m, operation in 5 seconds.

iii) **Specific locations lighting**

Emergency illumination in specific positions to enable normal activities to be terminated safely.

- Kitchens - 15 lux (min), operation in 0.5 seconds.
- First aid rooms - 15 lux (min), operation in 5 seconds.
- Treatment rooms - 50 lux (min), operation in 0.5 seconds.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- Refuges - 5 lux (min), operation in 5 seconds.
- Plant rooms, switch rooms and emergency winding facilities for lifts - 15 lux (min), operation in 5 seconds.
- Fire alarm control and indicating equipment - 15 lux (min), operation in 5 seconds.
- Reception areas - 15 lux (min), operation in 5 seconds.
- Panic bars and pads or security devices - 5 lux (min), operation in 5 seconds.
- Swimming pool surrounds and diving areas – 5 lux (min), operation in 0.5 seconds.

iv) **High risk task area lighting**

This is provided to ensure the safety of those involved in possibly dangerous situations and processes and to allow the correct shut-down procedures to be effected.

Design standard: 10% of the required maintained illuminance for the task, but not less than 15 lux (min), operation in 0.5 second.

#### 630 SYSTEM DESCRIPTION

##### 631 General

Supply and install the complete emergency lighting installation including all wiring, manual and automatic controls, luminaires, lamps and emergency supply equipment as detailed on the drawings, in this specification and in the equipment schedules.

Ensure that all luminaires notated as emergency are Industry Committee on Emergency Lighting (ICEL) approved whether detailed in the schedule of luminaires or not.

Ensure the emergency lighting system provides the following coverage:

1. Illumination of all defined escape routes within the building
2. Illumination of open areas
3. Illumination of high risk task areas – kitchen area

For the purposes of this specification the following emergency luminaire definitions apply:

**Non-maintained** – luminaire in which the emergency lighting lamps are only in operation when the supply to the normal lighting fails

**Maintained** – luminaire in which emergency lighting lamps are energized at all times when normal or emergency lighting is required

**Combined** – luminaire containing two or more lamps, at least one of which is energised from the emergency lighting supply and the others from the normal lighting supply. A combined luminaire is either maintained or non-maintained

**Standby lighting** - that part of emergency lighting provided to enable normal activities to continue substantially unchanged

Ensure the minimum duration in emergency mode is not less than 180 minutes.

Provide the facility for periodic testing via a local test switches / integral automatic self-test and monitoring facilities for each luminaire.

Ensure that the emergency lighting system is supplied and installed complete with lamps and control gear, and emergency supply as detailed in this section to form a compliant, complete and fully functioning emergency lighting system.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Co-ordinate the complete system installation, including planning cable routes, access requirements and equipment locations, to provide a neat and tidy installation.

Ensure that the emergency lighting installation is independent of all other systems' wiring in accordance with BS 7671 and as set out in this specification.

Unless detailed elsewhere install a "flush" installation. Utilise flush-mounted accessories with cabling systems generally concealed within the walls, ceiling voids and primary main service ducts.

In plant rooms and external to buildings, except in hazardous areas, ensure the installation is surface-mounted in galvanised conduit or designated cable types together with metal-clad accessories. In hazardous areas, install appropriate services commensurate with the hazard.

Refer to the layout drawings and this specification for wiring types, system operation, location of emergency lighting test switches, and automatic testing and monitoring systems.

Provide during the course of the contract works, samples of luminaires with the choice of louvres and lamp types for demonstration and final selection at site, generally in line with the Schedule of Luminaires.

Where alternative luminaires to those listed in the Schedule of Luminaires are proposed, provide full design calculations for the emergency lighting installation to all affected areas including an assessment of any load adjustment to the central battery system and associated electrical distribution system (where applicable).

#### **632 Luminaires**

Provide luminaires as specified in the Schedule of Luminaires.

. Provide emergency lighting luminaires complete with EC Directive 92/58/EEC or BS ISO 3864-1 and BS EN ISO 7010 standard exit legend (running man) at designated exit doors and changes in direction, as agreed with the relevant authorities.

#### **640 CONTROL REQUIREMENTS**

##### **641 Periodic testing**

Install the emergency lighting to enable testing by one or a combination of the following methods:

Type of testing:

- a) local test switches

Install the equipment for the testing of the emergency lighting system comprising:

- a) local key-switch controls suitably ganged as set out on the layout drawings

Unless specified otherwise, provide emergency lighting key-operated test switches, local, wired to break the circuit live supply to switch off the normal lighting luminaires and operate the emergency lighting luminaires for test. Ensure that the test switches are suitably engraved to indicate their function.

#### **650 SYSTEM COMPONENTS**

##### **651 General**

Install the system according to BS 5266, the appropriate product standards, and manufacturer's guidance.

##### **652 Luminaires**

###### **General**

Supply and install all luminaires for emergency lighting systems complete with diffusers, reflectors, lamps, control gear and necessary support and fixing brackets etc in the positions indicated on the

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

drawings, as detailed in the Schedule of Luminaires, and in accordance with specification section Y73.

##### **653 Self-contained luminaires**

Install local self-contained 3-hour duration maintained battery/inverter units to provide a secondary power source to illuminate lamps of luminaires at a reduced output in the locations indicated on the layout drawings.

Provide the units complete with self-contained sealed Lithium-ion batteries, inverter and changeover module housed within the body of the luminaire or within a separate proprietary sheet steel ventilated box type enclosure fixed to the rear of the respective luminaire.

Ensure that each luminaire/unit is complete with indicating LED to indicate the correct operation of the emergency lighting system.

Ensure that the luminaires are factory-converted by the emergency lighting/luminaire manufacturer to ensure correct operation and compliance with all other relevant standards.

##### **Batteries**

Ensure that the complete system is ready for test and adequate ventilation is available before the batteries are delivered to site.

Use only new batteries. Ensure that the batteries do not degrade during the construction stage of the Works.

##### **Chargers**

Ensure that each unit includes solid state switching and recharge equipment to enable a fully discharged battery to be fully recharged within 24 hours automatically and under mains healthy conditions.

##### **654 Lamps**

Supply and install all lamps for luminaires as detailed in the Schedule of Luminaires and in specification section Y73.

Ensure all luminaires are complete with matched lamp and ballast/control gear.

Ensure all luminaires operate within the operating voltage range as set out in the European Standard at a nominal voltage of 230V.

Ensure that there is no striation of lamps present in any operating conditions on mains or battery.

##### **655 Switches**

Supply and install all lighting switches, key switches and, where specified, control contactors, for emergency lighting system testing, in the positions as indicated on the layout drawings, and connect to the lighting final sub-circuit, also as indicated on the layout drawings and in accordance with the distribution board schedules.

Provide accessories from the same manufacturer and with the same finishes as detailed in section V22 of this specification.

Ensure that the cover plates are suitably engraved to indicate their function. Ensure that operation of the emergency lighting test switch switches off the normal circuit live supply and operates the respective emergency lighting luminaires for test.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

#### 656 Wiring

##### Wiring for self-contained systems

Supply and install emergency lighting final circuit wiring to the same standard as the normal luminaires.

#### 660 Equipment

#### 661 General

Install the system according to BS 5266, the appropriate product standards, and manufacturer's guidance.

#### 700 TELECOMMUNICATIONS (W10)

#### 710 PERFORMANCE OBJECTIVES

Provide a complete and fully functioning system telecoms facility

Organise, coordinate and schedule the data / telecom installer's works on site.

#### 720 SYSTEM DESCRIPTION

#### 721 General

Install all cables, containment and equipment within building voids and flushed into the building fabric as appropriate, to form a completely concealed installation.

Comply with sections, Y60, Y61, Y63, Y74, Y80, Y81, Y82 and Y89 of this specification.

#### 722 Telecoms connections

Provide and install telecoms services connections to the existing Sainsburys infrastructure

Terminate these services in the positions shown on the drawings.

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#### 800 RADIO/TV (W20)

#### 810 PERFORMANCE OBJECTIVES

Provide, install, test and commission a complete and integrated radio/television/satellite system for performance of all functions to the staffroom, as an extension of the existing Sainsburys system.

#### 900 INFORMATION TECHNOLOGY CABLING (W30)

#### 910 PERFORMANCE OBJECTIVES

To supply and install a structured cabling infrastructure to provide a flexible basis for the provision of voice, data, video and other services to users; the performance of the cabling must provide the following:

- a. be based on internationally recognised standards for design, performance and component type and quality
- b. provide full flexibility of work-station location and support concentration of work-station or networked services
- c. support a wide range of current and future data and voice communications techniques with any outlet being able to be used for any service type
- d. facilitate the rapid, cost effective relocation of users, regardless of their communications requirements

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- e. have a minimum fifteen years life, warranted by the manufacturer

To liaise with public telephone service providers to ensure that the correct infrastructure is provided for their services.

To test and commission all components of the structured cabling system.

#### 920 SYSTEM DESCRIPTION

##### 921 General

Ensure that the physical topology of the system is configured as current Sainsburys arrangement.

#### 930 SYSTEM COMPONENTS

##### 931 Horizontal cabling

###### UTP cables

Supply and install Category 5e (Class D<sub>E</sub>) cables, or as directed by Sainsburys

Ensure each horizontal cable is 100 ohms, four pair, with solid conductor.

Ensure the cable has low smoke and zero halogen (LSZH) over sheath.

Install the cables in accordance with the standards and manufacturer's requirements

Connect all eight conductors in each cable to a single RJ45 socket at each outlet and in a patch panel.

Ensure that the outer sheath of the cable is stripped back for the minimum distance necessary to terminate the cable.

Ensure that strain relief is provided for the cable at the outlet and in the patch panel, such that strain on the conductors is avoided.

Ensure that numbering and colour coding of wire pairs is as defined in EIA/TIA 568B; use this standard throughout the installation.

###### Outlets

Provide outlets to conform to the same Category or Class as the specified horizontal cabling.

Ensure all RJ45 outlets are fitted with spring loaded sliding shutters to prevent the ingress of dirt and dust.

Install outlets in the locations indicated on the drawings or described in this specification.

##### 932 Cable installation

Ensure that all cables are secured by broad cable ties at intervals of not more than 600mm horizontally and not more than 300mm vertically.

Ensure that individual bundles of cable do not contain more than 24 cables.

Provide strain relief for all cables at their termination to patch panels or outlets, to avoid stress on individual conductors or fibre optic elements.

Take care to avoid kinking cables or bending them at sharp angles (ie less than the minimum bend radius for the cable, recommended by the manufacturer).

Install cables in cable containment to a depth recommended by the manufacturer or in accordance with the standards.

Install UTP cables with a minimum of 200mm slack at each end to allow for re-termination; the slack is to be supported in the cabinet.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

#### 933 Warranty

For the installation provide a minimum 15 year extended product warranty and applications assurance from the date of acceptance.

The warranty is to cover components and system performance to the required standard for all elements of the system.

Identify limits to the exclusions from the warranty.

Include a description of the repair service including reporting methods, repair times and escalation procedures.

#### 940 INSTALLATION

#### 950 IDENTIFICATION OF ELECTRICAL SERVICES

#### 951 General

Comply with section Y82 of this specification.

#### 952 Labelling

Provide labelling to comply with the Sainsbury's requirements:

Ensure all cables are labelled at both ends at both sides of any fire barrier. Provide labels of the wrap-around, self-laminating type, printed with the identifier for the cable.

#### 1000 SECURITY SYSTEM (SMALL SCALE) (W44)

#### 1010 PERFORMANCE OBJECTIVES

#### 1011 Access control system

To design, provide, install, commission, and demonstrate an access control system designed for use in a professional security environment, which will allow an operator to manage and control pedestrian access to specified areas and in accordance with operator-defined access authorisation levels.

To provide a system that allows authorised operators to easily add, suspend, cancel, or change the access control information and authorisations of any person or groups of people.

To provide a system that continues to function normally when mains power is lost.

To provide a system that does not prevent persons from escaping in the event of a fire.

#### 1012 Surveillance system

This element of works is in abeyance awaiting clarification from Sainsburys.

#### 1020 DESIGN PARAMETERS

#### 1021 Access control system requirements

Use an electronic access control system that is fully compliant with the requirements for a Grade 1 / Grade 2 system as specified in BS EN 60839-11-1, except where these requirements are exceeded or modified in this specification.

#### 1030 SYSTEM DESCRIPTION

#### 1040 SYSTEM FUNCTIONS

#### 1041 General

Provide access control software and video management software to perform all setting up, configuration, control and monitoring functions simultaneously without affecting the performance of the system.



## **SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING**

### **MEP ENGINEERING SYSTEMS**

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#### **V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION**

Ensure that the system is based on an open protocol to allow easy interface and integration with third party systems, equipment and devices.

Use a system that will continue to operate normally based on the last system settings when communication between the central equipment and field devices are lost.

Provide a minimum of four levels of password protection to limit the software functions available to various users.

Ensure that all current and recurrent software licence fees are included within the tender return and transfer the licences to the Client at Practical Completion.

#### **1042 User interface**

Provide intuitive user interfaces for the access control system to allow an authorised operator to set up, monitor and control the relevant system.

Ensure that the system is capable of supporting multiple operator stations and multiple users, each interacting in real-time mode with the system via the interface.

#### **1043 Access control system functions**

##### **Operator functions**

Ensure that operators are able to perform the following control functions, depending on each operator's individual authorisation:

- ~ enrol, change and cancel users and authorisation details
- ~ set up and change system and device settings
- ~ create, set up and change icons
- ~ enter search criteria to retrieve recorded event data
- ~ monitor and acknowledge alarms
- ~ produce reports based on user-definable criteria

#### **1050 COMPONENTS**

##### **1051 Location**

Install all visible equipment and devices in accordance with the architectural setting-out details. Ensure that all central equipment, power outlets, data outlets and cables are installed in secure locations.

##### **1052 Cable and containment**

###### **Cables**

Install all cables between power and data outlets and security equipment.

Install all network cables between data outlets and security equipment. Use Cat 6 unshielded twisted pair (UTP) network cables. All network cables shall be Cat 6 unshielded twisted pair (UTP).

Comply with specification section Y61.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### **Containment**

Install all cables in rigid electrical conduit throughout its length. Ensure that all conduit is concealed in walls, floors or soffits, and that no cable or containment is visible after the works are complete.

In each instance where containment cannot be concealed, take responsibility for obtaining written acceptance from the Contract Administrator to install the relevant cables in rigid surface-mounted galvanized steel or stainless steel conduit throughout its length before commencing any work.

Take responsibility for liaising with the Main Contractor, the Electrical Installer and the IT Installer to coordinate final location and installation methods of all containment.

Comply with specification section Y60.

#### **1053 Access control equipment**

##### **Access controllers**

Provide access controllers to control all transactions relating to networked access controlled points. Install the controllers in a secure location within easy reach for maintenance.

Ensure that all controllers are fully intelligent and capable of operating in a standalone mode when communication with the central control computer is lost.

Ensure that failure of any individual controller does not compromise communication with, or operation of, any other controller within the system.

Ensure that there is no noticeable delay between the time when access is requested and the release of the relevant lock.

Provide a rechargeable battery for each controller to ensure normal operation of all hardwired access points for at least four hours when mains power is disconnected.

Ensure the batteries are no older than six months from date of manufacture at the time of installation and mark the date of installation on each battery in indelible ink. Install the batteries with the relevant access controller in the same enclosure, or where that is not possible in a separate lockable powder coated steel enclosure adjacent to the controller.

Connect all hardwired access control devices to the access controllers.

##### **Pushbuttons**

Provide flush mounted momentary pushbuttons to temporarily release the locks.

Use round stainless steel pushbuttons with bevelled collars, mounted in stainless steel face plates. Engrave the face plates with the words "PRESS TO EXIT" in clear green letters.

Ensure that all pushbuttons can be upgraded to readers at any time in the future without the need for builders work or changes to containment.

##### **Break glass units**

Provide semi-flush mounted, resettable, 3-pole break glass units (BGUs) to allow people to escape through access points in the event of an emergency. Use green-coloured BGUs engraved with the words "EMERGENCY DOOR RELEASE" in clear white letters.

Ensure that both conductors of the cable between the access controller and the lock are disconnected when the BGU is operated, and that the access point unlocks and remains unlocked until the BGU is reset.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Set up the system to generate an alarm signal when a BGU is operated.

Ensure that the BGUs can be reset by means of a reset key without the need to open the unit or replace any element. Provide three reset keys.

Weatherproof BGUs where installed in areas that are located externally or open to the elements.

##### **Fire alarm interfaces**

Provide fire alarm interfaces (FAIs) to automatically unlock access controlled points in the event of a fire.

Provide 3-pole, normally-open contacts held in closed position by a healthy signal from the fire alarm system.

Ensure that both conductors of the cable between the access controller and the lock are disconnected when the FAI is operated, and that the access point unlocks and remains unlocked until the fire alarm signal is restored.

Set up the system to generate an alarm signal when a FAI is operated.

##### **Status monitors**

Provide concealed magnetic reed switch type monitors to detect the closed or open status of all access controlled doors or gates.

Provide magnetic reed switch type monitors to detect the closed or open status of all non-access controlled doors and gates as indicated on the drawings, to allow monitoring of the door or gate status via the access control system.

Install concealed monitors in doors. On gates and garage doors provide weatherproof, rugged, aluminium clad, surface mounted monitors fitted with stainless steel armoured cables. Ensure that the detectors generate an alarm when the door or gate is opened by no more than 50 mm.

Ensure that the monitors cannot be defeated by the use of external magnets.

#### **1060 EQUIPMENT**

##### **1061 Electromagnetic locks**

Provide electromagnetic locks consisting of pull magnets and armature plates to provide effective locking of access controlled points. On double doors where both leaves are electronically locked provide a single unit with two integral electromagnetic locks.

Ensure that the pull strength of each individual lock is to be no less than 5,000 N, except on low security internal doors, where the pull strength of each individual lock may be no less than 2,500 N.

Take responsibility for liaising with the Main Contractor to coordinate the installation of each lock to ensure that the required clear head height of the door opening is maintained.

Provide all brackets, trims and mounting hardware to suit the specific requirements of each door.

Install all locks on the secure side of the door.

Ensure that the lock engages automatically when the door is returned to the closed position.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 1100 FIRE DETECTION AND ALARM (W50)

##### 1110 PERFORMANCE OBJECTIVES

Provide an extension / modification of the existing landlords and also the Sainsburys fire alarm systems, in each of the respective fit-out areas.

Provide design development to installation level detail design of the fire detection and alarm system in accordance with this specification and drawings, including verification of the current information, and co-ordination with other Installers.

Provide a fully automatic fire detection and alarm system to satisfy the area coverage, and operational and performance criteria as outlined elsewhere in this section. Ensure that the fire alarm system complies with the recommendations of BS 5839-1 for non-domestic premises and BS 5839-6 for domestic premises as applicable to the system category as specified in this specification.

Ensure that call points are of type A (direct operation) to comply with BS EN 54-11 and all other components are to the relevant part/s of BS EN 54.

Review the existing respective fire alarm cause and effects, and amend the existing software to accommodate the new fire alarm equipment

Provide all central control and indication equipment, and, where specified, distributed and repeat indication facilities.

Provide audible alarms and combined audible/visual alarms of the nature and type indicated, to achieve the required sound levels and intelligibility specified, and the remote information criteria, in compliance with all relevant British Standards.

Provide software system and programming, including security of stored information; and re-programming capability. Ensure that all devices use open-protocol unless an alternative is agreed and accepted by client.

Provide dedicated power supplies to fire detection and alarm system control panels, and, where required, ancillary and field devices, including independent standby battery-charger facilities.

Undertake all testing and commissioning of the system in accordance with standard and regulatory criteria, and specialised manufacturers' standard procedures, and to the satisfaction of the Contract Administrator, employer's representative and local fire authority, as required. Undertake all testing and commissioning to an integrated programme with other systems to ensure that all necessary power supplies are available, and that the correct operation of all interfaces with ancillary systems can be proved. Ensure that the commissioned system fully reflects the cause and effect schedule.

Perform and demonstrate a successful BS 5839-1 'soak test' for systems with 50 or more automatic fire detectors to the Contract Administrator's satisfaction.

Provide full record information, including testing results, operational and maintenance manuals, record drawings, zonal and address designations and certification.

Provide demonstration and instruction to selected members of the employer's staff.

Provide all system components from a single manufacturer's standard product range. Ensure that all components of the fire detection and alarm system are compatible and connectable to BS EN 54-13, and fully capable of delivering the requirements of this specification.

Do not use any equipment or components identified as end-of-line or otherwise not expected to have manufacturer continuing support and spares availability.

Ensure all control and indicating equipment, standard power supply units and standard repeater units comply with the EMC requirements described in BS EN 54 part 2 and BS EN 54 part 4.

Ensure all systems, components and equipment complies with EMC Regulations.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Use a incumbent fire alarm specialist to carry out the works

#### 1120 DESIGN PARAMETERS

##### 1121 System parameters

##### 1122 Status of Tender drawings

The fire detection and alarm system layout drawings are indicative only.

The position of all detectors, call points, visual alarm devices, and sounders / beacons are shown on the drawings for tender purposes only. At an early stage in the Contract, determine the exact locations of all components on site and inform the Contract Administrator of any required position change and obtain approval to change prior to installation.

#### 1130 SYSTEM DESCRIPTION

##### 1131 Existing system

Provide extensions and enhancements to, and reconfiguration of, the existing respective fire detection and alarm systems, ensuring that all components provided are fully compatible with the existing system's operation including software protocol. Ensure that installation and testing are undertaken in a planned and sequenced manner, in agreement with the occupier, to ensure minimal disruption to fire detection coverage to the premises.

#### 1140 CONTROL REQUIREMENTS

##### 1141 System operation

Ensure that the fire detection and alarm systems can be used to:

- ~ release passive control measures such as automatic closing fire doors
- ~ Stop ventilation systems.

##### 1142 Control interfaces

###### Fire protection system interfaces

Ensure that the fire detection and alarm system provides signals and interfaces with the operation of other fire protection systems and equipment including:

- ~ security access
- ~ ventilation

#### 1150 WIRING ARRANGEMENT

Provide the fire alarm system installation with a totally independent, separated and segregated wiring system in accordance with BS 5839-1 and BS 7671. Ensure that the system uses the same cable type throughout, sourced from a single BASEC approved cable manufacturer. Ensure that the cable type is LPCB approved.

Ensure all system equipment is connected in circuit loop formation as indicated on the schematic drawing, in conjunction with the specialist fire alarm system manufacturer's recommendations.

Install sufficient short circuit isolation devices in each detector loop to ensure that a single fault does not disable more than 20 manual call points or sensors or one fire zone. Plan the installation of the detector cables accordingly.

Ensure that the maximum number of addresses allowed to be connected on each loop is not exceeded, and allows a minimum of 30% spare capacity.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Ensure that the routes of each “leg” of each loop cable are segregated from each other, in order to reduce loss of the entire fire alarm loop in the event of short- or open-circuit or earth fault occurring, and that only one cable “leg” can be affected by a fault.

Do not use four-core loop cables.

#### 1151 Cables

Ensure that ‘standard’ fire resisting cables meet the BS EN 50200 PH 30 classification and the 30 min survival time when tested in accordance with Annex E of BS EN 50200.

Ensure that ‘enhanced’ fire resisting cables meet the BS EN 50200 PH 120 classification and the 120 min survival time when tested in accordance with BS 8434-2.

Provide all fire detection, alarm and signalling cabling using fire resistant cabling with red outer sheath.

Ensure that all cable sizing is in accordance with the manufacturer’s recommendations subject to a minimum size of 1.5 mm<sup>2</sup> for detection / actuation circuits and 2.5 mm<sup>2</sup> for sounder circuits.

Install and terminate all cable in accordance with manufacturer’s recommendations.

Provide all cabling for the complete system in soft-skinned fire resistant cable rated at 300/500 V to BS 7629-1. Ensure that the soft-skinned cable is of the ‘standard’ / ‘enhanced’ fire resisting type to match the existing installation.

#### 1152 Cable Installation

Ensure all cables are mechanically protected to BS 5839.

Install the cables to the FAS cable trays strictly in accordance with the manufacturer’s instructions and recommendations and terminate using proprietary Type A2 brass glands or zero halogen low smoke polymeric red coloured glands. Use only zero halogen low smoke coated copper ‘P’ clips coloured red for direct fixing of cables. Use only fire resistant cable ties, eg stainless steel, for fastening to the underside of cable trays or similar structures where support is required.

Install the cabling fixed to walls and on dedicated cable tray systems, to allow a practical means for future re-wiring of the system. Ensure all cable support is non-combustible and capable of withstanding an exposure to temperature at least equal to that of the supported cable. Fix cable supports and terminate cables in accordance with the recommendations of the cable manufacturer and in accordance with BS 7671.

Clip single or twin runs of cable in ceiling voids direct to the structure only where cable tray is not present. Provide cable trays where two or more cables follow a common route. Fix cable tray spaced off soffit by suitable galvanized brackets.

Adhere to the installation standards set down in the Y sections of this specification for the installation of the wiring system.

Earth all fire alarm system cabling in accordance with the requirements of BS 7671 and the recommendations of the manufacturer. Ensure that the electrical continuity of all electromagnetic screens are maintained throughout the system.

Install the wiring system concealed/flush other than in plant areas, including the final positioning and installation co-ordination of all system cabling and components together with the marking out of all associated builder’s works.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Install all cables in a manner such that they are physically continuous throughout the length of each circuit other than where connection is made at the terminations of a system component. Do not use any other cable connections or joints.

In all areas except plant areas, provide the final connections to all the system components via suitable conduit boxes fixed flush with the underside of the ceiling or flush in the wall. In plant areas, use a surface mounted installation.

Provide all necessary cabling from the main fire alarm panels to the appropriate MCCs, lift control panels, etc, and liaise fully with the installers of those systems to affect satisfactory connections and operation. Wire these services either directly from the fire alarm panels, or utilise the appropriate detector/alarm circuit loops, via suitable interface units, if required. Size cabling appropriate to the switching system's operation requirements.

Make good all penetrations through walls, floors, partitions or ceilings with fire-stopping material.

#### 1160 SYSTEM COMPONENTS

##### 1161 Field devices

###### General

Confirm all proposed device locations with the Contract Administrator and prepare installation drawings before commencing wiring or other equipment installation. Determine the full quantity of equipment, manual call points, detectors, interface units, monitors, sounders etc, from layout drawings and specification requirements.

Keep detectors free of any contamination due to works taking place after installation and commissioning by bagging etc, and replace any detectors contaminated at no extra cost.

All equipment to be compatible with existing systems / system equipment

###### Mounting heights

Mount items of equipment at the following typical centre line heights above floor level (except where indicated otherwise on drawings):

- ~ manual call points – 1200 mm
- ~ sounders in offices and other low ceiling rooms – 200 mm below soffit level
- ~ visual alarm devices – minimum 2100 mm

Agree all fire alarm equipment heights with the Contract Administrator prior to commencing installation and subject to architects' drawings which may be issued post tender.

###### Remote indicators

Provide remote LED indicators to indicate the operation of automatic detectors which are mounted in locations where they cannot readily be seen (eg within all plant rooms, switchrooms, substations, lift motor rooms, ceiling voids, and ducts). Do not connect the remote LED indicator units to the respective detector back plate terminals, and install flush or surface to ceiling or wall boxes, as required.

Mount indicators above plant room entrance doors, wired to their associated detector. These indicators are not necessarily detailed on either layout drawings or system schematics. Clearly label all remote indicators.



##### **Detectors – general**

Provide automatic detectors of the type and in the locations as indicated on the drawings and in accordance with BS 5839-1. Ensure each detector is of the analogue type and capable of being individually addressed.

Agree the final location of detectors on site with the Contract Administrator / specialist supplier.

Incorporate the following facilities in each detector:

- ~ common mounting base for different types, allowing detector heads to be fully interchangeable
- ~ integral LED alarm indication of operation where directly visible, with remote indication where concealed, ie duct sensors, lift shafts etc, and label suitably.
- ~ capability of automatic or manual disablement for maintenance purposes
- ~ appropriate indication on Main Control and Repeat Panel when the sensor is removed from its base
- ~ ensure removal of detector head does not render any part of system inoperative

Ensure all automatic detectors produce an analogue output which changes with smoke density or temperature, and that detectors change this to digital data for transmission to the processor.

Ensure all automatic detection devices are individually compensated, at the master control panel, for any degradation in performance due to ageing, dust accumulation, component characteristic change etc.

Ensure that detectors installed anywhere on any loop are capable of being assigned to any zone.

##### **Manual call points**

Provide manual call points of the addressable type complying fully with BS EN 54-11, made of polycarbonate/moulded ABS material and finished in red. Ensure all manual call points are of the same type. Install call points complete with suitable inscription of operation and provided with suitable proprietary enclosures for surface or flush mounting within internal/external locations.

Incorporate the following facilities within each manual call point:

- ~ external test facility to operate contacts without opening manual call point
- ~ an LED to indicate operation of manual call point
- ~ transparent safety covers to ensure that they are not operated inadvertently

##### **Optical smoke detectors**

Provide detectors of the obscuration or scatter light type, with sensitivity adjustment via the system control panel.

Ensure that point detectors comply with BS EN 54-7.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### **Fixed temperature/rate of rise type detectors**

Provide detectors of the electronic type and specifically designed for analogue operation, with sensitivity adjustment via the system control panel.

Ensure that heat detectors respond to either fixed temperature heat detection or fixed temperature heat detection combined with rate-of-rise of temperature. Do not use heat detectors that respond only to rate-of-rise of temperature.

Ensure that detectors comply with the sensitivity performance of BS EN 54-5.

##### **Short circuit (line) isolating modules**

Provide short circuit isolating modules to BS EN 54-17 and install between zone boundaries.

Provide these as proprietary units, capable of isolating the relevant section of the wiring installation either under circuit fault conditions, or whilst alteration/extensions are affected, leaving the remainder of the system unaffected.

##### **Interface units**

Provide interface units of the addressable type connected to the local loop circuit and which provide the required inputs and outputs for control or indication functions.

Ensure each input/output way is fully programmable from the control panel and fully monitored for open- and short-circuit conditions.

##### **Electronic sounders**

Provide sounders with an output frequency of 500 to 1000 Hz, providing a sound level of not less than 104 dBA at 1 metre and having an adjustable volume control. Ensure that the number of sounders on any one circuit does not exceed the manufacturer's recommended maximum.

Ensure sounders are electronic two-tone and red coloured. Ensure that sounders are polarised and suppressed as a standard. Supply units complete with a centre disc bearing the legend "Fire" in black.

##### **Flashing beacons**

Provide flashing beacons to operate at all times whilst sounder circuits are activated. Do not incorporate mute or isolation switches.

Ensure flashing beacon units are electronic Xenon / LED and sensor-base mounted, wall mounted and where necessary combined with audible alarm devices.

##### **Visual alarm devices**

Ensure that visual alarm devices conform to BS EN 54-23 and only use in conjunction with audible alarms.

Install visual alarm devices in accordance with BS 5839-1 and following the recommendations of the VAD manufacturer on the correct mounting height and orientation of VADs to ensure correct light dispersal and coverage.

## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Comply with the recommendations of the Loss Prevention Council Code of Practice CoP 0001 Issue 1.0 'Code of Practice for visual alarm devices used for fire warning'.

Arrange that the visual alarm device flashes at a rate between 30-120 flashes per minute.

#### 1200 EARTHING AND BONDING SYSTEMS (W51)

##### 1210 PERFORMANCE OBJECTIVES

To provide an earthing system for the transfer of electrical current to earth so that in the event of an earth fault, all earth fault currents are safely conducted to earth without danger to personnel or damage to equipment.

To provide an earthing system of sufficiently low impedance to facilitate operation of the electrical system protective devices such that all earth faults are cleared within the time scales specified in BS 7671.

To provide main and supplementary bonding in accordance with BS 7671, to create an equipotential zone of protection within all areas supplied by the associated electrical system, to ensure that all exposed conductive parts are at the same electrical potential as earth, and that personnel are not exposed to unsafe potentials under steady state or fault conditions.

To ensure that the consumer earthing requirements of the distribution network operator (DNO) supplying the building(s)/site are fully complied with.

##### 1220 DESIGN PARAMETERS

##### 1221 System designation

Survey and confirm existing earthing arrangement, and provide new earthing to the fit-out areas.

##### 1230 EARTHING REQUIREMENTS

##### 1231 LV system earthing

Extend the existing earthing system as part of the new LV distribution systems.

##### 1232 Equipment Earthing

###### Circuit protective conductors

Provide circuit protective conductors as follows:

- ~ separate copper circuit protective conductors with yellow/green insulation
- ~ armouring and/or metal sheaths of armoured cable
- ~ armouring and/or metal sheaths of armoured cable with auxiliary separate copper circuit protective conductors with yellow/green insulation
- ~ an integral protective conductor of any multi-core cable

Ensure that the size of the protective conductor is in accordance with BS 7671 and is as indicated on the drawings. Verify that no protective conductor is smaller than the minimum size of 1.5mm<sup>2</sup>.

Terminate bolted connections with compression type lugs formed by an automatic purpose made machine.

Bond the metal sheaths and/or armouring of paper and PVC insulated cables to the metal parts of the equipment to which they are connected, utilising a proprietary brass earthing tag and brass nut and bolt.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

When flexible conduit is used, ensure that the protective conductor at the equipment end is made-off to the equipment earth terminal. Install the protective conductor within the conduit and suitably sized for the circuit(s) passing through.

#### 1240 BONDING REQUIREMENTS

##### 1241 Bonding extraneous conductive parts

Bond extraneous conductive parts to earth in accordance with BS 7671 and BS 7430.

Ensure all building incoming main metallic services and building structure are securely connected to the main earth bar. Ensure that the following services are bonded:

- ~ main water pipes
- ~ main gas pipes
- ~ fuel oil pipes
- ~ heating pipework
- ~ chilled water pipework
- ~ exposed metallic parts of building structure
- ~ metallic cable sheaths of all cables
- ~ lightning protection systems.
- ~ suspended ceiling grids, (1 bond per 50m<sup>2</sup> of floor area connected between the primary grid members to the DB earth bar via dedicated CPCs).

Bond all simultaneously accessible conductive parts to the protective conductor system using supplementary equipotential bonds.

Agree on site with the engineer the final positions for equipotential bonding of piped services prior to commencement of the installation.

Provide an independent 6.0mm<sup>2</sup> supplementary bonding cable from locations where water services are in general use, such as toilets etc., to the local distribution board. Take all supplementary cross-bonding within such locations (where water services are in general use) from the independent main bonding point to pipes and fittings etc.

Ensure electrical continuity of metallic floor tile systems using supplementary bonding.

Ensure that bonds to the raised floor system are installed in each area of the building to the respective small power distribution board with a 6.0mm<sup>2</sup> LSZH earthing cable, mechanically protected as necessary.

For the purposes of this clause a building is defined as a separate structure. Structures linked by a corridor, subway or bridge are considered to be separate structures.

Bond together metallic water pipes, main metallic gas pipes, other metallic service pipes and metallic ventilation ducting, oil pipe services, piped gas systems, etc., entering/leaving plant rooms, boiler houses, calorifier rooms, bathrooms, kitchens and other wet-process areas, and bond to the electrical installation protective conductor system.

Ensure that all exposed or extraneous conductive parts having a resistance to earth of less than 1M $\Omega$  are bonded to the electrical services earth.

Prove each circuit protective conductor prior to making any supplementary bonding connection.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Bond final connections of all extraneous metalwork by means of a bolted type lug connection in a suitable position to be agreed with the engineer. Use only bronze nuts and washers when fixing earth tape.

No main or supplementary bonding cables to be less than 6mm<sup>2</sup>/copper LSZH-covered, green/yellow.

Connect all the protective conductors for bonding to the earthing system at the nearest convenient earthing terminal provided in an outlet box or equal. Conductors are to be installed within ducts etc., and where necessary within conduits to outlet boxes.

#### **1242 Bonding exposed conductive parts**

Carry out the equipotential bonding of the extraneous metalwork in the building in accordance with BS 7671.

Ensure the exposed metallic parts of the building structure are securely connected to the LV earth system.

Provide all conduit and trunking distribution services with equipotential and supplementary bonding systems throughout the installation, to ensure in conjunction with the separate CPC requirements that maximum earth continuity is provided for all such services.

Provide primary cable ladder and tray distribution systems with earth straps at each joint position and connect at source to the main earthing reference.

Bond each distribution board and switch panel, in addition to the CPC reference provided by the supply cable armouring, by a separate LSZH cable to the cable containment system.

#### **1243 Equipotential bonding of structural steelwork**

Install the equipotential bonding of the structural steelwork in the building in accordance with the BS 7671.

Allow for the equipotential bonding of the structural steelwork in X No. positions (), the exact positions to be agreed with the engineer.

Bond final connections of the structural steelwork by means of a bolted type lug connection in a suitable position to be agreed by the engineer.

Connect the protective conductors for bonding to the respective sub-main distribution board earth terminal.

#### **1244 Other bonding requirements**

Ensure any exposed or extraneous metalwork, other than any live part, forming part of the electrical installation is at earth potential.

Ensure that metallic structures forming part of sub-stations eg fencing, are bonded to earth.

Ensure all LV socket outlets have a green/yellow LSZH insulated 2.5mm<sup>2</sup> stranded copper conductor as a 'fly lead', connected between earth terminals secured to both socket assembly and socket box.

Provide each lighting switch grid with an earth terminal and a green/ yellow LSZH insulated 1.5mm<sup>2</sup> stranded copper conductor as a 'fly lead', connected between earth terminal and grid assembly.

Provide green/yellow LSZH insulated fly leads (6.0mm<sup>2</sup> minimum) for all hinged panels of switches, switchgear, control cubicles, distribution boards, etc., Route/protect the 'fly leads' to obviate damage to the cables when panels are opened and closed.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Provide protective conductors for the full length of all bus bar trunking systems. Ensure sizes are in accordance with BS 7671. Fix tinned copper tape externally to the side of the busbar trunking system using brass bolts and double (locking) nuts. Ensure that the maximum fixing centres are 900mm and each section of rising busbar trunking is securely bonded to the tape.

Provide and test earthing to desks in accordance with the requirements of BS 6396.

#### 1250 INSTALLATION

Carry out the installation in accordance with BS 7671 and BS 7430.

Make joints in earthing conductors by any of the following methods:

- ~ tin jointed area of conductor, install minimum of four rivets, then sweat joint solid. Wrap joint in Denso tape below ground
- ~ proprietary crimps, by purpose made automatic machine, ensuring that a crimp, once started cannot be released until full pressure, and crimp depth has been achieved. Wrap joint in Denso tape below ground
- ~ proprietary fusion welding system. Installed strictly in accordance with manufacturer's instructions. Wrap joints in Denso tape below ground

Ensure that where holes are drilled in the copper tape for connection to items of plant the effective cross-sectional area of the connection is not less than that required to comply with BS 7671. Tin the connected surface area.

Use clamps to BS 951 for bonding of pipes.

Provide all earthing cables with suitable mechanical protection, labelled and clearly identified throughout the installation on the cable tray, ladder, trunking and conduit distribution facilities.

Undertake all earthing and bonding in an inconspicuous and approved manner wherever possible. All cabling routes shall be agreed with the engineer prior to commencement of the installation.

#### 1300 LIGHTNING PROTECTION (W52)

#### 1310 PERFORMANCE OBJECTIVES

Install supplementary bonding links to additional roof mounted mechanical equipment.

To ensure that the design, installation and commissioning of the LPS and SPM is undertaken by a specialist lightning protection company that is a member of the Association of Technical Lightning & Access Specialists (ATLAS) and is BS EN ISO 9001 certified for quality assurance to provide all required technical advice, installation and monitoring services to ensure a complete installation as outlined in this specification.

To ensure that the LPS interconnects with the existing building LPS.

To ensure that fixed metallic components of the building(s) including steel chimneys, flue liners, TV antennae, rainwater disposal systems, roof mounted equipment, etc are protected as a part of the LPS.

To use in the system(s) materials that are resistant to corrosion from the environmental conditions to which the system is exposed, and thus minimize the risk of degradation of the function of the LPS and staining of the external fabric of the building(s).

To ensure that the system(s) does not/do not undermine the integrity, weatherproofing and waterproofing systems of roofs, nor any other part of a building's fabric.

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 1320 SYSTEM COMPONENTS

##### 1321 General

Ensure all lightning protection system components (LPSC) are compliant with the relevant part(s) of BS EN 62561.

Ensure that all components of the system are selected and installed fully in accordance with the manufacturer's written installation instructions.

Provide all system components with regard to the required LPL.

Ensure electrical insulation between air terminations, down conductors, and structural and internal system metal work is provided by separation distance in accordance with BS EN 62305-3.

##### 1322 Air termination systems

Provide an air termination system based on a determination by the rolling sphere/projection angle/mesh method of BS 62305-3. Use finials (air-rods), catenary wires, masts or natural components for air terminations. Locate air terminations at corners, exposed points and edges of the building(s) as determined by the method used.

Where the air termination system comprises finials, ensure that these are placed outside of the minimum separation distance between the finial and un-bonded equipment to prevent flash over.

Ensure the air termination system is designed and installed in strict compliance with BS EN 62305-3.

Provide only passive measures in the interception and conveyance of direct lightning strikes.

Coordinate with all appropriate parties (including the main contractor, roofing contractor, cladding contractor etc), to ensure that the LPS is installed at an appropriate time during the construction process.

Provide all necessary features (eg purpose manufactured connectors, surface treatment of materials, etc), to prevent electrolytic corrosion between dissimilar metals.

Configure the air termination network to have the minimum number of joints.

Bond the air termination grid to every down conductor.

##### Natural air termination components

Use the natural components of the roof structure as the air termination network in lieu of, and/or to supplement dedicated air termination components in accordance with the following clauses.

Ensure that the electrical continuity between the various parts is made by durable means of connection, eg by means of brazing, welding, crimping, seaming, screwing or bolting. Provide electrical bonding for any separated part of the metal roof to ensure a complete and continuous electrical network.

Ensure that all natural components such as metal sheets, metal roof components and ornamentation, metal pipes and tanks on the roof comply with BS EN 62305-3 thickness requirements. Treat all natural components not meeting these thickness requirements as part of the structure to be protected.

Install an accessible, bolted connection between each down conductor and the metal roof covering, ensuring the waterproof integrity of the roof.

Ensure metal parts such as ornamentation, railings, pipes, coverings of parapets, etc, used as natural air termination components have cross sections not less than that specified for standard air termination components.



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Ensure metal pipes, tanks and other equipment on the roof used as natural air termination components are constructed of material with thicknesses as set out above.

Do not use natural components where the conditions for thickness cannot be fulfilled; in such cases integrate the natural components into the LPS in accordance with this specification.

Do not use natural components carrying readily-combustible or explosive mixtures as an air termination component if gaskets in flange couplings are not metallic, or where the flange-sides are not otherwise properly bonded.

Do not use natural components that are clad with insulating material.

Ensure all natural components forming part of an LPS are in accordance with BS EN 62305 and BS EN 62561.

Obtain the agreement of the Contract Administrator to the proposed method of air termination system at the time of submission of working drawings, and prior to commencement of the Works.

Test and confirm the continuity of the covering between elements, and to the down conductor connection positions. Connect by a bonding conductor any part of the roof found to be electrically isolated from the remainder of the roof.

#### **Structures with a flat roof**

Provide lightning protection to parapets using an exposed perimeter copper/aluminium 25mm x 3mm flat conductor tape, bonded to the grid and secured using manufacturer's proprietary fixings suited to the parapet surface material.

Provide 25mm x 3mm proprietary roof joints and fixings as required to secure the air termination network.

Provide LPS connection to mechanical equipment. Bond mechanical equipment to nearby vertical air rod termination or air termination system, as appropriate.

Provide LPS connection to metallic structure. Include connections to roof top balustrading, lift shaft structure, roof steelwork, roof metallic covering and coping, as appropriate.

Provide LPS connections to all metallic structure items and mechanical equipment with conductor tape.

Where LPS conductor tape is required to be in contact with planted mediums, such as in green roof systems, install PVC coated copper tape bonded to the rest of the LPS. Where the LPS tape is not readily accessible for inspection, provide accessible test links at the points of connection with the rest of the LPS so that the inaccessible section may be separately tested for integrity.

#### **Connectors, clamps, links, bonds and bolts**

Ensure that all connectors, clamps and links between tapes, all clamps of tapes onto structural reinforcing steel and structural steelwork, and all bonds of tapes onto components that are not part of the LPS, are effective in reliably maintaining electrical continuity with negligible electrical resistance, and comply with BS EN 62561.

Clean all surfaces of conductors and apply a moisture inhibiting paste before jointing, and fit a proprietary waterproof shroud, colour matched to the PVC coloured conductor.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Robustly secure and fix all connectors, clamps, links and bonds so that the system is not damaged in operation.

Provide welded joints for all joints in LPS conductors that are buried in the ground.

#### 1330 BONDING OF OTHER SYSTEMS AND COMPONENTS

Bond the LPS to its associated main electricity earthing terminal.

Electrically bond all extraneous conductive parts connected to the structure of the building(s), including all metal projections on or above the main surface of the roof(s) to the LPS. This includes but is not limited to the following:

- ~ lift shaft steelwork
- ~ external mechanical plant and equipment
- ~ screens, louvres and grilles
- ~ handrails and external staircases
- ~ window cleaning cradles and rails
- ~ solar shading
- ~ aerials, antennae and satellite dishes
- ~ copings
- ~ vents and cowls
- ~ metal roof coverings
- ~ metallic door and window frames (where exposed to lightning strike or risk from flashover)
- ~ exposed steelwork
- ~ water pipes
- ~ gas pipes
- ~ gutters
- ~ metallic cladding and curtain walling

#### 1340 EQUIPMENT

##### 1341 Surge protection devices (SPD)

Install all SPDs in accordance with manufacturers' recommendations at appropriate locations suited to the application and equipment being protected.

Provide all SPDs to BS EN 61643 with the correct current surge rating, voltage protection levels and connection method suitable for the particular application and the structure's electrical system. Ensure all SPDs are installed to BS EN 62305-4 and operate with 'line to earth', 'line to neutral', 'neutral to earth', or 'line to line' mode of protection, according to the application.

Ensure that all SPDs are coordinated across LPZs. Provide all SPDs with visual indication that they are operational, and mount where readily accessible and visible.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Protect incoming and outgoing electrical service cables at the LPZ 0/1 boundary with a standard equipotential bonding Type 1 SPD to provide lightning current protection. Install Type 1 SPDs at the service entrance / main distribution board or other appropriate location to cover non-typical use.

Protect incoming and outgoing IT and communications service cables at the LPZ 0/1 boundary with a standard equipotential bonding Type 1 SPD (rated in accordance with BS EN 62305) to provide lightning current protection.

Protect all internal electrical and electronic systems at the LPZ 1/2 boundary with a coordinated set of standard Type 2 SPDs. Install Type 2 SPDs at the sub-distribution boards, or other appropriate location.

Protect all internal IT and communication systems at the LPZ 1/2 boundary with a coordinated set of standard Type 2 SPDs.

Protect the following designated equipment at the LPZ 2/3 boundary with a coordinated Type 3 SPD:

- ~ Equipment A
- ~ Equipment B

Confirm to the Contract Administrator that the proposals for LEMP protection contained in this specification meet the requirements of BS EN 62305.

Obtain the approval of the Contract Administrator for any additional protection required to meet the requirements of BS EN 62305; provide details of additional requirements at the time of submission of working drawings and prior to commencement of the Works.

Protect all ATEX zones with a coordinated set of SPDs on services entering or exiting the ATEX zone using ATEX approved SPDs. Install SPDs at the boundary to the ATEX zone, and within ATEX zone 1 and 2, using an isolated screen SPD.

Provide each surge protection device (SPD) with volt free contacts to signal the BMS for remote indication of SPD activation.

#### **1350 TESTING**

##### **1351 Tests**

Ensure that the complete LPS is fully tested by the specialist installer in accordance with BS EN 62305.

Arrange a mutually agreed programme for the demonstration of the LPS with the Contract Administrator. Prepare a method statement for the test, commissioning and demonstration stating exactly how these are to be carried out, and submit the statement to the Contract Administrator for comment.

##### **1352 Procedure**

Complete, test and commission the structural lightning protection system at an early stage in order that the building is provided with protection for as much of the construction program as is practicable.

Where the natural components within steel reinforced concrete or other encased element are required to be bonded according to the LPS design, prove acceptable continuity of each section and joint prior to the encasement, and after the encasement. Operate a sign-off system, mutually agreed between those involved, the management contractor and the project manager, to ensure adherence to the system of verification. Confirm that acceptable impedance values are achieved pre and post encasement.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Once the system down conductor paths are complete, measure the resistance to verify that they represent a suitably low resistance path to the earth termination network of 0.2 ohms or less.

During the construction of the foundation system measure the earth resistance of every individual foundation element forming an earth electrode, in isolation from all others. Ensure such resistance in ohms does not exceed ten times the number of down conductors on the structure.

Measure the earth resistance of every individual reference earth electrode against the foundation earth, and record the results with those of the foundation earth system.

Once the foundation earth is completed and bonded with the rest of the LPS, measure the resistance to earth of the complete lightning protection system. Ensure that all results from this test do not exceed 10 ohms.

#### 1400 CONDUIT AND CABLE TRUNKING (Y60)

#### 1410 GENERAL REQUIREMENTS

Except where otherwise stated in this specification these general requirements will be applicable.

#### 1411 Circuit protective conductors (CPCs)

Do not use conduit or trunking as the primary means of CPC medium. Install CPCs and ensure that they are of the same voltage grade and temperature rating as the live conductors of that part of the circuit. Use green and yellow coloured insulation for CPCs as required by BS 7671.

Ensure that all CPCs are electrically continuous and bonded to earth throughout.

Ensure that each circuit has its own CPC emanating from the distribution position and installed in the same trunking/conduit as the live conductors of that circuit.

Ensure that every CPC is sized in accordance with BS 7671.

Identify the CPC clearly on all equipment by a cable marker at the earthing terminal. Fix a label adjacent to the earthing terminal of every equipment box, appliance box and the like, stating 'PROTECTIVE CONDUCTOR – DO NOT DISCONNECT'

#### 1412 Enclosure cable capacities

Size all conduit and trunking in accordance with *IET Guidance Note 1: Selection and Erection* to provide the following space factor (sum of cross sectional area of cables / net internal area of conduit or trunking) unless otherwise specified in this section:

- ~ Conduit – space factor not to exceed 35% of net internal cross-sectional area of conduit
- ~ Trunking – space factor not to exceed 45% of net internal cross-sectional area of trunking

Do not use conduit less than 20mm nominal diameter.

Ensure that the internal surfaces and ends of conduit and trunking are kept clear of any protrusions, burrs, sharp edges or other foreign bodies except where allowed for as part of the respective conduit or trunking manufacturer's recommended fittings and use. Do not restrict the cross-sectional area capacity or diminish the smoothness of the trunking and conduit internal surface.

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 1413 Protection against corrosion

Do not place dissimilar metals liable to initiate electrolytic action, or other materials liable to cause mutual or individual deterioration, in contact with each other unless specific arrangements are made to avoid the consequences of such contact.

Ensure that all metallic conduit systems comply with BS EN 60423 and BS EN 61386 and are of the heavy gauge welded seam and screwed pattern. Ensure that all metallic conduit systems are mechanically and electrically continuous and bonded to earth throughout.

Ensure that all metallic trunking systems comply with BS EN 50085, and specifically BS 4678-2 for under-floor trunking systems. Ensure that all metallic trunking systems are mechanically and electrically continuous and bonded to earth throughout.

##### 1414 Fire resistance and reaction-to-fire performance

Support conduit and trunking such that they would not be liable to premature collapse in the event of fire.

Do not install containment that has a lesser performance with respect to fire-resistance and reaction-to-fire than the cables contained by it.

Where specified, install non-metallic conduits using conduit manufactured from low smoke zero halogen material.

Install fire barriers as required to meet the project fire strategy and the requirements of the Building Regulations.

Ensure that all containment systems (other than metallic conduit) passing through fire compartments are packed inside and outside with intumescent material, or are otherwise preventative of the passing of fire and smoke. Do not use non-metallic containment systems where passing between fire compartments.

##### 1415 Trunking Performance standard

Ensure that the trunking system, unless specified otherwise in the Particular Specification, (ie trunking and trunking fittings) meets or exceeds the performance classifications as defined in BS EN 50085 (and cross-referenced to BS 4678 in terms of corrosion protection and impact resistance) unless an alternative performance criterion is explicitly required elsewhere in this section.

Enclose non-sheathed (single insulated) cables in conduit, ducting or trunking in accordance with BS 7671 to provide a degree of protection to IPXXD and IP4X. Ensure covers are removable only with the aid of a tool or other deliberate action.

##### 1416 Conduit performance standard

Ensure that the conduit performance classification conforms to the *Table 1 - Performance Classification as per BS EN 61386-1*

| Conduit<br>Performance<br>Property | Table 1: Performance Classification as per BS EN 61386-1 |                 |                  |                  |                     |   |   |
|------------------------------------|--|-----------------|------------------|------------------|---------------------|---|---|
|                                    | 1  | 2               | 3                | 4                | 5                   | 6 | 7 |
| Resistance to<br>compression (N)   | V. light<br>(125N)                                       | Light<br>(320N) | Medium<br>(750N) | Heavy<br>(1250N) | V. Heavy<br>(4000N) | - | - |

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|   |   |   |  |  |                          |                         |                               |
|---|---|---|--|--|--------------------------|-------------------------|-------------------------------|
| Resistance to impact  | V. light  | Light   | Medium   | Heavy  | V. Heavy                 | -                       | -                             |
| Lower temperature range, °C   | +5  | -5  | -15  | -25  | -45                      | -                       | -                             |
| Upper temperature range, °C   | +60   | +90   | +105   | +120   | +150                     | +250                    | +400                          |
| Resistance to bending   | Rigid   | Pliable   | Pliable / Flexible   | Flexible   | -                        | -                       | -                             |
| Electrical characteristics  | With electrical continuity characteristics  | With electrical insulating characteristics  | With electrical continuity & insulating characteristics  | -  | -                        | -                       | -                             |
| Protection against the ingress of solid objects<br><br>(IP coding as per BS EN 60529 in brackets) | -   | -   | > 2.5mm & greater<br>(IP3X)  | > 1.0mm & greater<br>(IP4X)  | Dust protected<br>(IP5X) | Dust-tight<br>(IP6X)    | -                             |
| Protection to the ingress of water<br><br>(IP coding as per BS EN 60529 in brackets)              | Vertical falling water drops<br>(IPX1)  | Drops at 15°<br>(IPX2)  | Spray<br>(IPX3)  | Splashing<br>(IPX4)  | Jets<br>(IPX5)           | Powerful jets<br>(IPX6) | Temporary immersion<br>(IPX7) |
| Resistance to corrosion   | Low inside and outside<br><br>Example:<br>priming paint<br><br>(BS EN 61386-1 Class 1.) | Medium inside and outside<br><br>Example:<br>stove enamel/electro zinc plate/air drying paint<br><br>(BS EN 61386-1 Class 2.) | Medium inside, high outside<br><br>Example:<br>Stove enamel inside; sherardizing outside<br><br>(BS EN 61386-1 Class 3.) | High inside and outside<br><br>Example:<br>Hot dip zinc coating/ sherardizing/ stainless steel<br><br>(BS EN 61386-1 Class 4.) | -                        | -                       | -                             |
| Tensile strength  | V. light<br>(100N)  | Light<br>(250N)   | Medium<br>(500N)   | Heavy<br>(1000N)   | V. Heavy<br>(2500N)      | -                       | -                             |
| Resistance to flame propagation   | Non-flame propagating   | Flame propagating   | -  | -  | -                        | -                       | -                             |
| Suspended load capacity   | V. light<br>(20N)   | Light<br>(30N)  | Medium<br>(150N)   | Heavy<br>(450N)  | V. Heavy<br>(850N)       |                         |                               |

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Ensure that the conduit system (ie conduit and conduit fittings) meets or exceeds the performance classifications shown in and as defined in BS EN 61386 unless an alternative performance criterion is specified in the Particular Specification.

**Table 1 - Conduit performance**

| <b>Conduit performance property to BS EN 61386</b> | <b>General areas / zones where higher performance not required.<br/>Classification number:</b>                             | <b>Higher performance areas / zones or specific application:<br/>Plant areas; kitchens etc.<br/>Classification number:</b>  |
|--|--|---|
| Resistance to compression and impact               | 2 (light)  | 4 (heavy)   |
| Low and high temperature                           | 2 (-5°C to +90°C)  | 4 (-25°C to +120°C)   |
| IP Rating, solid object                            | 3 (IP3X)   | 5 (IP5X)  |
| IP Rating, water                                   | 2 (IPX2)   | 4 (IPX4, and if non-sheathed cables used)<br>6 (IPX5, Swimming pools)   |
| Corrosion protection                               | 2 (medium inside and outside)<br>Example: stove enamel / electro-zinc-plate / air drying paint.<br>(BS EN 61386-1 Class 2) | 4 (high inside and outside)<br>Example: Hot dip zinc coating / sherardizing / stainless steel<br>Use in kitchens; plant rooms; tank rooms; ducts buried in ground; external and all internal areas subject to dampness<br>(BS EN 61386-1 Class 4) |
| Suspended load                                     | 2 (light)  | 4 (heavy)   |

Ensure that the protective coating on conduit and trunking fittings (including saddles, conduit boxes, adaptable boxes) are the same class as that on the conduits to which they are joined.

#### 1420 GENERAL INSTALLATION REQUIREMENTS

Except where otherwise stated in this specification comply with these general installation requirements.

#### 1421 Safety

Do not use the conduit and cable trunking installation at any time as part of a fall arrest system.

Ensure that the conduit and cable trunking installation is coordinated with any spatial requirements necessary to accommodate all installation and future access requirements.

#### 1422 Common installation practice - trunking systems

Do not use trunking in exterior locations.



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Use multi-compartment trunking where segregation of cables is required. Ensure that the compartments remain fully segregated throughout the length including the bends, sets and tees.

Ensure trunking routes are mechanically continuous throughout their length. Provide all trunking that crosses a construction movement joint with a sliding coupling, for metallic systems, complete with a flexible protective conductor that ensures equipotential bonding.

Fit removable cable restraining straps into trunking at maximum intervals of 600 mm where trunking covers are fixed on the bottom or side of trunking.

Install drip-proof, close fitting trunking covers along the complete trunking length. Use trunking covers of the same material and protective finish as the trunking. Ensure that the cover is removable over the whole length of the trunking. Where trunking passes through building fabric (including walls and ceilings, etc), provide a short length of fixed cover to form a sleeve extending 25mm beyond each face of the building fabric.

Ensure that each cover is fixed throughout its length, and at each end within the last 50mm of its length.

Do not use self-tapping screws or fixed bridge pieces to hold the cover in position.

Do not use non-metallic trunking for vertical routes of 5m or more, for passing through floors or passing through fire compartment walls. In such locations use bonded metal trunking of the correct classification, with a short length of cover to form a sleeve. Install bagged intumescent material within and around the trunking where it traverses fire compartments or between floors, as required to maintain fire integrity.

Install heat barriers in vertical routes of metallic trunking of 5m or more.

Install insulated pin racks for supporting cables in vertical routes of trunking of 3m or more, and at maximum centres of 2m.

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Use the trunking manufacturer's standard fittings, of the same material and protective finish as the trunking. Ensure all changes of direction, terminations and tees, use the trunking manufacturer's fittings, suitably 'gusseted' where necessary, for the largest cables. Do not use site-fabricated fittings unless the situations encountered make the use of manufactured fittings impracticable. Submit sample site-fabricated trunking and obtain the Contract Administrator's prior written agreement to any proposal to use fittings not manufactured by the trunking manufacturer.

Make connections to distribution boards, equipment, panels etc, by using manufactured flanges giving the full trunking capacity, making due allowance for the future installation of cables from spare ways. Join each such flange to its associated trunking permanently, and such that the ingress protection of the trunking system is maintained. Fit appropriate gaskets between the flange and board, etc to maintain the IP rating.

Make each connection between trunking and equipment by means of a brass male bush, a coupling and an internally serrated washer, or a standard flanged coupling.

Where multi-compartment trunking is required, do not pass conduit through one compartment in order to reach another compartment. Provide exposed conduit connections to a multi-compartment trunking via a conduit box mounted on the outside of the trunking. In concealed conduit systems, terminate the recessed conduit boxes immediately behind the appropriate compartment, and feed cables through a bushed hole.

In situations where tees and junctions are to be installed in multi-compartment trunking systems, use multi-compartment fittings of such depth as to ensure suitable pass-over connections.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

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Use only flush-type covers for all flush trunking. Ensure that all finished edges of the trunking are flush with the adjoining surfaces of the fabric of the building. Ensure that all flush covers are coloured to match the finish of the immediately adjacent surface.

Perform all trunking work in accordance with sound practice and in a competent manner using skilled operatives. Ensure that all trunking is installed neatly (whether directly to a surface, or via a suspension or other support system) and routed horizontally level, vertically plumb, or parallel with the features of the building. Use tools and equipment suitable for the intended purpose.

Do not allow suspensions, fixings or other foreign bodies to intrude into the internal space of any trunking. Use roundhead screws for joining to suspensions or fixings. Remove all burrs from the head of all such screws.

Prior to installing cables in trunking remove all debris and take precautions to prevent further ingress of debris.

#### 1423 Common installation practice - conduit systems

##### General

Provide each lighting point, socket outlet, equipment point, etc, with a suitable conduit box securely fixed to the building fabric, that is able to support the weight of the fittings, etc. It is only permissible to solely suspend the luminaire or wiring accessory from the conduit box where the conduit system is of rigid metallic construction, with the conduit box fixed to the conduit system using metallic couplers and bushes as appropriate.

Install conduit from trunking to directly above each luminaire position. Size the conduit for the quantity of cables installed.

Install conduit from trunking to each switch-drop back-box position. Size the conduit to include 25% spare capacity, in addition to a maximum space factor of 35% specified.

Co-ordinate trunking and conduit routes. Allow a minimum of 300mm separation between trunking and cable-basket where running in parallel, and 50mm minimum separation where trunking and cable cross. Cross over at 90 degrees

Plan and install routes so that the crossing of surface-mounted conduits is avoided.

Ensure that the mounting plate of each item of surface-mounted equipment completely covers the recessed box to which it is fitted. Ensure that any cables are correctly bushed and protected against mechanical and electrical damage.

Use countersunk screws only where a countersunk hole is also provided otherwise use roundhead screws in all other cases.

Ensure that each accessory box is securely fixed using a minimum of 2 No. fixings.

Drill and tap holes in metalwork suitable for metal thread screws of 6mm diameter, or larger as required.

##### Concealed

Fix all conduits installed above suspended ceilings to the building fabric at distances to comply with BS 7671, Guidance Note 1. Use saddles, or steel strapping suspensions, or circular steel suspension sets with saddles, or proprietary suspension clips. Do not use suspensions that permit greater than a negligible amount of sideways movement of the conduit in normal service.

Provide conduit that is concealed above plastered or rigidly-constructed false ceilings, with ceiling mounted conduit boxes flush with the finished ceiling surface using extension rings where necessary.

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Fix all ceiling-mounted lighting points or pull-cord operated switches independently of the support structure of false ceilings. Provide break-joint rings at all luminaire or ceiling switch points as necessary.

Ensure that all conduits concealed in plastered walls have 12mm minimum cover along their whole length and are routed vertically, not horizontally.

Where partitions and walls are of such a construction that it is not possible to make a normal conduit entry to the flush accessory box, terminate the conduit in a box recessed deep into the wall and use an extension box to achieve a flush finish.

Provide boxes of all types (including adaptable, conduit, draw-in) with an overlapping cover flush with the finished wall or ceiling surface, and coloured to match the finish of the immediately adjacent surface.

Where containment is to be installed within and beneath the surface of a screed:

- ~ Do not allow an installation to proceed that may lead to the premature failure of the screed, or screed-embedded services.
- ~ Install containment with at least 25mm depth of cover over its entire length, increasing the burial depth as dictated by the screed manufacturer and the designer of the building fabric.
- ~ Ensure that the installation layout conforms to the requirements of the screed manufacturer and the designer of the building fabric, with specific attention to requirements regarding the lateral separation between buried services. Gain the specific consent and direction of the building fabric designer where conduits would be installed in parallel with other buried services (including containment), with less than 150mm clear space between each.

Where conduits are to be concealed in concrete, fix them securely to the steel reinforcement and fix conduit boxes to the shuttering.

#### Conduit layout and cable draw-in

Ensure that all conduit systems are of the surface-fixed or the concealed type as appropriate and as detailed in the system section(s) of this specification.

Ensure all lubricants and adhesives used for installation are suitable for the intended purpose and do not cause damage or other deterioration to the installation.

Lay conduits parallel and at equal distance to each other maintaining equal distance throughout all turns and bends.

Wherever possible, locate conduits in inconspicuous areas. Wherever a surface conduit turns through a wall install a back outlet box.

Install inspection boxes in accessible positions having due regard to switch and socket positions, and all aesthetic requirements.

Allow for sufficient draw-in boxes to permit ease of wiring/rewiring and comply with *Table 2 - Distance between draw-in boxes*:

**Table 2 - Distance between draw-in boxes**

| No of right-angled bends | Maximum distance between draw-in boxes (m) |
|--------------------------|--|
| Nil                      | 10   |

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|   |    |
|---|----|
| 1 | 10 |
| 2 | 6  |

For the purpose of this specification, a double-set constitutes the equivalent of 1 No. right-angled bend. Do not use more than two right-angled bends or a 10m length of conduit between draw-in boxes.

Ensure that conduit installation allows for the easy pulling in of cables with minimal risk of cable damage. Rectify all causes of difficult draw-in, replacing all damaged cable as necessary.

Take special care to prevent debris and moisture entering conduit systems (conduit and all fittings). Do not leave ends of conduits or conduit boxes open during building operations; effectively plug open ends and cover conduit boxes, and coat with petroleum jelly. Use only shaped plugs or screwed caps.

Remove all swarf, assembly fluids (eg lubrication, adhesive), other debris and moisture ingress to conduit systems and take steps to prevent further ingress.

Remove all swarf, assembly fluids (eg lubrication, adhesive) and other debris from all external conduit surfaces.

Do not draw in cables until the associated section of the conduit installation is complete and free of all debris and moisture.

Arrange conduits so as to minimise the collection of water from condensation or other sources. Where necessary drill drain holes (3mm diameter) in conduit boxes located at local low points and at any other points required by the Contract Administrator.

#### 1424 Conduit and trunking support

Support conduit as per *Table 3 - Conduit support spacing* and trunking as per *Table 4 – Trunking support spacing* or in accordance with the manufacturer's recommendations if such recommendations specify a lower distance between supports. Use additional supports where conduit provides support to luminaires and other electrical fixings:

**Table 3 - Conduit support spacing**

| Nominal diameter (d) of conduit in millimetres (mm) | Maximum distance between support (m) for rigid conduit |          |                      |          |
|---|--|----------|----------------------|----------|
|   | Metallic conduit                                       |          | Non-metallic conduit |          |
|   | Horizontal   | Vertical | Horizontal           | Vertical |
| $d \leq 25$   | 1.75   | 2.0      | 1.5                  | 1.75     |
| $25 < d \leq 40$                                    | 2.0  | 2.25     | 1.75                 | 2.0      |
| $d > 40$  | 2.25   | 2.5      | 2.0                  | 2.0      |

**Table 4 – Trunking support spacing**

| Cross sectional area (A) of trunking in square | Maximum distance between support (m) for trunking |          |                       |          |
|--|---|----------|-----------------------|----------|
|  | Metallic trunking                                 |          | Non-metallic trunking |          |
|  | Horizontal  | Vertical | Horizontal            | Vertical |

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| millimetres (mm <sup>2</sup> ) |      |     |      |      |
|--------------------------------|------|-----|------|------|
| 300 < A ≤ 700                  | 0.75 | 1.0 | 0.5  | 0.5  |
| 700 < A ≤ 1500                 | 1.25 | 1.5 | 0.5  | 0.5  |
| 1500 < A ≤ 2500                | 1.75 | 2.0 | 1.25 | 1.25 |
| 2500 < A ≤ 5000                | 3.0  | 3.0 | 1.5  | 2.0  |
| A > 5000                       | 3.0  | 3.0 | 1.75 | 2.0  |

Support each bend, set, adaptable box, conduit box, etc, by a conduit fixing equally spaced on each side at 150mm maximum.

Use spacer bar type saddles with 3mm clearance between the conduit and fixing surface on all resistance to corrosion Class 2 installations.

Use distance spacing type saddles with 12mm clearance between the conduit and fixing surface on all resistance to corrosion Class 4 installations.

Secure saddles and boxes by screws of minimum size 30mm x No.8. Use brass or sherardized screws for Class 4 installation.

#### 1425 Services Support and Suspension Systems

Comply with section Y93 of this specification.

#### 1426 Fixing to building fabric

Comply with section Y90 of this specification.

Do not undermine the fire integrity or acoustic integrity of the building-fabric. In addition to the items of good practice described within the MEP information, also comply with any project-specific detail or requirement with respect to fire stopping and acoustics.

#### 1427 STORAGE

Where conduit and trunking is stored for any amount of time prior to installation, ensure that they are stored on racks in dry storage conditions that do not promote corrosion, staining, warping or cracking, or allow other damage and defacement to occur. Dispose of any damaged materials; do not install them.

#### 1430 METALLIC CONDUIT AND FITTINGS

##### 1431 Metallic conduit

Use only conduits and fittings that are free of mechanical defects and surface rust. Ensure that this condition is maintained on installation.

Unless permitted to remain by the Contract Administrator, replace conduits where the protective coating is damaged, or where the protective coating becomes damaged after installation. If permitted to remain by the Contract Administrator, make good the rust patches by cleaning down to bright metal, priming and re-painting to match the undamaged conduit and subject to the satisfaction of the Contract Administrator.

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##### **1432 Fittings for metallic conduit**

Ensure all fittings are malleable iron conforming to BS EN 60423 and BS EN 61386.

##### **Conduit boxes**

Use circular malleable iron draw-in boxes at all lighting points, angle boxes, tee boxes, and all junctions having up to four conduits. For all other cases use adaptable boxes of the appropriate protective finish.

Fit every conduit box with a heavy steel cover, secured with brass screws, except where covered with a directly mounted accessory or fitting. Ensure all such covers are oversized, where used as flush inspection points, and have break-joint rings at luminaire and ceiling switch positions. Use standard or deep pattern conduit boxes having spout entry, except where they are loop-in boxes.

Ensure that all loop-in boxes are of the non-screwed entry type.

Ensure that all exterior installations and wet or damp installations use hot-dipped galvanised finish conduit boxes having external fixing lugs, malleable iron covers, machined mating surfaces and, where necessary, appropriate neoprene gaskets.

##### **Adaptable boxes**

Use adaptable boxes complying with BS EN 61386. For areas that are considered subject to mechanical damage and/or an aggressive environment, install adaptable boxes made of malleable iron or heavy duty steel with welded joints and tapped lugs to receive the cover screws. For all other areas, heavy duty hot-dipped galvanised pressed steel adaptable boxes may be installed.

Provide Class 4 installations located in exterior locations, or in areas that are expected to be wet and/or damp, with adaptable boxes having external lugs, a 3mm drainage hole at the lowest point, and a waterproofing seal between the box and the cover; where they are in other areas, use adaptable boxes that do not have external lugs.

Ensure adaptable boxes used as junction boxes for accommodating permissible cable joints, are of adequate size to receive a fixed porcelain or heat-resisting terminal block capable of withstanding the same temperature range as the cable insulation.

Install cable sweeps and neat connections.

Where necessary, use adaptable boxes having earthed barriers to retain segregation of cables for incompatible circuits (eg low voltage and data communications).

Provide overlap lids on flush installations, that are coloured to match the finish of the immediately adjacent surface.

##### **Bushes**

Use only brass, male type, long-threaded bushes where loop-in non-screwed entries are provided. Do not use lock nuts and ring bushes.

##### **Couplings**

Ensure that all couplings are in accordance with BS EN 61386 with protection against corrosion, where applicable.

##### **Earthing terminals**

Ensure that earthing terminals are provided and securely fixed to all equipment boxes, conduit accessories and adaptable boxes, to which either cables, flexible conduits, equipment or other accessories are mounted and terminated.

##### **Serrated washers**

Use spring metal, female-type serrated washers.

#### **1433 Installation**

##### **General**

Cut all conduit threads 'square' and to the correct length and properly butt. Clean existing threads using appropriate running dies before installation. Do not leave threads exposed except on running couplings. Ream all ends smooth.

Provide conduit connections to trunking, metallic boxes, panels, switchgear, or any item not having a tapped entry (or a tapped entry of 6 mm or less), using long-threaded male brass bushes with a flanged coupling and serrated spring washer. Make connections after removing the paint with a purpose-made tool.

Use locknuts with running couplings on Class 2 installations only when approved by the Contract Administrator.

Do not use running couplers with locknuts for Class 4 installations; use only manufactured conduit unions.

Form all-site manufactured bends and sets on a proprietary bending machine using the recommended former for the diameter and type of conduit. Use only proprietary fittings where tee, cross, right-angle, loop-in, thru, "U", "H", "Y", terminal or inspection pieces are to be installed in the conduit system

Space conduits at least 150 mm from other services, (including gas, water and steam services), unless otherwise agreed with the Contract Administrator.

Provide all conduits which cross-construction movement joints with at least two 90-degree sets (or more to counter the offset) centred on the joint-line such that movement of the joint is taken up by lateral flexing of the conduit sets.

Ensure that the entire conduit system is electrically continuous throughout, forming a fully bonded system, the whole system being effectively earthed. Cross-bond all exposed conductive containment to any other conductive containment systems, structure and services in the locality. Where conductive containment systems extend to the wiring accessory, ensure that there is continuity between the CPC(s) and the containment system. Carry out earth continuity tests before any conduits are concealed.

##### **Concealed installation**

Ensure that all conduits that are to be buried in concrete or in floor screed are hot-dipped galvanised. Ensure that all exposed threads of conduit joints are completely coated with zinc-rich paint prior to concreting or screeding.

Ensure that all conduits specified for installation in the ground are of high corrosion protection inside and outside to BS EN 61386-24 (generally equivalent to Class 4 protective finish). Wrap all ground



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installed conduit with 'half-lap' wrap mastic damp-proof bond tape. Extend such wrapping at least 300 mm beyond the ground emergence point.

#### 1440 NON-METALLIC CONDUIT AND FITTINGS

##### 1441 Non-metallic conduit

Ensure that all non-metallic conduit complies with BS EN 61386, is rigid, heavy gauge, high impact, non-flame propagating, , free from imperfections, smooth inside and outside.

Ensure that all non-metallic conduits are of the same colour throughout the entire installation.

Ensure that all non-metallic conduit is UV-stable.

##### Fittings for non-metallic conduit

Ensure that all fittings are of the same specification and colour as the conduit to which they are attached and comply with BS EN 61386.

Ensure that standard boxes are circular pattern with push-fit spouts to BS EN 61386 and with lid held in place with brass screws. Ensure all conduit box lids are of the same specification and colour as the conduit system.

Ensure that all boxes used at outlet points for luminaires and ceiling-mounted switches, are heat-resistant, have factory-fitted brass earth terminals, and are reinforced with tapped metal inserts for screws used to secure the cover or the fitting.

Ensure that adaptable boxes are of the same British Standard specification as the conduit and have lids fixed by brass screws. Do not use adaptable boxes smaller than 75mm x 50mm or larger than 300mm x 300mm. Where cable joints are permitted or specified, ensure that such boxes are of adequate size to contain the terminal block with sufficient space for making neat connections.

Fix the terminal block to the adaptable box using brass or nylon screws.

Fix concealed non-metallic conduits using saddles of the single-hole, half-clip type.

#### 1442 Installation

##### General

Use proprietary conduit adhesive for jointing conduit to couplers, adaptable boxes, etc. Insert square-cut conduits to the full depth of the spout.

Provide conduits terminating in trunking, accessories, or any item not having a smooth bored spout with connections using female plain-to-threaded adaptors, secured by a male bush.

Use male plain-to-threaded adaptors where conduits terminate at tapped conduit entry boxes.

Ensure all bends made on site use only appropriate bending springs. Make the radius of such bends not less than 2.5 times the diameter of the conduit. Make bends only where the ambient temperature is above +10°C. Do not use elbows or tees.

Position expansion joints at maximum intervals of 6m. Install expansion joints in accordance with the manufacturer's recommendations. Ensure that the conduit and expansion joint are correctly aligned and free from binding.

Do not use non-metallic conduits in situations where ambient temperatures are likely to be lower than -5°C or higher than 60°C. If temperatures are likely to be lower than -5°C but not lower than -25°C, then use non-metallic conduit of appropriate temperature rating, as described in BS EN 61386.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Use 2-No. fixings with large washers for conduit boxes supporting luminaires or ceiling-mounted pull switches.

##### **Concealed installation**

Do not bury non-metallic conduits in floor screed where electromagnetic screening is required.

Make fixings by means of single-hole plastic half-clips. Place these at intervals to comply with BS 7671 and at all changes of direction, to prevent displacement.

##### **Surface mounted installation**

Ensure that conduit work complies with *Table 3 - Conduit support spacing* above and uses only appropriate spacer bar saddles.

#### **1450 METALLIC CABLE TRUNKING**

##### **1451 General**

Manufacture all metal cable trunking from sheet steel in accordance with BS EN 50085, and BS 4678-2 for under-floor systems.

Use galvanised trunking. Ensure that the trunking emanates from the distribution centres.

Ensure that the trunking is complete with earth links to bond across all joints and utilises only manufacturers' proprietary parts.

Supply the trunking in standard lengths, free from all sharp edges and projections and with each length having a coupling sleeve.

Use stove-enamelled or electro-zinc-plated inside and outside in areas having Class 2 conduit installations, and a minimum designation of G275 (to BS EN 10143) of hot-dipped zinc coating in areas having Class 4 conduit installations.

Ensure that the entire trunking system is electrically continuous throughout, forming a fully bonded system, the whole system being effectively earthed. Fit brass continuity links to all trunking joints external to the trunking, using brass bolts and shake-proof washers. Cross-bond all exposed conductive containment to any other conductive containment systems, structure and services in the locality. Where conductive containment systems extend to the wiring accessory, ensure that there is continuity between the CPC(s) and the containment system. Carry out earth continuity tests before any containment systems are concealed.

Protect all cut edges of the trunking with a suitable material to prevent damage to the installed cables.

#### **1460 NON-METALLIC CABLE TRUNKING**

##### **1461 General**

Ensure that all non-metallic cable trunking complies with BS 4678-4 and BS EN 50085, is of heavy gauge high impact resistance construction, non-flame propagating, is smooth inside and outside, and is fitted with drip-proof lids along the complete trunking length. Do not use plastic trunking or plastic trunking products unless they are constructed using low smoke, halogen-free material.

Ensure that the cover of non-metallic trunking is removable throughout.

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Make due allowance for expansion to all fixings and connections as recommended by the trunking manufacturer.

Fix dado / skirting trunking with round head screws with oversized washers at a maximum interval distance of 500mm, and at the top and bottom of the trunking. In addition to regular fixing, install further fixings at all trunking-run ends, within the last 50mm of the trunking length. Fill irregularities between trunking and wall with silicon beading to eliminate gaps.

#### **1500 HV/ LV / ELV CABLES AND WIRING (Y61)**

#### **1510 GENERAL**

#### **1511 Cables**

Use only cables that have received product certification from the British Approvals Service for Cables (BASEC) or equivalent third party certification.

For any cable requiring fire resistance, use only products having received certification of their compliance via the LPCB.

Supply and install all cables in compliance with the Construction Product Regulations. Ensure that all cables are CE marked; are marked with the appropriate Euroclass code and labelling; and have a suitable Declaration of Performance (DoP) based upon testing and verification by BASEC or another equal and accepted notified body. Provide the DoP to the Contract Administrator for comment in advance of cable procurement.

For all power-system cables (including for small power), installed within buildings, install only cables with a Euroclass of D<sub>ca</sub>, s1b, d2, a2 or better.

For all telecoms-system cables within the scope of BS 6701 and installed within buildings, install only cables with a Euroclass of C<sub>ca</sub>, s1b, d2, a2 or better.

Where installed outside of buildings, install only cables with a Euroclass of E<sub>ca</sub> or better.

Where the term “low smoke zero halogen” (LSZH) or “low smoke and fume” (LSF) is included in the project specifications, this means cables with such performance that when affected by fire, they emit only limited smoke and negligible amounts of corrosive gases. Ensure that any cable specified to have “LSZH” or “LSF” sheath and or insulation, meets the Euroclass minimum performance sub-classes of s1b and a2 for smoke density and corrosive gas emission respectively.

Ensure that all containment and fixings of LSZH cabling is of a type producing low levels of smoke and negligible halogens, such that a coordinated strategy for LSZH materials in the cabling and containment systems is achieved.

Ensure that the neutral conductor of a 4-wire three-phase final or distribution circuit is of equal cross-sectional area to a phase conductor.

For recessed tungsten and fluorescent luminaires or for heat-producing or heat-emitting equipment that have final connections using flexible cables, make the final connections using heat-resisting flexible cables. Where heat-producing/emitting equipment is directly wired, fit heat-resisting sleeving, of temperature rating not less than 185°C, over conductors within electrical equipment.

Determine the appropriate value of current carrying capacity for cables in accordance with BS 7671 and BS IEC 60287-1-1, based on a maximum permissible conductor temperature of 70°C in normal service.

Where a conductor operates at a temperature exceeding 70°C ascertain from the manufacturer that the switchgear, protective devices, accessories, other types of equipment connected to the conductor, and the fabric of the building or other material the cable is touching, is suitable for the resulting temperature at the point of contact.

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Do not use any current carrying conductor less than:

- ~ 2.5 mm<sup>2</sup> for general power applications
- ~ 1.5 mm<sup>2</sup> for general lighting and fire alarm applications
- ~ 0.75 mm<sup>2</sup> for ELV control and signalling applications

Do not use thermoplastic insulated (PVC) cables if the expected ambient temperature exceeds 50°C. Do not use thermosetting insulated (XLPE) cables if the expected ambient temperature exceeds 70°C. In applications where the ambient temperature exceeds these limits, install heat-resisting cables back to the first switch or distribution board or a termination box that is not in an area with elevated temperature.

Where it is permissible for cables to traverse channel-ways or similar on continuously mounted fluorescent luminaires, ensure that the cable rating is appropriate for the temperature inside the channel or duct by applying the appropriate de-rating factor. Do not use thermoplastic insulated (PVC) cables if the expected temperature exceeds 50°C. Do not use thermosetting insulated (XLPE) cables if the expected temperature exceeds 70°C.

Do not use thermoplastic insulated (PVC) cables for final connections to any appliances containing a heating element or any appliance emitting heat. Wherever a final connection is within flexible conduit, make it using heat-resisting cables. Ensure that the full length of cable installed in flexible conduit is heat resistant from the point of connection of the appliance to that with the fixed wiring system contained by rigid containment.

Ensure cables are not in direct contact with any form of polystyrene used in the building.

Ensure that all cables are installed, straightened, dressed and supported to give a neat and workmanlike installation in accordance with BS 7671.

Ensure wherever practicable, low voltage and extra low voltage cables cross at ninety degrees to each other and such that they do not cause interference or mutual detriment.

Do not install cabling in thermal insulation wherever practicable. Ensure cable routes and fixings are selected to prevent mechanical damage or overheating of the cable during installation or during their use.

Wherever cores less than 4 mm<sup>2</sup> are terminated in tunnel and similar terminations, double them back on themselves to ensure a good level of contact is achieved. Whenever preparing a cable for connection by stripping insulation from it, ensure that the stripping tool does not damage the conductor. Strip back only so much of the insulation that none of the conductor beyond its termination is exposed, and ensure that the termination compresses only its conductor and not its insulation. Do not use soldered connections or lugs.

Terminate all conductors requiring bolted connections with compression lugs using an automatic compression crimp tool that releases only after obtaining the correct crimp depth. Ensure that the cable, the compression lug, the die used and the crimping tool are all compatible. For small compression lugs, use an appropriate hand-crimping tool to BS EN 50109. Test every crimped termination and every mechanical termination for mechanical soundness immediately after making.

Make all bolted terminations using suitable bolts, nuts and shake-proof washers. Tighten connections to the torque recommended by the equipment manufacturer.

Ensure that all cable joints and connections are electrically and mechanically sound.

For low-voltage cables identify conductors using colours and cable markers in accordance with BS 7671.

Identify all cables using a proprietary alphanumeric marker system manufactured by 'Critchley' or an equal alternative supplier accepted by the Contract Administrator. Identify cable references at both

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ends of the cable, including individual conductors within the distribution boards and at every floor within risers, and allow for up to fourteen alphanumeric characters. When cable markers with a limited fire hazard (LFH) rating are required, use zero-halogen markers made from self-extinguishing material.

Arrange cable routes so that cables, hangers, cleats, and the like, do not come into contact with, or in close proximity to, pipe services.

Where cables rise from below the floor, protect them by metal conduit to a height of 300 mm above the floor surface. Increase the height of such protection to 2 m where the cables are exposed to potential mechanical damage.

Ensure that all installation work results in a workmanlike installation consistent with recognised 'good practice' in the industry.

#### 1512 Cable ties

Where cable ties are used, comply with BS EN 62275, and use the following minimum classification for cable ties:

- ~ 6.1 according to material: may be metallic, non-metallic or composite depending on the location of the installation
- ~ 6.2 according to minimum loop tensile strength: sufficient to support the mass of the cables and any loads that may be imposed during the installation or any subsequent alteration of the installation and not less than 180 N
- ~ 6.3 according to temperature: maximum temperature not less than 85°C; minimum temperature not higher than -5°C for indoor application and not higher than -15°C for outdoor application
- ~ 6.4 according to the flame application time: not less than 30°seconds
- ~ 6.5 according to environmental influence: for outdoor application, declared by the manufacturer as resistant to UV and, for any metallic component, resistant to atmospheric corrosion

Use cable fixings that, when affected by fire, emit levels of smoke and corrosive gases no greater than the cable that they support.

Support wiring systems such that they will not prematurely collapse in the event of a fire, use only metal cable fixings.

Where final-circuit and other minor-gauge cabling is laid in and is supported by incombustible support components, secure them with zero halogen, self-extinguishing, ultra-violet resistant ties. For all other cabling, use plastic coated metallic cable ties or metallic cable cleats. Do not use wire or similar material for cable ties.

Where a cable is fire resisting, select its fixings to maintain the overall fire performance of the cable installation.

#### 1513 Cable cleats

Select cleats of duty to suit the application with the following BS EN 61914 requirements:

- ~ capable of accommodating the size or range of cable bundle diameter without cracking or breaking, or stripping screw threads
- ~ resistant to impact at the minimum declared temperature

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- ~ capable of withstanding the lateral load at the maximum declared temperature
- ~ capable of withstanding the axial load at the maximum declared temperature
- ~ resistant to electromechanical forces

Ensure each cleat is to be marked with the manufacturer's logo or trademark and the identification or type.

Ensure that surfaces of cleats are free from sharp edges and burrs that are likely to damage cables or cause possible injury to the installer.

Avoid excess pressure of cleats and other fixings on cables to prevent deformation of the plastic sheathing. Ensure that non-metallic and composite cable cleats and intermediate restraints have adequate resistance to flame propagation and are able to withstand a 30-second period of exposure to a needle flame in accordance with BS EN 61914.

Where a cable is fire resisting, select its fixings to maintain the overall fire performance of the cable installation.

For single-core SWA cables, use aluminium (non-ferrous) or proprietary plastic cleats / brackets for restraints, as opposed to steel, to reduce the effect of eddy current heating within the cleats / brackets.

#### 1514 Cable glands

Select cable glands according to the size, type and profile of the cable. Select cable glands complying with the following standards:

- ~ for non-armoured cable: BS EN 62444. Ensure that the classification of the gland as detailed in 6 Classification is compatible with the cable, the installation, and the intended purpose
- ~ for armoured cable: BS 6121-1 with the gland selection compliant with BS 6121-5. Ensure that the protective connection to earth for the gland is certified to a current at least equal to the maximum expected for the installation
- ~ for mineral insulated cables: BS EN 60702-2

Use metallic glands where electrical continuity or high impact resistance is required.

Use non-metallic glands where a lightweight gland is required or to be used with a non-metallic enclosure to avoid the need for a separate earth connection to the part of a metal gland.

Use composite glands where it is necessary to guard against electrolytic and / or chemical attack.

For single-core cables, use non-ferrous glands, as opposed to steel glands, in order to reduce the effect of eddy currents which may cause heat and therefore possible thermal damage to the installation.

Fit cable glands with shrouds. Ensure that glands for flexible cables include an effective cable guard.

Use cable glands, shrouds and all associated components that, when affected by fire, emit levels of smoke and corrosive gases no greater than the associated cable they support.

Where a cable is fire resisting, select the gland to maintain the overall fire performance of the cable installation.

Use a cable gland with inner and outer seals where ingress protection is to be maintained at the point of cable termination.



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##### 1520 LV CABLES IN CONDUIT AND TRUNKING

##### 1521 Cables

Select cable for the method of installation that meets the requirements of the relevant standard referred to in clause Y61.100 or in the relevant 'system' section of this specification. This clause applies primarily to the following:

- ~ thermosetting insulated non-sheathed single-core cable to BS EN 50525-2-31, harmonised code H07Z-R, cable code 6491B ( low smoke zero halogen cable)
- ~ PVC insulated non-sheathed single-core cable to BS EN 50525-2-31, harmonised code H07V-R, cable code 6491X
- ~ heat-resisting rubber insulated non-sheathed single-core cable to BS EN 50525-2-42, harmonised code H07G-R
- ~ heat-resisting silicone-rubber insulated non-sheathed single-core cable to BS EN 50525-2-41, harmonised code H05SJ-K

This clause also applies to insulated and sheathed single-core cables or insulated and sheathed multi-core cables with or without a circuit protective conductor described below when installed in conduit or trunking:

- ~ thermosetting insulated sheathed single-core or multi-core cable to BS 7211, table 3, cable code 6181B, or table 5 cable code 624#B. Use class 2 multi-stranded conductors for cables of 4.0 mm<sup>2</sup> and above. Use class 1 single-stranded conductors for cables below 4.0 mm<sup>2</sup> (low smoke zero halogen cable)
- ~ PVC insulated and sheathed single-core or multi-core cable to BS 6004, table 3 or 5, cable code 618#Y or table 4 or 5, cable code 624#Y. Use class 2 multi-stranded conductors for cables of 4.0 mm<sup>2</sup> and above. Use class 1 single-stranded conductors for cables below 4.0 mm<sup>2</sup>
- ~ thermosetting insulated PVC sheathed single-core cable to BS 7889, table 3, cable code 6181X
- ~ [In the descriptions above # denotes number of cores.]

This clause also applies to cables of other types where installed in trunking or conduit for support or mechanical protection.

When installing cables within a building or occupied space use only cables that, when affected by fire, emit low levels of smoke and zero halogens (LSZH sheathed multicore and LSZH insulated single core cables), unless specified otherwise in the relevant 'system' section of this specification or on the drawings.

Select cables according to external influences not only for proper functioning, but also to ensure the reliability of the measures of protection for safety in accordance with BS 7671 and BS EN 50565.

Use only new cables with each coil having its manufacturer's seal intact giving the size, classification and the like.

Ensure that the sizes of all cables including circuit protective conductors (CPCs) are in accordance with BS 7671. Design the cable sizing with a grouping correction factor for the actual circuits within the same containment, plus a further factor for not less than 25% additional future circuits.

Where an installation includes an extension or alteration to a pre-existing installation, do not add cables where their installation would result in the grouping correction factor for the total number of circuits reducing the current carrying capacity of the cables below that required by BS 7671.



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Where cables are routed outside of their associated trunking for making the final connection to an energy meter, use sheathed and insulated single cables. Ensure that such cables where outside the trunking, are as short as practicable and meet the metering requirements of the supply company. This method of connection is generally applicable only for directly metered supplies of 100 A or less.

#### 1522 Installation

Install and fix all cables in accordance with BS EN 50565.

Install cables only of the same voltage band within the same conduit and trunking system. Do not install cables forming part of a fire alarm and detection system in the same cable containment as other circuits. Install a dedicated cable containment system exclusive to the wiring system serving a Group 2 medical location (as defined in chapter 9 of Guidance Note 7 'Special Locations' published by the IET) where electrical equipment is supplied through a safety-isolating transformer.

Ensure the electromagnetic compatibility of equipment connected with wiring routed within the same conduits and trunking.

Ensure that all conduit and trunking is de-burred and free from sharp edges, water, chemicals, building debris, dust and other contaminants before cables are installed, and throughout the period of the installation works.

Where tungsten luminaires are ceiling-mounted direct to conduit boxes, use heat-resisting cables from the luminaire to its lighting switch and respective neutral conductor.

Carry out all wiring of multi-point circuits in a 'loop-in' system, and do not use joints or connections, other than those required for the connection of switches, fuses, socket outlets, motors and the like.

Do not make cable joints within trunking.

Do not allow cables to exceed the capacity of the conduit and/or trunking as defined in Guidance Note 1 'Selection and Erection of Equipment' published by the IET.

Ensure that the sheathing and insulating materials of cables are not damaged while drawing cables into conduit.

Do not install cables when the temperature is below the minimum installation and handling temperature given in BS EN 50565. If the cables have been exposed to such temperature, allow a warming up time before the cables are handled.

In the event of any insulation being damaged, eg while cables are being drawn or laid in, remove and replace the whole length of cable. Damage includes any instance of bending to a radius less than the normal-use minimum bending radius given in BS EN 50565 or specified by the cable manufacturer.

Do not bend cables during installation to a smaller radius than the normal-use minimum bending radius specified by the cable manufacturer or BS EN 50565 where the manufacturer data does not exist. Take into account that the minimum bending radius allowed for installation work is within a limited range of ambient temperatures.

Do not draw cables into conduit occupied by cables. If conduits occupied by cables have to be used for additional circuits or alterations, then isolate, identify, label, disconnect and withdraw all wiring from the conduit. Replace the wiring by drawing it back into the conduit with the new wiring.

Do not draw cables into trunking but lay them in, irrespective of whether the trunking is installed 'lid-up', 'lid-down', or 'lid-on-side'. 'Comb' cables as laying-in proceeds and lay the neutral and circuit protective conductor of each circuit with each phase cable of that circuit. Where trunking is installed lid-down, support the cables with proprietary cable retainers at intervals not exceeding 1 m. Ensure that cables are not trapped between the trunking body and its lid or fastening.

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Ensure that the respective neutral or switched live conductor and the circuit's permanent live conductor are contained in the same containment section to prevent eddy current heating of the containment.

Where cables of several circuits occupy the same trunking, bind the cables of each individual circuit together at intervals not exceeding 5 m, by labelling ties or other similar means. As a minimum ensure that the ties at each end of the circuit clearly show the circuit reference number.

Leave sufficient slack in the cables at conduit and trunking expansion joints.

Where cables are left unattended before installing them in conduits or trunking, temporarily form them into coils, bind them and securely support the resulting coils at high level.

#### 1523 Circuit protective conductors (CPCs)

Do not use conduit or trunking as a CPC medium. Install CPCs and ensure that they are of the same grade and temperature rating as the live conductors of that part of the circuit. Use green/yellow coloured insulation for CPCs in accordance with BS 7671.

Ensure that each circuit has its own CPC emanating from the distribution position and installed in the same trunking/conduit as the live conductors of that circuit.

Ensure that every CPC is sized in accordance with BS 7671.

Identify the CPC on all equipment clearly, by a cable marker at the earthing terminal. Permanently fix in a visible position adjacent to the earthing terminal of every equipment box, appliance box and the like, a durable label to BS 951 indelibly marked with the words "SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE".

#### 1530 INSULATED AND SHEATHED CABLES

##### 1531 Cables

Select cable for the method of installation that meets the requirements of the relevant standard referred to in clause Y61 or in the relevant 'system' section of this specification. This clause applies primarily to the following:

- ~ thermosetting insulated sheathed single-core or multi-core cable to BS 7211, table 3, cable code 6181B, or table 5 cable code 624#B. Use class 2 multi-stranded conductors for cables of 4.0 mm<sup>2</sup> and above. Use class 1 single-stranded conductors for cables below 4.0 mm<sup>2</sup> (low smoke zero halogen cable)
- ~ PVC insulated and sheathed single-core or multi-core cable to BS 6004, table 3 or 5, cable code 618#Y or table 4 or 5, cable code 624#Y. Use class 2 multi-stranded conductors for cables of 4.0 mm<sup>2</sup> and above. Use class 1 single-stranded conductors for cables below 4.0 mm<sup>2</sup>
- ~ thermosetting insulated PVC sheathed single-core cable to BS 7889, table 3, cable code 6181X
- ~ [In the descriptions above # denotes number of cores.]

Ensure that the cross-sectional area of the integral circuit protective conductor complies with BS 7671.

Identify conductors using colours in accordance with BS 7671. Fit coloured sleeves over bare copper CPCs, where stripping-back the sheath has exposed them. Fit coloured sleeves to BS EN 60684 where the standard colour of the phase or neutral conductor is at variance with the identification

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colour given in BS 7671 (for example, when the blue conductor in a two-core cable is used as a switch wire).

#### 1532 Installation

##### General installation requirements

Do not install cables when the temperature is below the minimum installation and handling temperature given in BS EN 50565. If the cables have been exposed to such temperature, allow a warming up time before the cables are handled.

In the event of any cable being damaged, remove and replace the whole length of cable. Damage includes any instance of bending to a radius less than the normal-use minimum bending radius given in BS EN 50565 or specified by the cable manufacturer.

Do not bend cables during installation to a smaller radius than the normal-use minimum bending radius specified by the cable manufacturer or BS EN 50565 where the manufacturer data does not exist. Take into account that the minimum bending radius allowed for installation work is within a limited range of ambient temperatures.

Ensure compliance with the requirements of BS EN 50565 in respect of instances where the sheath temperature may exceed 50°C by ensuring that:

- ~ either the cable is located so that persons or animals will not touch it, or
- ~ the cable is de-rated to prevent its temperature from rising above 50°C

Do not bury these cables underground. Only install these cables in external locations if contained within conduits or trunking.

Do not install these cables in locations classified as hazardous areas.

Install and fix all cables in accordance with BS EN 50565 using single-pin or saddle clips. Use clips that, when affected by fire, emit levels of smoke and corrosive gases no greater than the cable that they support. Where cables are supported on cable tray, or supported in other similar ways, fixing of the cables using cable ties is acceptable. Where cables are fixed using cable ties ensure that the rating of the cables is not affected beyond that allowed for by the grouping factors applied.

Support wiring systems such that they will not prematurely collapse in the event of a fire, use only metal cable fixings.

Where final-circuit and other minor-gauge cabling is laid in and is supported by incombustible support components, secure them with zero halogen, self-extinguishing, ultra-violet resistant ties. For all other cabling, use plastic coated metallic cable ties or metallic cable cleats. Do not use wire or similar material for cable ties.

Where cables are supported from a catenary system use only proprietary catenary fixing clips suitable for the environment they are installed in and in accordance with BS 7671.

Where the final circuit cable installation is intended to be installed without containment as in domestic installations using multicore cabling, fix these cables to maximise their capacity by installing multiple bunches of no more than ten cables in any one bunch with heavy loads separated. Install accessory boxes for all terminations and accessories.

Where cables enter boxes ensure that all cable sheaths pass fully into the box via a rubber insert bush and web. In areas where class 4 conduit or trunking is installed (eg in kitchens, plantrooms and areas subject to dampness), use packed glands with neoprene washers in lieu of rubber insert bushes. Within every box ensure that the CPC has sleeving coloured green/yellow in accordance with BS 7671, where connecting to the earthing terminal. Install a separate green/yellow sleeved CPC from the earthing terminal of the box to the earthing terminal of the accessory or appliance.

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Do not use these cables for final connections to any heat-emitting appliance nor to any appliance containing any heating element.

Fit heat-resisting sleeving of temperature rating not less than 185°C, over conductors within electrical equipment, including tungsten luminaires where the temperature at the termination may exceed the temperature rating of the cable.

##### **Installation requirements for surface installations**

Install cables as inconspicuously as possible, taking advantage of the features of the building by fixing in corners, along skirting boards, mouldings and the like, and around fittings and the like while maintaining the appropriate bending radius of the cable.

Where cables are installed in roof spaces or lofts, clip them to the side of joists and rafters. Where traversing between adjacent joists or rafters, install a 'binder-joist' or suitable batten and clip the cable to its side.

##### **Installation requirements for concealed installations**

Protect cables by means of galvanized metal capping where concealed in solid masonry walls.

Where cables are installed in a wall or partition at a depth of less than 50 mm from a surface of the wall or partition, ensure that the cable:

- ~ (i) Is installed in a zone within 150 mm from the top of the wall or partition or within 150 mm of the vertical junction of two adjoining walls. Where a cable is connected to an electrical point, accessory or switchgear on any surface of the wall or partition, install the cable in a zone either horizontally or vertically to the point, accessory or switchgear
- ~ (ii) Incorporates an earthed metallic covering which complies with the requirements for a protective conductor of the circuit, complying with BS 5467, BS 6724, BS 7846, BS 8436 or BS EN 60702, or
- ~ (iii) Is installed in earthed trunking or ducting complying with BS EN 61386 and satisfying the requirements for a protective conductor, or
- ~ (iv) Is enclosed in earthed trunking or ducting complying with BS EN 50085 and satisfying the requirements for a protective conductor, or
- ~ (v) Is provided with mechanical protection against damage sufficient to prevent penetration of the cable, or
- ~ (vi) Forms part of a Separated Extra-Low Voltage (SELV) or Protective Extra-Low Voltage (PELV) circuit complying with BS 7671

Where clause (i) has been met but neither of the clauses (ii) to (vi) apply to the installation, provide the cable with additional protection by means of a residual current device (RCD) with the characteristics specified within BS 7671.

Ensure that, irrespective of its buried depth, a cable in a wall or partition with metallic parts, other than fixings such as nails, screws and the like (for example, a metal stud frame):

- ~ is provided with additional protection by means of an RCD, or
- ~ complies with the requirements within BS 7671 for a cable installed at a depth of less than 50 mm

Where cables are routed through joists, drill through the neutral axis of each joist perpendicular to its surface, ensuring that there is at least 50 mm of joist above and below the hole. Do not notch joists.

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Terminate all lighting points in a ceiling rose box mounted flush to the ceiling. Ensure that every such box is of heavy-gauge, self-extinguishing PVC to the relevant British Standard, reinforced with tapped metal inserts.

Do not lay cables directly on suspended ceilings. Where groups of cables are routed above suspended ceilings, clip them directly to the soffit or secure them to cable trays (or similar containment). Where single cables are routed above suspended ceilings, secure them to a catenary wire or route them through a length of rigid suspended conduit bushed at both ends. Secure sheathed multi-core flexible cables connecting electrical equipment fixed in the ceiling void (eg fan-coil units) or recessed into the suspended ceiling (eg luminaires), in a similar manner.

Where sheathed multi-core flexible cables are used to make final connections to electrical equipment and luminaires, ensure that cord-grips are used at both ends to secure the sheath of the cable in order to prevent strain on the conductors.

#### 1540 FIRE-RESISTING CABLES FOR VOICE ALARM AND FIRE ALARM SYSTEMS

##### 1541 Cables and cable systems

For public address systems that are used for announcing the evacuation of a building (including voice alarm systems), emergency voice communication (EVC) systems and for fire detection and alarm systems, use fire-resisting cable systems of 'standard fire resistance' (PH30) or 'enhanced fire resistance' (PH120) as required by the appropriate part(s) of BS 5839 and as defined by the testing regimes of BS 8434 and BS EN 50200.

Use one or more of the following wiring systems:

- ~ mineral insulated cable systems complying with BS EN 60702-1 and BS EN 60702-2 and BS EN 60332-1-2
- ~ fire-resistant cables complying with IEC 60331-1 or IEC 60331-2 or IEC 60331-3 and with BS EN 60332-1-2
- ~ fire-resistant cables complying with test requirements of BS EN 50200 or BS 8434 or BS 8491, appropriate for the cable size and with BS EN 60332-1-2
- ~ a wiring system maintaining the necessary fire and mechanical protection

Select the wiring system to meet the requirements of the appropriate part(s) of BS 5839 relative to the application, and install in such a way that the circuit integrity will not be impaired during a fire.

Install cabling of minimum fire survival time as required by BS 8519 and to the requirements of the specific system for which the cable is being used. Mechanically protect the cabling either by the cable's own armoring or additional enclosures.

Use clips that emit levels of smoke and corrosive gases when affected by fire no greater than the cable that they support.

Ensure that all accessories, including, but not limited to fixings, supports, terminations, terminals and glands are compatible with the cable selected, and together with the cable containment and supports form a cabling system that meets the required integrity standard. Produce documentary evidence and technical information that demonstrates that the cable system as a whole is consistent in its fire-resistance rating. Ensure that such documentation is incorporated in the building health and safety file and forms part of the relevant operation and maintenance instruction manuals.

Other than for instances prohibited in Y61 or otherwise specified in the relevant 'system' section of this specification, or otherwise shown on the drawings, flexible soft-skin cables are acceptable.

Obtain written assurance from the manufacturer of the fire alarm, voice alarm and EVC systems installed, that the proposed cabling system is compatible with the fire alarm, voice alarm or EVC

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system. Ensure that the assurance documentation is incorporated in the building health and safety file and forms part of the relevant operation and maintenance instruction manuals.

#### 1542 Installation

Install fire-resisting cables in accordance with BS EN50565, BS 5839 and the cable manufacturer's guidance. Fix fire-resisting cables to fire-resisting structure and secure with fire-resisting fixings.

Where there is risk of damage by rodents, use armoured cable or install the cable within steel conduit.

Do not install cables when the temperature is below the minimum installation and handling temperature given in BS EN 50565. If the cables have been exposed to such temperature, allow a warming up time before the cables are handled.

In the event of any cable being damaged, remove and replace the whole length of cable. Damage includes any instance of bending to a radius less than the normal-use minimum bending radius given in BS EN 50565 or specified by the cable manufacturer.

Do not bend cables during installation to a smaller radius than the normal-use minimum bending radius specified by the cable manufacturer or BS EN 50565 where the manufacturer data does not exist. Take into account that the minimum bending radius allowed for installation work is within a limited range of ambient temperatures.

Do not bury flexible soft-skin cables underground.

Do not install flexible soft-skin cables in locations classified as hazardous areas unless appropriate certification exists for the cable and installation.

For surface installations install cables as inconspicuously as possible, taking advantage of the features of the building by fixing in corners, along skirting boards, mouldings and the like, and around fittings and the like while maintaining the appropriate bending radius of the cable.

Protect cables by means of galvanized metal capping where concealed in solid masonry walls. Where cables are routed in hollow partitions ensure they are mechanically protected by virtue of their position or otherwise by metallic conduit. Ensure that cables installed in hollow partitions are arranged in such a way that they are effectively supported.

Where cables are concealed within solid walls or partitions, route them vertically in the zone directly above or below the accessory they serve. Do not install horizontal cabling to or from accessories.

Where cables are routed through joists, drill through the neutral axis of each joist perpendicular to its surface, ensuring that there is at least 50 mm of joist above and below the hole. Do not notch joists.

Do not lay cables directly on suspended ceilings. Where groups of cables are routed above suspended ceilings, clip them directly to the soffit or secure them to cable trays (or similar containment). Where single cables are routed above suspended ceilings, secure them to a catenary wire or route them through a length of rigid suspended conduit bushed at both ends.

#### 1550 FIRE-RESISTING CABLES FOR GENERAL APPLICATIONS

##### 1551 Cables and cable systems

Where wiring and interconnection is required to maintain circuit integrity under fire conditions for longer periods than can be achieved with cables of conventional construction, use one or more of the following wiring systems:

- ~ mineral insulated cable systems complying with BS EN 60702-1 and BS EN 60702-2 and BS EN 60332-1-2



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- ~ fire-resistant cables complying with IEC 60331-1 or IEC 60331-2 or IEC 60331-3 and with BS EN 60332-1-2
- ~ fire-resistant cables complying with test requirements of BS EN 50200 or BS 8434 or BS 8491, appropriate for the cable size and with BS EN 60332-1-2
- ~ a wiring system maintaining the necessary fire and mechanical protection

Select the wiring system to meet the requirements of the appropriate part(s) of BS 5266 or BS 8519 relative to the application, and install in such a way that the circuit integrity will not be impaired during a fire, with the cable support system achieving a level of fire resistance via suitably sized suspension rods as calculable according to Annex E of BS 8519.

Install cabling of minimum fire survival time as required by BS 8519 and to the requirements of the specific system for which the cable is being used. Mechanically protect the cabling either by the cable's own armoring or additional enclosures.

Where the cable itself cannot achieve the required fire rating such as for high and medium voltage distribution, it is acceptable to install non-fire resistant cabling within fire resistant enclosure(s) meeting the minimum fire survival time published in BS 8519.

For control and bus systems of safety services, use wiring meeting the same requirements as the wiring used for the safety services in question, except for circuits thereof that do not adversely affect the operation of the safety equipment.

Use clips that emit levels of smoke and corrosive gases when affected by fire no greater than the cable that they support.

#### 1552 Installation

Install fire-resisting cables in accordance with BS EN 50565, BS 8519 and the cable manufacturer's guidance. Fix fire-resisting cables to fire-resisting structure and secure with fire-resisting fixings.

Where there is risk of damage by rodents, use armoured cable or install the cable within steel conduit.

Do not install cables when the temperature is below the minimum installation and handling temperature given in BS EN 50565. If the cables have been exposed to such temperature, allow a warming up time before the cables are handled.

In the event of any cable being damaged, remove and replace the whole length of cable. Damage includes any instance of bending to a radius less than the normal-use minimum bending radius given in BS EN 50565 or specified by the cable manufacturer.

Do not bend cables during installation to a smaller radius than the normal-use minimum bending radius specified by the cable manufacturer or BS EN 50565 where the manufacturer data does not exist. Take into account that the minimum bending radius allowed for installation work is within a limited range of ambient temperatures.

Do not bury flexible soft-skin cables underground.

Do not install flexible soft-skin cables in locations classified as hazardous areas unless appropriate certification exists for the cable and installation.

For surface installations install cables as inconspicuously as possible, taking advantage of the features of the building by fixing in corners, along skirting boards, mouldings and the like, and around fittings and the like while maintaining the appropriate bending radius of the cable.

Protect cables by means of galvanized metal capping where concealed in solid masonry walls. Where cables are routed in hollow partitions ensure they are mechanically protected by virtue of their position



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or otherwise by metallic conduit. Ensure that cables installed in hollow partitions are arranged in such a way that they are effectively supported.

Where cables are concealed within solid walls or partitions, route them vertically in the zone directly above or below the accessory they serve. Do not install horizontal cabling to or from accessories.

Where cables are routed through joists, drill through the neutral axis of each joist perpendicular to its surface, ensuring that there is at least 50 mm of joist above and below the hole. Do not notch joists.

Do not lay cables directly on suspended ceilings. Where groups of cables are routed above suspended ceilings, clip them directly to the soffit or secure them to cable trays (or similar containment). Where single cables are routed above suspended ceilings, secure them to a catenary wire or route them through a length of rigid suspended conduit bushed at both ends.

#### 1560 ARMoured Cables – LOW VOLTAGE

##### 1561 Cables

Use cables having class 2 stranded copper conductors, unless specified otherwise in the relevant 'system' section of this specification or on the drawings.

The following abbreviations apply:

- ~ "XLPE/SWA/LSZH" indicates; XLPE compound insulation, polymeric material bedding, single steel-wire armouring, black low smoke zero halogen sheath overall, 600/1000-V grade in accordance with BS 6724
- ~ "XLPE/AWA/LSZH" indicates; XLPE compound insulation, polymeric material bedding, single aluminium-wire armouring, black low smoke zero halogen sheath overall, 600/1000-V grade in accordance with BS 6724
- ~ "XLPE/SWA/LSZH/FR/F#" where # is either 2, 30, 60 or 120 indicates; XLPE compound insulation, polymeric material bedding, single steel-wire armouring, black low smoke zero halogen sheath overall, 600/1000-V grade fire-resisting cable in accordance with BS 7846. F# indicates the category of fire resistance as given in BS 7846 and in the absence of the inclusion of this designation use F120 cable.
- ~ "XLPE/SWA/PVC" indicates; XLPE compound insulation, polymeric material bedding, single steel-wire armouring, black PVC sheath overall, 600/1000-V grade in accordance with BS 5467
- ~ "XLPE/AWA/PVC" indicates; XLPE compound insulation, polymeric material bedding, single aluminium-wire armouring, black PVC sheath overall, 600/1000-V grade in accordance with BS 5467

Use only cables that, when affected by fire, emit low levels of smoke and zero halogens (LSZH sheathed multicore and LSZH insulated single core cables), unless specified otherwise in the relevant 'system' section of this specification or on the drawings.

Where cable sizes are not detailed then size these in accordance with BS 7671 and in addition, those standards pertinent to the installation and load supplied.

Ensure all cables are of the same manufacture and delivered to site in continuous lengths, complete with end caps.

At the manufacturer's works, subject all cables to the routine tests detailed in the relevant British Standards. Submit duplicate copies of test certificates to the Contract Administrator.

For every single-core cable operating on ac systems, use armouring that is non-magnetic (ie is not steel).

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##### **1562 Terminations, straight joints, tees and branches**

Make all cable joints using a proprietary cast-resin kit system, cold-shrink system or heat-shrink joint system supplied by one manufacturer and install strictly in accordance with its instructions. Prior to selecting heat-shrink technology, demonstrate that the installation practices to be adopted make the potential risks associated with hazards negligible (eg applied heat, fire hazards, escaping flammable gas and exposure to fumes).

Install mechanical protection for the cable joint (in the case of a cast-resin joint kit the encapsulation is considered to provide this). For shrink joints, use a further encapsulation where buried or on cable tray or similar arrangement, and cover the joint with a metal tray or equivalent.

Make connections at joints using connectors designed for LV applications, and correctly sized for the type and size of conductor. Connections may use either compression tooling or be of the shear-bolt type. For compression connectors use a compression tool that does not release until the correct compression has been achieved, and ensure compatibility between the tool, die and connector. Verify that the continuity resistance of the jointed conductors is no greater than that of the equivalent length of a conductor without a joint, and that the insulation resistance between cores, and between cores and earth, is no less than that of the original cable.

At joints use solder-less earthing connections comprising a constant-force spring and earthing connection for the armour connections. Ensure that the conductivity and fault current capability of the earth connection across the joint is at least equal to that of the cable without the joint.

Fit cable glands complying with BS 6121-1 at all terminations. Select glands in accordance with BS 6121-5. Use brass compression glands for steel-wire armoured cables and aluminium alloy glands suitable for accepting an insulated insert for single-core aluminium-wire armoured cables. Use non-ferrous gland plates for single-core cables. Ensure that all glands have cone grip armour clamps with suitable provision for cross-joint bonding.

Where armoured cables are used in hazardous areas (ie where gases, vapours or dust present a risk of explosion), terminate them with glands and seals that have been certified for use in the hazardous area. Use a type of termination that is compatible with the electrical installation in the hazardous area (eg flameproof, intrinsically safe, etc). Ensure that the certification meets the current ATEX standards, eg ATEX 95 (Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations) and ATEX 137 (Dangerous Substances and Explosive Atmospheres Regulations), and include a copy of the certification in the operating and maintenance instruction manuals.

Ensure the environmental conditions when jointing or terminating cables are such that the work can be carried out without detriment to the completed joint or termination.

##### **1563 Installation**

Where cables are buried underground, comply with the requirements of the relevant clause of the Y61 specification.

Do not install cables when the temperature is below the higher of:

- ~ the minimum installation and handling temperature specified in the installation recommendations appendix of the appropriate cable standard, or
- ~ the minimum installation and handling temperature given by the cable manufacturer

If the cables have been exposed to such temperature, allow a warming up time before the cables are handled.

Do not bend cables to a radius smaller than the larger of:

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ the minimum installation radius specified in the installation recommendations appendix of the appropriate cable standard
- ~ the minimum installation radius given by the cable manufacturer

Where cables need to be pulled by winches or use similar mechanical aids, use them fully in accordance with the cable manufacturer's instructions. Record the pulling tension and do not exceed the allowable maximum for the method by which the winch is attached to the cable.

Ensure cables, wherever installed including those fixed on walls or installed in accessible ducts, are fixed at intervals to prevent sag, in accordance with the manufacturer's recommendations. Ensure bends are fully supported.

Fix cables, including those in building engineering services ducts, using cable cleats complying with clause Y61 of this specification and galvanized bolts where:

- ~ the cable is rated as clipped direct (Reference method C (20) of BS 7671)
- ~ the cable is rated as on perforated trays with the cables in a group spaced (Reference method E or F (31) of BS 7671)
- ~ the cable is rated as in trenches (Reference method B (54 or 56) of BS 7671)

Note that the rating of cables is based on cables in a group being spaced, unless otherwise specifically indicated.

Fix cleats so that the maximum spacing between supports does not exceed the lower spacing of those recommended by the manufacturer of the cable and the cleat. In selecting the cleat and fixing, take into account the full details of the installation including the static load of the cable and any load imposed by, but not limited to, wind, icing and the load for wind including icing.

Ensure the maximum spacing of supports for armoured cables in accessible positions complies with the recommendations of the manufacturer and in any case do not exceed the following:

| Overall diameter of the cable | Maximum horizontal spacing | Maximum vertical spacing |
|-------------------------------|----------------------------|--------------------------|
| 9 mm to 15 mm                 | 350 mm                     | 450 mm                   |
| 15 mm to 20 mm                | 400 mm                     | 550 mm                   |
| 20 mm to 40 mm                | 450 mm                     | 600 mm                   |

When the selection takes into account the full details of the installation including the static load of the cable and any load imposed as described above, the fixing may use plastic covered, galvanized, perforated steel strip and galvanized bolts where:

- ~ the cable is rated as clipped direct with the cables in a group touching (Reference method C (20) of BS 7671)
- ~ the cable is rated as on perforated trays with the cables in a group touching (Reference method E or F (31) of BS 7671)

Ensure the material used for cleats, any covering on a metal cleat and the plastic covering of any strip fixing has properties in a fire condition at least equal to that of the cable.

Where the cable is fire resisting, select the fixing so that the overall fire performance of the cable installation is maintained.

Avoid excess pressure of cleats and other fixings on cables to prevent deformation of the plastic sheathing. Install suitable supporting steelwork and/or galvanized cable tray where cables cross open spaces. Protect such steelwork by a rust-inhibiting paint.

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Unless specified otherwise in the relevant 'system' section or Y63 of this specification or on the drawings, arrange the installation of single core cables neatly in close trefoil using cable cleats and intermediate restraints complying with clause Y61 of this specification.

Install fixings at intervals compliant with the cleating system certification for a maximum fault current at least equal to that of the installation. Install the neutral conductor adjacent to the group and fix in a similar manner. When approaching terminations, ensure the cores remain in close trefoil for as long a distance as possible, keeping the splayed length to the minimum that practical considerations will permit, having regard to minimum bending radii. Where single-core cables are installed with more than one cable per phase, cleat the cables in three-phase groups with the neutral alongside each group using cleats as described above.

Where single-core cables are specifically detailed to have a flat spaced installation, arrange them neatly at the required spacing fixed to a non-magnetic cleating system otherwise as described above for cables in trefoil. Install fixings at intervals compliant with the cleating system certification for a maximum fault current at least equal to that of the installation. Install the neutral conductor adjacent to the group fixed in a similar manner. Where single core cables are installed with more than one cable per phase, cleat the cables in three-phase groups as described in Y63, using cleats as described above.

Fix cables laid in racks, hangers or on steelwork at intervals to prevent sag, in accordance with BS 7671.

Ensure the armouring is independently bonded to the switchgear and at termination points, using the brass earth "banjo" tag of the gland and single green/yellow cable. Ensure the armouring is bonded for continuity at all points. Use copper conductors of the correct size in accordance with BS 7671.

Where cables pass through walls and floors fit them with permanently fixed oversized sleeves each packed with fire resisting infill. Ensure where cables rise or fall on walls they are protected to a height of 2 m with a sheet steel guard where prone to mechanical damage.

Ensure all cables are installed, straightened and dressed to give a neat and workmanlike installation.

Where armoured cables are installed or terminated into electrical equipment in hazardous areas ensure that a sealed gland with ATEX certification is used of the correct size and type for the cable and the equipment into which it is installed. Ensure that the gland is correctly rated for the gas group of the particular gas or vapour. Where solvent vapours are present ensure that the sheath of the cable and the gland material will not be degraded.

#### **1600 SUPPORT COMPONENTS – CABLES (Y63)**

##### **1610 GENERAL REQUIREMENTS**

##### **1611 General**

This specification applies to cable tray systems, wire tray, cable ladder systems and cable matting systems for cable management. The specification is also applicable for metal channel cable support systems for electrical installations where they are used as support devices for cable tray systems, cable ladder systems or independently for cable management. Note the term 'manufacturer' used in this specification includes the term responsible vendor as used in BS EN 61537.

Obtain all cable system components and fixings from a single manufacturer.

Size and select the containment system to be fit for purpose, to include a spare capacity of 30% and to withstand the effects of cable weight and the forces during a cable fault. Where appropriate, make further allowance in the selection of the containment system to take account of other loads such as those due to wind, snow and ice.

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Allow 30% of the base area of the cable containment length and of the safe working load (SWL) as spare capacity for future cables when sizing and placing support components. Make allowance within the support components and system selection, where appropriate, for the additional load that could be placed upon the system due to wind, snow, ice, etc.

Ensure that all ferrous metal for cable tray, cable ladder, and wire cable tray lengths, their fixings and suspension components have a resistance against corrosion classification to BS EN 61537 as follows:

- ~ Class 2 minimum for all indoor heated spaces
- ~ Class 3 or Class 4 for all indoor heated spaces containing mission critical IT (eg datacentres)
- ~ Class 5 minimum for all external areas, plant rooms and risers
- ~ Class 5 minimum for all indoor unheated spaces subject to high moisture levels and/or condensation

Use metal channel support systems that comply with BS 6946 or support devices that are part of the cable tray system or cable ladder system to support cable runway.

Ensure that all surfaces, which are likely to come into contact with cables during installation or use, do not cause damage to the cables.

Ensure that all surfaces are safe for handling and that sharp edges and burrs are removed.

Do not place dissimilar metals liable to initiate electrolytic action, or other materials liable to cause mutual or individual deterioration, in contact with each other unless specific arrangements are made to avoid the consequences of such contact.

Never allow any copper cable or fitting to be in contact with the galvanising. Generally ensure that cables have an outer covering of polymeric material that prevents contact between the metal parts of the cable and the supports. Where cables have no outer covering then lay them on a layer of polymeric material securely fixed to the support components. Ensure that any additional polymeric material does not add to the spread of fire, smoke or the generation of corrosive gases in the event of a fire.

Use standard fittings that are supplied as part of the cable tray system or cable ladder systems; if local situations make it impracticable, fabricated fittings are acceptable provided they are of the same quality and the same protective finish as the standard fittings.

Ensure that sets and bends are sized to allow for the minimum permissible radius of the largest cable and that cables retain their relative positions on all bends and sweeps.

Fit grommets to all holes cut into the support components.

Maintain electrical continuity at all joints with suitable earthing links. Ensure that joints have all burrs removed and are made by fishplates and screws.

Ensure that the weight of cables is uniformly distributed on the cable tray system or cable ladder system with the exception of cable management systems supported via cantilevered support arrangement. Where cantilever supports are provided, align the heavier cabling closest to the vertical support surface. Ensure that the weight imposed onto the cable support system does not exceed the SWL specified by the manufacturer (including future allowance).

Where cables of fire resisting construction are carried on the containment system, provide a cable support system achieving a level of fire resistance as calculable according to Annex E of BS 8519.

Ensure that mitigation of building expansion is incorporated in the installation of the cable support components.

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##### 1612 Installation

Provide all fixings in compliance with Y90.

Provide all suspension systems used for support in compliance with Y93.

Comply with the written installation instructions of the cable tray, cable ladder or wire cable tray system manufacturer.

Use butt joints to connect adjacent cable tray or ladder lengths or to connect to fittings. Do not weld any joints. Ensure that every connection is mechanically strong, allowing no relative movement between the two components.

Install the cable runway on mild steel support devices having suitable protective coating, fixed to the structure at not more than 1 metre intervals, or at such spacing as to ensure the SWL of the system is not exceeded. For sides, bends and intersections provide supports at a distance not exceeding 300 mm. Use external fixing devices of expanding masonry bolts or equal. Alternatively, use proprietary steel channel permitting easy adjustment and modification. Proprietary clamp fixings onto the flanges of structural beams are also permitted.

Allow 75mm minimum space between any part of the cable tray or cable ladder system and structure to give ease for securing the cable fixings and general maintenance. Comply with the minimum spacing between services as set out in BS 8313.

Avoid any obstruction and all other services to ensure that the installation can be properly installed and maintained.

Check and agree with the engineer and architect the final positioning and routing of all exposed containment systems. Provide detailed and dimensioned coordinated construction drawings for this purpose.

Provide and install proprietary plastic caps to the ends of threaded rod. Cap the ends of channel support systems using proprietary caps.

Ensure that internal fixing devices and external fixing devices do not come into contact with cables in a way that may give rise to damage of the cables.

Prime and paint all metalwork, exposed cut ends, fixing bolts, mild steel supports, brackets, etc., where the manufacturer's galvanised coating is damaged, or where no galvanised coating has been applied, with two coats of zinc-enriched paint.

##### 1613 Safety

Do not use any part of the cable support installation at any time as part of a fall arrest system.

Ensure that the cable support installation is coordinated with any spatial requirements necessary to accommodate all installation and future access requirements.

##### 1620 PRODUCTS AND MATERIALS

##### 1621 Cable tray systems

###### General

Ensure that cable tray lengths and fittings that form the cable runway comply with BS EN 61537 are of perforated sheet steel meeting classification D in accordance with BS EN 61537 and are formed with a return flange. Ensure steel complies with BS 1449-1.

Ensure that cable tray systems have electrical continuity characteristics in accordance with BS EN 61537, can fulfil a protective earth (PE) function, and are bonded and earthed throughout. Fix copper



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connectors with tinned connections across all joints of the cable trays in order to maintain the earth continuity. Ensure that the length of the copper connector is slightly longer than the distance of its attachment points to allow for movement or expansion of the joint.

As a minimum use medium-duty trays internally, heavy-duty trays for external work, or as appropriate to the installation conditions and manufacturers guidance.

Use a dropout plate of the same width as the cable tray or other proprietary cable guide product as the cables exit the cable tray.

Select the size and type of cable tray bends according to the most onerous bending radii requirements.

#### Installation

Cut cable trays along a line of plain metal only; do not cut through the perforations. Remove all burrs from cut edges so that surfaces are smooth and clean before painting. Treat all cut edges with a zinc enriched paint.

Achieve the jointing of cable tray lengths and the fixing of the cable runway tray to support devices, by means of sherardized steel mushroom headed bolts and nuts with the threaded portion away from the cables.

Where cable tray systems are installed across building expansion joints fit a proprietary slip connector fixed at one end only.

#### 1622 Wire cable tray systems

Ensure that wire cable tray (cable basket) lengths and fittings that form the cable runway comply with BS EN 61537, are made of high strength steel wires formed into wire mesh pattern with intersecting wires welded together. Use wire cable tray lengths and fittings from lateral and longitudinal sidewall steel wires with minimum diameters of: 4mm for wire cable tray widths up to 100mm, 5mm for wire cable tray widths of 150mm and 200mm, and 6mm for wire cable tray widths of 300mm or greater.

Ensure that wire cable tray systems have electrical continuity characteristics in accordance with BS EN 61537, can fulfil a PE function, and are bonded and earthed throughout. Fix copper connectors with tinned connections across all joints of wire cable trays to maintain earth continuity. Ensure that the length of each such copper connector is slightly longer than the distance of its attachment points, to allow for movement or expansion of the joint.

Use a dropout plate of the same width as the wire cable tray or other proprietary cable guide product where more than two cables exit the tray, in all other cases provide suitable cable support to prevent physical stress on the cable(s). Where cables exit the wire cable tray within conduit, provide a proprietary conduit take off bracket to secure the conduit to the tray.

Check that all wire ends along the basket's sides are rounded during manufacturing, to ensure the safety of cables and installers.

Use only centre support hangers, trapeze hangers or wall brackets, to support the wire cable tray system.

#### Installation



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Use side action bolt cutters with offset jaws to cut mesh wires; do not use saws, nor cutters with centre cut jaws. Make cuts at the intersection of longitudinal and lateral wires. Treat all cut edges with a zinc enriched paint.

Use serrated flange locknuts and bolts for all splicing assemblies.

Use flexible couplers to joint cable basket systems across expansion joints of the building structure. Do not use rigid fittings across expansion joints.

#### **1623 Cable matting**

Use cable matting manufactured from flexible, elastomeric, moisture resistant, closed cell, foam rubber.

Ensure that the cable matting system complies with BS 476 parts 6 and 7, is resistant to flame spread and is certified to be of fire rating class 1.

Ensure that all parts of the cable matting system are constructed from low smoke and zero halogen (LSZH) material.

Where matting is applied directly to the sub floor in areas with an accessible floor system, provide matting of minimum 13mm thickness. Where applied to cable tray, apply matting of minimum thickness of 6mm.

Cut the cable matting using a proprietary tool as recommended by the manufacturer and join lengths of cable matting using a proprietary tape that maintains the fire resistant properties of the mat.

Where required to traverse obstructions, apply the cable matting to proprietary bridging pieces constructed of LSZH material.

#### **1624 Cable cleats**

Use cable cleats that are made from materials that are resistant to corrosion without the need for any treatment. Ensure that plastic materials are non-brittle down to -20°C. For cables having low emission of smoke and zero halogens (LSZH) when exposed to high levels of heat, use non-metallic or aluminium cleats made from LSZH material. Use trefoil cleats for single core cables.

Ensure that cleats are of such a size that they can be tightened down to grip the cables without exerting undue pressure or strain and allows for longitudinal expansion of the cable. For vertical cables, use two-bolt cleats which grip the cables firmly enough to prevent them from slipping.

Space cable cleats in accordance with the minimum spacings in accordance with the manufacturer's recommendations. Locate cleats immediately before and after any bends in the cable. Ensure that cleats and other cable support systems are adequately supported themselves by fixing into a suitable substrate, and that the fixing to the substrate will maintain its integrity in fire conditions to an equal degree of performance as the cable support system.

#### **1625 Cable installation**

Provide cable cleats and cable ties to BS EN 61914 and BS EN 62275 respectively. Use only proprietary cable support systems and fixings.

Support wiring systems such that they will not prematurely collapse in the event of a fire, use only metal cable fixings.

Where final-circuit or other minor-gauge cabling is laid in and is supported by incombustible support components, secure them with zero halogen, self-extinguishing, ultra-violet resistant ties. For all other

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

cabling, use plastic coated metallic cable ties or metallic cable cleats. Do not use wire or similar material for cable ties.

Install cables individually and lay the cables in or on support components.

Where single core conductors are arranged in three phase parallel configuration, ensure equal current sharing between the parallel conductors via a suitable arrangement of the conductors, ensure that conductors of the same phase are not grouped together. Where parallels of no more than two conductors per phase are to be installed, install these on ladder rack and according to the following arrangements:

- ~ Three phase (no neutral), arranged as trefoil sub-groups spaced from one another by twice the cable diameter.
- ~ Three phase and neutral, arranged as quadrofoil sub-groups, with L3 and L2 arranged adjacent to L1 with the neutral conductor opposite L1, with each group spaced from one another by twice the cable diameter.

Where parallel single core conductors are installed, verify that the load current is shared evenly at varying load conditions and phase imbalance.

Ensure that cables are protected from damage during installation. Replace all damaged cable immediately on discovery.

Fix cables to support components at minimum spacing in accordance with the manufacturer's recommendations. Do not allow any cable to be used to support the weight of any item other than its own self weight.

Where the final circuit cable installation is intended to be installed without containment as in clipped direct installations using multicore cabling, fix these cables to maximise their capacity by installing multiple bunches of no more than ten cables in any one bunch with heavy loads separated.

Where cables are fitted to support components that are:

- ~ mounted in the horizontal plane running horizontally but with cables fitted to the underside, or
- ~ mounted in the vertical plane running horizontally, or
- ~ mounted in the vertical plane running vertically

Secure cables using plastic coated metal straps or proprietary cleats of a pattern recommended by the cable manufacturer.

Ensure that all fixing bolts/studs are sherardized and where necessary of sufficient length to allow stacking of cables.

#### **1700 LV SWITCHGEAR AND DISTRIBUTION BOARDS (Y71)**

#### **1710 PRODUCTS AND MATERIALS**

#### **1711 Assemblies**

Ensure all LV switchgear and controlgear assemblies have verification to BS EN 61439. Ensure that the assembly maintains BS EN 61439 verification after integration into the on-site electrical systems.

Ensure all individual devices and self-contained components within assemblies conform to relevant product standards.

Ensure all equipment is free of damage and any deterioration from the manufacturer's intended standard before incorporation into the on-site electrical system.

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##### **1712 Switchgear: 500 V**

This clause covers circuit breakers, switches, disconnectors, switch-disconnectors and fuse-combination units and their associated controlgear.

Ensure that all switchgear and controlgear complies with BS EN 60947-1, BS EN 60947-2 and BS EN 60947-3.

Handle and mount all loose switchgear and assemblies in accordance with manufacturer's instructions at locations defined by the drawings or the relevant 'system' sections of this specification.

Ensure that all short circuit ratings, current ratings, number of poles and fusing arrangements are as indicated by the drawings or the relevant 'system' sections of this specification.

Contain the neutral connection/link of each circuit breaker, switch, disconnector, switch-disconnector, and fuse-combination unit within its respective enclosure/moulding.

Ensure that all multi-pole isolators conform to BS EN 60947-3 and are of Utilisation Category AC-23A. Provide high breaking capacity fuses to Class 'gG' to BS EN 60269-1 unless stated otherwise in the relevant 'system' sections of this specification. Ensure that they are of the make and ratings indicated by the drawings or the relevant 'system' sections of this specification. Fit fuse carriers rated at 200 A and over, with wedge or bolted contacts. Provide spare fuses of the number and sizes indicated by the relevant 'system' sections of this specification.

Ensure that all isolators and fuse-switches, are suitable for padlocking in the OFF position. Where isolators and fuse-switches are used for fire alarm, intruder alarm, UPS supplies, etc, ensure that they are also suitable for padlocking in the ON position.

Ensure that each type of switchgear classified as either circuit breakers, switches, disconnectors, switch-disconnectors and fuse-combination units under BS EN 60947 is of the same manufacture as all other switchgear of that type.

Provide sufficient space in all enclosures to accommodate external conductors from point of entry to terminal in accordance with BS EN 60947.

##### **1713 Switchgear: 250 V**

Ensure that where 250 V rated switchgear (eg a consumer unit) is used it is not within 2.0 m of any other phase within the same room. Where multiple phases are within 2.0 m of each other use 500 V rated switchgear.

##### **1714 Residual current-operated circuit breakers (RCCBs)**

Unless otherwise specified use RCCBs having a sensitivity of 30 mA.

Ensure that all RCCB units without integral overcurrent protection conform fully to BS EN 61008 and are of the sensitivities, load ratings and pole configurations indicated by the drawings or the relevant 'system' sections of this specification.

Ensure that all RCCB units with integral overcurrent protection conform fully to BS EN 61009 and are of the sensitivities, load ratings and pole configurations indicated by the drawings or the relevant 'system' sections of this specification.

Adhere to the selected RCCB manufacturer's installation requirements. Ensure that the respective breaker trips lie within the time limits recommended for the category of breaker.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### **1715 Distribution boards - general**

Ensure that adequate provision is made within every distribution board to receive the specified cabling and that it is physically sized to suit the proposed installation location.

Ensure within TP&N distribution boards that the earth and neutral terminal bars have sufficient terminations for the maximum number of single phase circuits that the board can accommodate.

Ensure that insulated barriers and phase segregation barriers are properly fitted in every distribution board to prevent accidental contact.

Ensure that all cable entries into every distribution board are made to uphold the ingress protection rating of the associated distribution board and be a minimum of IP31 to BS EN 60529.

Mount distribution boards so that they are readily accessible and fixed firmly to masonry by plated anchors, each having a loose bolt and washer or by other approved fixing, or by nuts, bolts and washers to a painted mild steel framework.

##### **1716 Miniature circuit breaker (MCB) distribution boards**

Ensure that all MCB distribution boards have a minimum rating of 400 V with the number of ways and MCB of the sizes indicated by the drawings or the relevant 'system' sections of this specification. Ensure they conform to BS EN 60947-3 and are of the same finish and manufacture as the main switchgear/panels selected for the works.

Securely clamp every MCB to its busbars, or properly install the plug-in type.

Use combined MCB/RCCB units where indicated by the drawings.

Ensure that where the selected manufacturer's RCCD unit(s) takes up more than one way on a board, a larger board is provided so as not to compromise the number of spare ways required by the drawings or the relevant 'system' sections of this specification.

##### **1800 LUMINAIRES AND LAMPS (Y73)**

##### **1810 PRODUCTS AND MATERIALS**

##### **1811 Luminaires**

Do not permit luminaires that are fixed to, or recessed into, suspended ceilings, to have their weight borne by the ceiling unless written acceptance is obtained from the Contract Administrator.

Suspend luminaires from the structure or from false ceiling support beams using steel strapping, circular steel suspension, or proprietary fixing methods. Use at least two fixings for luminaires up to 300 mm wide and four fixings for sizes over 300 mm wide.

Supply and fix all materials for fixing and suspending the luminaires, from the building structure, building fabric, or system of beams provided by others for the support of false ceilings and/or other services or equipment, unless specified otherwise.

Ensure that the luminaire backplate fully covers the conduit box in concealed installations. Use white break joint rings where the conduit boxes cannot be concealed by the luminaire backplate.

Do not use luminaires for through-wiring unless the luminaire is specifically designed for that purpose and incorporates a segregated wiring channel.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Ensure there is suitable strain relief via clamping of the supply wiring's sheath or strain relief lugs, for every luminaire.

Ensure that the lighting and lighting control system does not undermine the sound pressure levels set by the acoustic brief, the architectural specification, and the project design criteria. Additionally, ensure that the sound power levels associated with any luminaire or luminaire control device located within areas other than equipment spaces, are not of a magnitude such that they cause any noise perceptible against the ambient conditions. Ensure no lighting or lighting control device emits a sound power level of greater than 10dB below the room sound pressure level stated in the design criteria.

Ensure that all luminaires are individually power factor corrected. Use shunt connected capacitors to achieve a power factor greater than 0.95 for fluorescent luminaires, and greater than 0.85 for other discharge luminaires. Ensure LED luminaires' power factor (including both driver and light source) is greater than 0.9.

Before installing any luminaire ensure that it is appropriately selected for all aspects including: the type of installation, the location in which it is installed, the ceiling void size, the ceiling type (including tee section size) and the lamp voltage.

Provide an assembly of luminaire and exhaust air device or luminaire and supply air device to meet the design requirements for illumination and air flow. Ensure that every such assembly can be integrated and flush-mounted into the associated false ceiling. Ensure that the fixing is capable of carrying the weight of the whole assembly.

Where specified, incorporate a path for exhaust air in the diffuser. Provide an outlet for the air either by a series of circular openings in the top of the assembly or by a circular spigot for direct connection to extract or exhaust ducting.

Ensure that the acrylic diffusers are 100 percent virgin acrylic plastic and have a high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation. The lens thickness to be a minimum of 3mm

Ensure that the glass diffusers are annealed crystal glass unless otherwise indicated.

Ensure that the aluminium diffusers or reflectors consist of high quality aluminium with shape surface finish that is in accordance with the photometric data published for the luminaire.

#### **1812 Emergency lighting luminaires**

Ensure that all emergency lighting luminaires comply with BS EN 60598, BS EN ISO 7010 and BS ISO 3864-1.

Comply with ICEL 1001. Ensure that emergency lighting luminaires are marked with the ICEL certification labels.

Ensure that luminaires comply with ICEL 1004.

#### **1813 Exit signs**

Ensure that exit signs comply with BS EN ISO 7010 and BS ISO 3864-1.

#### **1814 Signs and high voltage installations**

Ensure that signs and high voltage installations comply with BS 559 and BS EN 50107-1.

Ensure that neon transformers comply with BS EN 61050.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### **Supply terminals**

Use screw terminals for supply cables and circuit protective conductors, each sized to terminate up to three 2.5mm<sup>2</sup> conductors. Provide separate terminal blocks for each incoming circuit, with marking to identify each circuit.

##### **Fuse**

Include a fuse holder and BS 1362 fuse in each incoming circuit phase connection.

##### **Interference**

Comply with BS EN 55015.

##### **Remote gear**

Locate controlgear in a separate enclosure with the same degree of protection and finish as that specified for the luminaire. Comply with the luminaire manufacturer's recommendations for maximum cable length between gear and lamp.

#### **1820 LED**

#### **1830 LED Luminaires**

Ensure that LED luminaires comply with the general and safety requirements of BS EN 62031.

Ensure that the LED luminaire product data is presented in accordance with BS EN 62722-2-1.

Ensure that the complete LED luminaire is tested in accordance with IESNA LM-79-08 and absolute photometry is conducted in accordance with this method.

Ensure the lumen output of the luminaire complies with the requirements indicated in the luminaire schedule and the luminaire performance is rated for the ambient temperature in which it will operate.

Ensure the maintained luminous flux at 25% of lumen maintenance life up to a maximum of 6000 hours is greater than 90% of the initial lumen output.

Ensure the drive current and junction operating temperatures are in accordance with the LED manufacturer's requirements.

Ensure cooling is achieved by passive heat sinks integral to the luminaire. Do not utilise luminaires with active cooling.

For standard white light applications ensure colour variance is within a 3-step MacAdam ellipse initially and also within a 3-step MacAdam ellipse through lumen maintenance.

For wall-washers, museum lighting and other white light applications where visual appearance is critical, as specified in the luminaire schedule, ensure colour variance is within a 2-step MacAdam ellipse initially and within a 3-step MacAdam ellipse through lumen maintenance.

Ensure luminaires are CE and ENEC marked.

#### **1831 LED Modules**

Ensure that LED modules comply with the general and safety requirements of BS EN 62031.

Ensure that the LED module product data is presented in accordance with IEC 62717.

Ensure that the lumen maintenance of the LEDs within the luminaire is tested in accordance with IESNA LM-80-15.

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Meet or exceed the lumen maintenance life specified in the luminaire schedule, ensuring that the declared lumen maintenance life of the LED package, array or module is extrapolated in accordance with IESNA TM-21-11.

Ensure that the minimum performance of the LED module complies with the following

|                                      |                |
|--------------------------------------|----------------|
| Minimum luminaire efficacy           | 90 lumens/watt |
| Minimum colour rendering index(CRI)  | 65             |
| Minimum LLD at 100 000 hours at 25°C | 0.85           |

#### 1832 LED Lamps

Ensure that self-ballasted LED lamps with voltage >50V comply with:

- ~ Safety requirements of BS EN 62560
- ~ Performance requirements of BS EN 62612
- ~ The most recent generation of LED models available

#### 1833 Electronic Control Gear for LED Modules

Ensure that DC or AC supplied electronic control gear for LED Modules complies with the performance requirements of BS EN 62384.

Ensure that the minimum performance of the control gear complies with the following

|                             |  |
|-----------------------------|--|
| Total harmonic distortion   | <20%   |
| Power factor                | >0.9   |
| Operating temperature range | -40°C to +40°C for all electrical components in the luminaire including the LED engines/modules, drivers and surge devices |
| Voltage fluctuations        | +/- 10%  |
| Dimming control             | Integrated capability when specified using an external 0 - 10V DC control signal   |
| Operating lifetime          | At least L80 of 50,000 hours   |
| Efficiency                  | >80%   |

#### 1840 WORKMANSHIP

##### 1841 General

Install luminaires complete and as indicated on the drawings or in the schedules. Unless otherwise stated, install luminaires plumb, square, and level with ceilings and walls, and in alignment with adjacent lighting fixtures.

Do not use the permanent lighting installation for temporary lighting purposes during the contract period unless prior written acceptance is obtained from the Contract Administrator. Where such acceptance is given, and the luminaires are not LED, provide new lamps at the handover for the employer's use.



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Fix every surface-mounted luminaire to a conduit box (or boxes) that has a porcelain screw type connector.

Fix all luminaires and pendants with brass roundhead screws.

Provide all pendant luminaires with a suspension system and an associated flexible cable to a minimum length of 600 mm unless otherwise defined in section V21, V40, V41 or V42 of this specification.

Connect all metalwork on luminaires to the circuit protective conductor with proper and approved earthing arrangements for metalwork.

Upon completion of the installation and after circuits have been energised, apply power and demonstrate to the Contract Administrator the capability and compliance with requirements of all luminaires and circuits. Correct, or remove and replace, malfunctioning units, then re-test and demonstrate to the Contract Administrator's satisfaction. Ensure that all lamps are fully operational; replace all failed lamps at no extra cost to the contract. When directed by the Contract Administrator, remove all temporary protective covering from luminaires.

#### **1842 Orientation**

Install luminaires in the positions indicated on the drawings and in the horizontal plane, unless shown otherwise on the drawings or in the schedules.

#### **1843 Cleanliness**

Ensure that all luminaires are clean and grease-free on handover. Thoroughly clean all luminaires after installation, leaving the installation in a new, clean condition at handover.

#### **1844 Installation**

##### **Recessed fittings**

Mount fully recessed luminaires within the suspended ceiling in the positions indicated on the drawings.

Install luminaires flush with the finished surface of the associated ceiling, wall or floor into which they are fitted.

Ensure the luminaire has the correct void, as specified by the manufacturer, for the dissipation of heat. Ensure the luminaire is free of thermal insulation in all directions to a minimum distance of 100mm.

Ensure that all recessed luminaires maintain the fire barrier integrity of their respective area.

##### **Semi-recessed fittings**

Install luminaires in accordance with the manufacturer's instructions to achieve the extent of recessing required.

##### **Wall-mounted fittings**

Install luminaires at the height indicated on the drawings or in the schedules.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### Material supportive surface

Ensure that the fire classification of luminaires is appropriate. Do not mount luminaires on flammable surfaces.

##### 1845 Supports

Ensure that every support is adequate for the weight of the associated luminaire.

Provide the following minimum number of supports for each luminaire longer than 600mm:

| Luminaire Width (mm) | Minimum number of supports |
|----------------------|----------------------------|
| ≤ 300                | 2                          |
| > 300                | 4                          |

##### Conduit

Where luminaires are supported from conduit, provide a conduit box forming an integral part of the lighting conduit system at each point of suspension. Ensure that all such suspensions are vertical. Use tube of the same corrosion resistance as the conduit of the lighting system.

Secure the luminaire body with back-nuts and washers where the conduit enters it.

Where the temperature of the material may exceed 60°C or the mass suspended exceeds 5 kg, do not support luminaires directly from conduit boxes made from non-metallic or heat sensitive materials.

##### Trunking

Where luminaires are supported from trunking, use proprietary clamps or brackets that are compatible with both the luminaire and the trunking.

Where the temperature of the material may exceed 60°C or the mass suspended exceeds 5 kg, do not support luminaires directly from trunking made from non-metallic or heat sensitive materials.

##### Direct fixing

Install luminaires in accordance with the manufacturer's instructions.

##### Luminaires located in suspended ceilings

Support luminaires directly from building fabric and in accordance with the manufacturer's instructions.

##### Suspension

Suspend luminaires at the height indicated on the drawings or in the schedules. Ensure that all suspensions hang vertically unless otherwise indicated.

##### Rod

Use washers, nut and lock-nut at the top and bottom of the rod. Paint cut ends with zinc-rich paint.

##### Chain

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Use a 'hook cover' for suspension from a circular conduit box. For connection to luminaires use the luminaire manufacturer's own chain hook but, if not available, use a hook with standard screw threaded end and secure it to the luminaire body with nuts and washers. Where indicated use captive hooks.

##### **Flexible cord**

Suspend cord from the ceiling rose. Ensure strain relief, via the clamping of the cord sheath, is provided at both ends.

##### **Ball and socket**

Install cable through ball and socket connected to the conduit box.

#### **1846 Connections**

##### **Luminaires**

Use the appropriate size of grommet where cables enter through the hole in the luminaire body.

Ensure that the earthing terminal of BS EN 60598 - Class 1 luminaires is connected to the circuit protective conductor of the supply circuit.

Clip, or tie back with suitable proprietary devices, loose wiring within luminaires, at 300 mm intervals.

##### **Direct to conduit**

Terminate circuit wiring in a terminal block within the supporting conduit box. Use flexible cord from the terminal block to the luminaire.

Terminate circuit wiring at the supply terminals of the luminaire. Take all conductors through the same cable entry into the luminaire.

##### **Direct to trunking**

Terminate circuit wiring in a terminal block in an adaptable box located on the side of the trunking. Use flexible cord from the terminal block to the luminaire.

Terminate circuit wiring at the supply terminals of the luminaire. Take all conductors through the same cable entry into the luminaire.

##### **Suspended from trunking**

Where luminaires are suspended from trunking, secure plug-in type ceiling rose to BS 6972 and BS 5733 adjacent to, or on the side of, trunking. Terminate circuit wiring at the socket of the ceiling rose. Take flexible cord from the plug of the ceiling rose to the supply terminals of the luminaire.

#### **1900 ACCESSORIES FOR ELECTRICAL SYSTEMS (Y74)**

##### **1910 LIGHTING SWITCHES**

Ensure local lighting switches comply with the manufacture, rating and type as indicated in the Particular Specification or on the drawings.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Ensure lighting switches comply with the relevant BS.

Ensure switches are capable of switching the full rated inductive or resistive load, and where connected to fluorescent loads in excess of 600 Watts, use minimum 15 amp rating.

Install all switches with suitable boxes of 37 mm minimum depth with adjustable lugs to ensure switch plates are true and square where required. Fit boxes flush with wall finish and make any adjustment to depth using extension rings. Install back boxes constructed from pressed steel/PVC/pressed steel and PVC as detailed in the Particular Specification.

Ensure all switch boxes are compatible with the wiring system used and are complete with CPC terminal.

Where several switches of the same phase are required in the same position, use a multi-gang switch box to accommodate all switches on a common faceplate.

Where switches are specified for installation in situations exposed to weather or continual dampness, ensure they are of the weatherproof pattern in accordance with the relevant BS and minimum IP56 rating.

Where different phases are present at one switch location, segregate each phase in a separate compartment and cover each compartment by its own internal warning plate suitably engraved, "WARNING 400 VOLTS PRESENT".

Mount switches adjacent to the closing side of doors where possible.

#### 1920 SOCKET OUTLETS

Ensure socket outlets comply with the relevant BS, are switched and shuttered, are mounted in single-gang or multi-gang assemblies, and are of the type and rating as indicated in the Particular Specification or on the drawings.

Fit plug tops to appliances with fuses of the correct rating.

Install all socket outlets with suitable boxes of not less than 35 mm depth with adjustable lugs to ensure socket plates are true and square. Where required fit boxes flush with finished surface (eg floors, skirtings or walls) and make any adjustments to depth using extension rings. Install back boxes constructed from pressed steel/PVC/pressed steel and PVC as detailed in the Particular Specification.

Ensure all socket outlet boxes are compatible with the wiring system used and are complete with CPC terminal.

Ensure all socket outlets installed within circuits likely to serve equipment having high protective conductor currents are provided with dual earth terminals compliant with the high integrity earthing requirements of BS 7671. The dual earth terminal requirement equally relates to any non-socket outlet accessories connected to the same circuit.

Ensure cover plate finishes match the lighting switches and are flush or surface to suit the mounting box.

Ensure the earth terminal(s) of each socket is connected to the box earth terminal with a green/yellow insulated protective conductor. Do not use cover screws for earth continuity.

Ensure socket outlets are complete with indicating lamps where intended for appliances with a heating element.

Where socket outlets are specified for installation in situations exposed to weather or continual dampness, ensure they are of the weatherproof pattern in accordance with the relevant BS and minimum IP56 rating.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 1930 FUSED CONNECTION UNITS

Ensure these are to the relevant BS and are double-pole switched or unswitched insulated patterns with plates to match the socket outlets.

Where used as a flex outlet for an appliance, ensure they are of the flex outlet pattern with cable anchoring clamp.

Fit fuses of the correct rating.

Install fused connection units with suitable boxes of not less than 35 mm depth with adjustable lugs to ensure the connection unit are true and square. Fit boxes flush with the wall finish and make any adjustment to depth using extension rings. Install back boxes constructed from pressed steel/PVC/pressed steel and PVC as detailed in the Particular Specification.

Ensure all boxes are compatible with the wiring system used and are complete with CPC terminal.

Ensure all connection units installed within circuits serving equipment likely to introduce high protective conductor currents are provided with dual earth terminals compliant with the high integrity earthing requirements of BS 7671.

Ensure the earth terminal(s) of each connection unit is connected to the box earth terminal with a green/yellow insulated protective conductor. Do not use cover screws for earth continuity.

##### 1940 LAMPHOLDERS

Provide ceramic interiors for screw type lamps and when used in areas exposed to weather or continual dampness.

Provide brass lampholders with ceramic interiors when integral with luminaires.

Provide lampholders with compression cord grip with integral moulded grip.

Ensure batten lampholders are heat resistant and skirted.

Ensure metal lampholders are effectively earthed using an earth terminal fixed to the lampholder by the manufacturer.

Ensure low energy lampholders have a non-standard interface.

Ensure all bayonet lampholders are safety type unless specified otherwise.

##### 1950 CEILING ROSES

Provide ceiling roses for all lighting points with a luminaire suspended by a flexible cable without an integral mounting.

Ensure ceiling roses conform to the relevant BS, of the white insulated pattern incorporating 2, 3 or 4 terminals as necessary, and complete with cord grips.

##### 1960 LAMPS

Ensure all lamps are new at handover, allowing reasonable time for testing etc.

"Break-in" fluorescent lamps used on dimming circuits for at least forty hours.

Ensure lamps comply with the relevant BS.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 1970 FLEXIBLE CABLES

Use flexible cables for pendant luminaires and for final connections to equipment (fixed, or portable). Ensure these are 300/500 V grade to BS 6500, Table II, PVC insulated white circular with high conductivity tinned copper conductors of minimum size 1.0 mm<sup>2</sup>.

Ensure the maximum mass of any suspended luminaire is 5 kg unless additional support is provided.

Use heat resistant flexible cables for all non-pendant type luminaires.

Use heat resistant flexible cables for making final connections to equipment (fixed or portable) with a heating element or equipment fixed to pipework or appliance forming part of a heat distribution system. Ensure the flexible cables are 300/500 V grade complying with the relevant BS.

##### 1980 CONTROL SWITCHES

Ensure double-pole and triple-pole and neutral control switches are in accordance with relevant BS (Category AC22) respectively and are suited as other accessories defined in the Particular Specification.

Ensure each switch is of the surface or flush pattern as appropriate and install with suitable back box and flylead. Install back boxes constructed from pressed steel/PVC/pressed steel and PVC as detailed in the Particular Specification.

Ensure switch plates are complete with pilot lamp, and where defined in the Particular Specification, engraved with coloured lettering identifying the equipment being controlled.

If cable outlet plates are required for final connections to equipment, suite these to other accessories.

##### 1990 MOUNTING HEIGHTS AND VISUAL CONTRAST

Ensure all accessories are mounted in line with current best practice and at heights to meet accessibility requirements. Refer to Specification Section Y89 for further details.

Ensure that the contrast, as measured by the Light Reflectance Value (LRV), between all accessories and the background they are mounted on meet the Approved Document M requirement to contrast visually.

##### 2000 EARTHING AND BONDING COMPONENTS (Y80)

##### 2010 GENERAL

Comply with section W51 of this specification.

Bond the lightning protection system, if fitted, to the main electrical electricity earthing terminal in accordance with section W52 of this specification.

Install the whole of the earthing and bonding installations in accordance with the requirements of BS 7671, the Distribution Network Operator, BS 7430, and other relevant British Standards and Codes of Practice.

Ensure all enclosures, equipment, exposed conductive parts, extraneous conductive parts, metallic trunking, metallic conduits, metallic cable trays and any other metalwork, other than any live part, forming protection or part of the electrical installation, including apparatus and appliances, are

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

effectively bonded to earth and do not form part of the earth fault path of the protective conductor system.

Ensure all main water pipes, main gas pipes, other service pipes, ventilation ducting (including ductwork flexible connections, riser of central heating and air conditioning systems), oil pipe services, storage tank, piped gas systems, etc, and the exposed metallic parts of the building structure are effectively connected to the main earthing terminal points. Make connections using, where applicable, earthing clamps which conform to BS 951.

Fix copper tape to the building structure by means of purpose-made 'spacer bar' saddles.

Ensure bolts, nuts and washers for any fixing of the earth tape are bronze.

#### 2020 PRODUCTS AND MATERIALS

##### 2021 Earth rods and plates

Earth is normally the earth terminals or earthed cable sheath of the electricity supply installation, provided the company has given written approval for the use of their earthing system for this purpose. Forward duplicate copies of the Distribution Network Operator's written approval to the Contract Administrator before the earth connection is made.

Install an earth electrode system to meet the site and soil condition.

Use solid drawn high-conductivity copper rods to BS EN 13601, 15 mm diameter and 1200 mm sections with internal screw and socket joints.

Use earth plates only where use of earth rods is unsuitable. Make earth plates of solid copper a minimum of 3.0 mm thickness.

Fit rod sections with hardened steel tips and driving caps. Ensure that the depth of the driver rods are a minimum of 2400 mm and the spacing between rods is at least equal to their length. Ensure that no electrode is within 3000 mm of the building foundations.

Make connections by using proprietary clamps and within a concrete inspection pit with removable covers inscribed "EARTH".

Provide earthing terminals at all main incoming supply positions and connect to earth. Ensure main and/or sub-main panels have an earthing terminal and are effectively connected to earth.

Carry out soil resistivity and other tests, as detailed in the relevant British Standard.

##### 2022 Extension and alterations to existing installations

Check existing installations which are being extended to ensure that the existing protective conductors comply with BS 7671.

Where a connection is made to another protective conductor, supply and fix a permanent label to BS 7671 and BS 951 indelibly marked with the words "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE".

##### 2023 Warning notices

Permanently fix in a visible position a durable label to BS 951 with the words "SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE" at or near:

- ~ the point of connection of every earthing conductor to an earth electrode



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ the point of connection of every bonding conductor to an extraneous conductive part
- ~ the main earthing terminal, where separate from the main switchgear

#### 2100 IDENTIFICATION OF ELECTRICAL SYSTEMS (Y82)

##### 2110 GENERAL

Provide all identification labels and notices in accordance with BS 7671.

Install warning, caution and instruction notices where indicated in the engineering system sections of this Specification or on the drawings, or where required, to ensure safe operation and maintenance of electrical systems and of the items to which they connect.

Fix a warning notice in all positions where there are live parts which are not capable of being isolated by a single device. Ensure that warning notices state the location of each isolator. Ensure that every such warning notice is in a prominent position and clearly visible before access to the live parts can be gained.

Ensure that, where a nominal voltage exceeding 230V exists, a warning label stating the maximum voltage is present and clearly visible.

Ensure that all identification labels and notices are installed in a visible position, without interference to the operation and maintenance of equipment.

Ensure that labels and notices are sized in proportion to the equipment on which they are mounted and that they are securely fixed.

Obtain agreement from the Contract Administrator, with regard to style, colour, lettering, size and position of all labels and notices. Provide samples, at no cost to the contract, for the Contract Administrator's acceptance.

Identify every termination and joint box by an externally fitted label indicating the type of service contained, such as 'bells', 'radio', 'fire alarm'.

##### 2111 Materials and marking

Ensure that materials used for labels and notices have a predicted lifespan equal to or greater than the lifespan of the installation to which they refer.

Ensure that labels and notices which are fitted outside buildings use the appropriate material and marking method from the following list:

- ~ rigid, laminated, ABS substrate material, of three or five layers of different colours, machine engraved in a contrasting colour [eg Traffolyte]
- ~ rigid plastic, hot press printed
- ~ pressure sensitive labels to BS 4781, printed
- ~ brass, engraved
- ~ stainless steel, engraved

Ensure that labels and notices which are fitted within buildings use the appropriate material and marking method from the following list.

- ~ rigid, laminated, ABS substrate material, of three or five layers of different colours, machine engraved in a contrasting colour [eg Traffolyte]

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ thermosetting rigid plastic, screen printed
- ~ flexible plastic, screen printed or manuscript lettering
- ~ rigid plastic, hot press printed
- ~ pressure sensitive adhesive labels to BS 4781, printed
- ~ aluminium or aluminium alloy, letter pressed, letter engraved or letter embossed
- ~ stainless steel, engraved

#### 2112 Fixing

Ensure that fixing methods and materials have a predicted lifespan equal to or greater than the lifespan of the installation to which they are applied.

Fix every label and notice using materials compatible with it and with the surface to which it is being fixed. Use only non-corrodible fixings for external labels and notices.

Thoroughly clean surfaces of dust, loose materials and protective/oily films before fixing labels and notices to them. Fix labels and notices to a surface only after all finishing to that surface is complete.

#### 2120 LABELLING OF EQUIPMENT

##### 2121 Cables

Provide all cables including those routed underground, on cable trays, on cable ladders or in wire baskets, except final sub circuit wiring enclosed in conduits or trunking, with identification labels.

Fix each underground cable with a label at each point it emerges from or enters the ground.

Identify all cables using a proprietary alphanumeric marker system similar to 'Critchley' manufacture or an accepted equivalent. Provide for the cable reference at both ends of the cable, at either side of wall/ floor/ roof penetrations, and at every fourth floor within the riser and include in the tender for up to fourteen (14) alphanumeric characters. When cable markers with a Limited Fire Hazard (LFH) rating are required, zero halogen markers made from self-extinguishing material shall be provided.

Ensure that all cable identification labels provide a 'unique reference number' to include the following information unless agreed otherwise with Contract Administrator:

- ~ points of termination (ie the locations where the cable starts and finishes)
- ~ size and number of conductors
- ~ type of cable (eg LSZH, XLPE, PVC)
- ~ operating voltage of cable

##### Cable conductor colour coding

Identify cable conductors in accordance with BS 7671; note that a lighting sub-circuit switch wire is a phase conductor in a single phase circuit.

##### Cable sheath identification

Submit for agreement by the Contract Administrator the colour and coding methods of both internal and external cable sheaths.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Ensure that fire alarm cables use red, telephone and data cables use grey, intruder alarm and nurse call cables use white, television aerial cables use brown and speaker cables use black unless otherwise stated in the system sections of this Specification.

##### **Terminal marking and conductor identification**

Apply identification markers, in accordance with BS 7671, to all conductor termination points.

Arrange for the manufacturer of switchgear and controlgear to mark their terminals in accordance with BS 5472 and BS 6272. Use a unique reference to identify each element in the switchgear or control gear. Mark the unique reference on or adjacent to each element. Identify each terminal for connection to external wiring or cabling using a reference system complying with BS EN 60445 based on the element reference and the appropriate element terminal reference.

Use lettered or numbered ferrules or sleeves to BS 3858 to mark each core, cable, auxiliary conductor, control cable core or any other conductor not otherwise obviously identifiable. Mark all cores, cable and conductor within all switchgear, controlgear, distribution boards, and all other enclosures with the identity of the terminal to which it is connected and the reference of plant or equipment to which it is connected and the identity of the terminal at the remote end.

Identify the main circuit conductors in accordance with BS 7671.

Ensure that the material of cable markers is at least the same standard, or better, as the cables they identify, ie LSZH.

#### **2122 Conduit and trunking colour coding**

In areas of mechanical plant or voids accommodating mechanical services, or where otherwise indicated in the 'engineering system' sections of this Specification or on the drawings, identify electrical conduits in accordance with BS 1710. Apply colour 'orange' to BS 4800, by one of the following methods:

- ~ painting on service as a band over 150 mm
- ~ applying an adhesive tape (of wrap-around type services) over a length of 150 mm

Place such identification colours at bulkheads, wall penetrations and any other place where identification is necessary.

#### **2123 Switchgear**

Ensure that all switchgear is fitted with labels in accordance with BS 7671 and BS EN 61439 to indicate duty of unit, its voltage, phase and current rating, protective device rating, size of conductor involved, and all other necessary details.

Use an agreed serial coding system, and provide at the switch a legend of the coding system.

Identify loose switchgear such as fused switches, switch fuses, distribution boards, isolators, indicating switches, starters and control switches controlling remote equipment, by fitting an external label or engraving, indicating the equipment controlled.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 2124 Distribution boards

Clearly identify the circuit ways either by the miniature circuit breaker or fuse bases and carriers being indelibly numbered in an accepted manner or by a label. Use a numbered plan or a printed statement held in a pocket on the inside of the door, to the effect that the numbering of the ways is from left to right, or top to bottom.

##### **Internally**

Identify every outgoing way with a renewable circuit chart, in a transparent plastic envelope, permanently fitted inside the cover of every distribution board.

Clearly indicate for each circuit, in typed script, the following information:

- ~ circuit identification number
- ~ cable size
- ~ fuse or circuit breaker rating (including whether an RCD or not)
- ~ description of item supplied and area supplied by circuit

Label all cable connections internally with their circuit reference. Use lettered or numbered ferrules or sleeves to BS 3858.

##### **Externally**

Clearly identify each distribution board, with a label that is compatible with the schematic and wiring diagrams, and complies with BS 7671.

##### 2125 Motor and starter labels

Fit identification labels to all motors, starters and starter panels. Ensure the positive identification of respective motors and starters. Ensure that all such labelling is compatible with schematic and wiring diagrams and complies with BS 4999-103.

Check that every motor bears secure markings indicating the type of lubricant to use (if any) at its bearings and its correct direction of rotation. Where it does not, notify the Contract Administrator.

Check that every motor fitted with surge suppressors or thermistors bears secure markings indicating that insulation test voltages must not be applied. Where it does not, notify the Contract Administrator.

##### 2126 Plant and equipment labels

Label all electrical plant and equipment with the labels specified in the appropriate British Standards for that plant or equipment.

Fit labels on all items of electrical equipment, switches, etc, that include the following information:

- ~ service controlled
- ~ circuit reference
- ~ voltage and number of phases
- ~ circuit protection type and rating

Label all 'accessory boxes' internally with their circuit reference.

Identify externally the mid-point of each ring main circuit.

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Engrave switchplates, spur units, pushes and special plates for bedhead units, call systems, fire alarms, kitchen appliances, etc, as indicated in the 'engineering system' sections of this Specification or on the drawings. Use 6 mm high letters with engraving (in a contrasting colour), except where otherwise stated.

Where voltage above ELV exists, label all electrical plant and associated controlling equipment, using safety signs.

#### **2127 Indicator lamps and push buttons**

Use indicator lamp and push button colours in accordance with BS EN 60073.

#### **2128 Final circuit accessories**

Label all electrical final circuit accessories such as socket outlets, fused connection units, cooker outlets, isolators etc., with labels that indicate the circuit reference.

Ensure that, where additional protection by RCD is not provided, socket outlets with a rated current not exceeding 20A and mobile equipment with a current rating not exceeding 32A for use outdoors are provided with a label indicating the particular item of equipment it serves.

Label all 'back boxes' internally with their circuit reference.

Identify externally the mid-point of each ring main circuit.

Use 6 mm high letters with engraving (in a contrasting colour), except where otherwise stated.

Where voltage above ELV exists, label all electrical plant and associated controlling equipment, using safety signs.

#### **2130 SIGNS NOTICES AND DIAGRAMS**

##### **2131 Safety signs**

Ensure that all safety signs comply with HSE L64.

Ensure that each safety sign is of the correct type and complies with BS 5499.

Provide with each safety sign supplementary or text signs complying with BS 5499.

Identify each substation and main switchroom with safety signs and supplementary signs complying with BS 5499 and, for any associated fire extinguishing system, with BS 5306. Ensure that all such notices and signs give details of:

- ~ name of the substation or switchroom
- ~ the presence of high and low voltages
- ~ administrative instructions for access
- ~ location and method of contacting controlling authority
- ~ actions to be taken in emergency

##### **2132 Additional safety signs**

Provide additional safety signs at locations shown on the drawings or noted in the engineering system sections of this Specification or as appropriate, in accordance with BS 5499. Ensure that all such additional safety signs comply with HSE L64.

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##### **2133 Maintenance notices**

Fix notices giving warning of and instructions on, any special maintenance procedures to plant and equipment.

Upon completion of the installation or maintenance work, ensure that notices of periodic inspection and testing are fixed in a prominent position at every installation.

##### **2134 Schematic diagrams**

Permanently fix to a nearby wall of the room, a purpose made schematic diagram, showing all the electrical connections to equipment and plant served at the following locations:

- ~ at main switchgear
- ~ at sub-main switchgear

Ensure that all such diagrams and symbols comply with BS 5070 and BS EN 61082-1.

Ensure schematic is at least A3 drawing size and mounted in picture frame.

##### **2135 Earthing**

Adjacent to the final connection of the electrical system of the building to the earth electrode or earthing terminal, provide a clear and permanent warning label stating "Safety Electrical Connection – do not remove".

Fit labels describing the purpose and instructions for operation and maintenance to all special purpose earthing conductors [eg 'clean earths' for IT networks] and connection points.

Label main earth bonding cables in the same manner as submain cables.

##### **2136 Shock treatment card**

Provide a copy of the 'Electrical Times' Shock Treatment Card at each main switch panel position. Ensure that the card gives the following information:

- ~ instructions for isolating a person from live conductors
- ~ artificial respiration and resuscitation methods
- ~ location of the nearest telephone and the telephone number of whom to contact for assistance

##### **2137 Periodic inspection and testing notice**

Fix a periodic inspection and testing notice in accordance with BS 7671.

##### **2138 Alternative supplies**

Fix warning notice for all alternative or multiple supplies in accordance with BS 7671.

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##### **2139 Non-standard colours**

Fix warning notices to BS 7671 where the installation contains wiring colours under different versions of BS 7671.

##### **2200 SUNDRY COMMON ELECTRICAL ITEMS (Y89)**

##### **2210 GENERAL**

##### **2211 Definitions**

Use the definitions given in BS 7671. Where a term is not defined in BS 7671, use that given in BS IEC 60050.

##### **2212 Electricity supply**

Ensure that the electricity supply provided is at 400/230V, 50Hz, 3-phase, 4-wire, unless detailed otherwise in the 'engineering system' sections of this specification. Check that the fault level at the origin, and the earth-loop impedance external to the installation, is as given in the 'engineering system' sections of this specification and inform the Contract Administrator if they are not. Ensure that the size and rating of the overcurrent device at the origin, and the method of earthing used in the installation, is as given in the 'engineering system' sections of this specification or as indicated on the drawings.

##### **2213 Design criteria**

The main distribution schematic diagram and/or the 'engineering system' sections of this specification, indicates the design criteria applicable at the time of tender.

Do not make any change to the installation that invalidates such design criteria without prior written agreement from the Contract Administrator.

##### **2220 PRODUCTS AND MATERIALS**

##### **2221 Faulty materials and workmanship**

Replace any material or installation rejected under clause A33 at no cost to the contract including all costs arising from any associated building works or the works of other trades, together with all costs arising from delay in the replacement of rejected items.

##### **2222 Supports and fixings**

Comply with specification section Y63 and Y93.

Supply and install complete all necessary support steelwork, including brackets and suspension/threaded rods etc to support the electrical installation defined in this specification and shown on the drawings.

Provide corrosion resistance to the minimum levels appropriate to the environment as specified in relevant standards (eg BS EN 61537 minimum Class 1 (electroplated) for internal heated spaces and minimum Class 5 (post galvanised zinc costing) for external areas unless otherwise defined in the 'engineering system' sections of this specification).

Do not fix electrical services to any support steelwork that is subject to vibration or heat transfer.



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Do not support electrical services from any suspended tile ceiling system but provide independent support fixings.

#### **2230 ANCILLARIES**

##### **2231 Fire and smoke barriers**

Fit sleeves or transit frames around cables (including those supported by trays, wire trays or cable ladders), and fire-seal the gap between them and the cable(s), as appropriate, wherever electrical installations pass through fire and smoke barriers (including compartment walls and compartment floors). Provide and fit, at all fire or smoke barriers, internal fire stopping to conduits, trunking, ducts and busbar products that have internal space that can conduct combustion products.

Carry out all such work to the requirements of Building Regulations Part B and those of BS 7671.

Arrange the integrity of the fire and smoke barriers through which such cables, conduits, trunking, busbar systems, etc, pass, by advising the Contract Administrator of the need to arrange for making good around the sleeves, transit frames and trunkings with appropriate fire stopping materials.

##### **2232 Expansion joints**

Ensure that every expansion joint in conduits, trays, trunkings and busbar enclosures/trunking is of a recognised pattern supplied by the appropriate equipment manufacturer.

Loosely clamp within the adjacent fixing saddles/cleats to allow movement, and where necessary install formed loops' at each cleated cable crossing at expansion joints.

##### **2233 Enclosures**

Install all site-fitted electrical components (including relays, contactors, RCDs) that are not installed within a distribution board, consumer unit or control panel, within a proprietary enclosure. Ensure that every such enclosure is ingress protected to suit its location, is manufactured from a material that resists combustion, and is equipped with DIN rails or detachable mounting frames for mounting the equipment.

##### **2234 Other sundry components**

Ensure that all other sundry components used are proprietary and are of a recognised pattern, supplied by the appropriate service manufacturer.

#### **2240 WORKMANSHIP**

Comply with the positions and heights given in Y89, and Approved Document M, unless otherwise agreed in writing with the Contract Administrator. Prior to installation of any sockets, switches, controls, etc, agree the positions with the building control authority responsible for the project.

##### **2241 Positioning**

Comply with the requirements of specification sections A11 and A13.

Check and confirm all measurements and work to the larger scale, formally issued, detail plans in the possession of the clerk of works or main contractor to verify the positional dimensions of accessories and associated electrical equipment. Do this before commencing work. In the absence of large-scale drawings being available, agree all positions with the Architect.

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Do not scale dimensions from the drawings as the symbols representing electrical accessories and equipment on drawings are not drawn to scale.

Install wall mounted socket outlets, switches, telephone outlets, TV outlets and control items (eg adjustable thermostats) with their nearest edge at least 350 mm horizontally from room 'internal angle' corners.

Position at least one outlet above kitchen work surfaces at the return end (work surface end abuts wall) where the work surface does not have wheelchair manoeuvring space beneath. Position the outlet with its centre no more than 150 mm horizontally from the front edge of the work surface, and no more than 100 mm above the work surface.

Install door entry phones, card readers and manual controls for powered door systems within 200 mm horizontally of the associated door frame, except that, where the door opens towards the user, set-back such items 1400 mm horizontally from the swinging stile (leading edge) of the door (so that wheelchair users do not have to move to avoid contact with the door as it opens.)

Install lighting pull cords at 150 mm maximum horizontally, from the door frame of the swinging stile (leading edge) of the associated door and as close to the wall as possible.

#### 2242 Mounting heights in walls

Locate and mount all switches, outlets and controls as shown on architectural setting out drawings, if available, and to satisfy Building Regulations Approved Document M and BS 7671. In the absence of large-scale drawings being available, all positions are to be agreed with the Contract Administrator.

Select mounting heights for landing push buttons, keypads and 'indicator arrows' associated with lifts, and for emergency stop buttons associated with escalators and conveyers, to satisfy relevant standards, codes and manufacturer's recommendations.

In car parks and garages mount all socket-outlets at 1.2 m above floor level to avoid mechanical impact from the movement of motor vehicles. Confirm with building control and other relevant authorities that mounting of socket-outlets in this manner is acceptable.

Mount all items of the same category and within the same room, at the same height unless otherwise agreed with the Contract Administrator.

Mount all accessories at the heights Above Finished Floor Level (AFFL) given in this clause unless otherwise detailed in the 'engineering systems' sections of this specification or otherwise stated.

Apply the heights given in this clause to the accessory and not to the conduit box to which it is fitted.

Ensure that the bottom edge of the accessory is no lower than the lowest AFFL in the range, and the top edge of the accessory is no higher than the highest AFFL in the range, unless stated otherwise. Apply them but make due allowance for coordinating with any building feature, eg wall tiling.

Do not mount accessories within 50 mm of the upper edge of tiling. Do not mount accessories within 100 mm of the underside of a worktop.

| CAWS | CATEGORY OF ITEM/ ACCESSORY   | mm AFFL     | NOTES   |
|------|-------------------------------|-------------|---|
| V20  | Utility meters                | 1200 – 1400 |   |
|      | Distribution boards           | 400 – 1800  | Dependant on size of the distribution board with meters |
|      | Consumer units (non-domestic) | 750 – 1200  | As BS 8300  |

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

|           |   |             |  |
|-----------|---|-------------|--|
|           | Consumer units mounting height from FFL to switches (in dwellings)                    | 1350 – 1450 | Approved Document M recommends that switches sockets and other equipment should be located between 450 mm and 1200 mm from finished floor level. Approved Document P suggests one way to comply is by mounting the consumer unit so that the switches are between 1350 mm and 1450 mm from the finished floor level. |
| V21       | Lighting switches   | 900 – 1200  | And level with door handles  |
|           | Lighting pull cords   | 900 – 1100  | To lower end of cord   |
|           | Access for those with reduced reach   | 450 - 1200  | Serving habitable rooms  |
| V22       | Socket outlets and switched socket outlets  | 400 – 1200  |  |
|           | Switches for permanently wired appliances (eg fused connection units)                 | 400 – 1200  | Higher if needed for particular appliances   |
|           | Socket outlets, switched socket outlets and switches for permanently wired appliances | 100 – 200   | To centre above work surfaces in kitchens and laboratories   |
|           | Isolators, push buttons, starters, cooker control units                               | 750 – 1200  |  |
|           | Cooker connection units   | 450 – 750   |  |
|           | Shaver socket outlets, hot air hand driers  | 800 – 1000  | To bottom edge   |
|           | Flex-outlets  |             | To suit the circumstances  |
|           | Powered window controls   | 800 – 1000  |  |
| V40       | Safety signs (emergency exit signs)   | 2000 – 2500 | To bottom edge or as risk assessed under BS 5266   |
| W10       | Doorbell pushes, door entry 'phones   | 400 – 1200  | Depending on accessibility requirements  |
|           | Telephone outlets (non-domestic)  | 400 – 1200  |  |
| W11 & W14 | Emergency assistance alarm pull cord  | 100         | To lower red bangle  |
|           |   | 800 – 1000  | To upper red bangle  |
|           | Emergency assistance alarm reset button   | 800 – 1000  | To bottom edge   |

#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

|     |  |  |  |
|-----|--|--|--|
| W20 | TV outlets (non-domestic)  | 400 – 1200   |  |
| W23 | Clocks   | 2500   |  |
| W40 | Manual controls (including push pads and green emergency break glass units) for powered door systems | 750 – 1400   | Reset back 1400 mm from leading edge of door when fully open   |
|     | Swipe card readers   | 950 – 1000   | To centre of reader  |
| W50 | Fire alarm manual call points  | 900 – 1200   | And level with door handles *  |
|     | Alarm sounders   | 2500   | To centre  |
|     | Visual alarms  | 2100   | Minimum  |
| W60 | Room thermostats and humidistats that room occupants adjust  | 1400   | To top of thermostat or humidistat   |
|     | Room thermostats, temperature and humidity sensors that are not adjustable by room occupants         |  | At height recommended by manufacturer, approximately 1200 – 1800 mm (with default height of 1800 mm) |
| X10 | Lift controls (non-domestic)   | 900 – 1100 mm from the FFL and 500 mm from any return wall | As Approved Document M, Volume 2, 3.34.g   |
|     | Lift controls in dwellings   | 900 – 1200 mm and 400 mm from the front wall               | As Approved Document M, Volume 1, 1.11.k   |

NOTE \* Where fire alarm manual call points are mounted at lower than 1100 mm record this as a variation from the BS 5839 requirement of 1400 mm, (a variation of less than 300 mm need not be recorded as a variation), in the 'Design Certificate' and have it approved by the controlling fire authority.

#### 2300 FIXING TO BUILDING FABRIC (Y90)

#### 2310 PRODUCTS AND MATERIALS

Where appropriate securely fix all engineering components to the building fabric using any of the following methods:

1. expanding anchors and bolts for heavy loads fixed to masonry or concrete
2. white finished metal or plastic wall plugs and screws for light loads to masonry or concrete

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3. screws into wood for light fixings
4. clamps and adaptors to fix to structural steelwork, if accepted by the Contract Administrator in writing
5. proprietary adaptors for proprietary cast in fixings when provided as part of the building

Employ all fixings within the loading recommendations and substrate recommendations of the manufacturer.

#### **2320 Composite / concrete slab embedded channel**

Use only proprietary cast-in channels and other fixings if provided as part of the building specification.

Use only proprietary loose fixings such as wedge and T-nuts approved for use with cast-in channels and other fixings by cast-in channel manufacturer..

#### **2330 Fixing methods not allowed**

Do not use the following fixing methods:

1. drilling structural steel work
2. hanging supports with loose back plates under floor screed
3. wooden or fibre wall plugs
4. built-in fixings unless specifically detailed in the specification or on the drawings

#### **2340 Holes for fixings**

#### **2341 Testing**

Undertake proof testing in accordance with BS 8539 and CFA Guidance Note: Procedure for site testing construction fixings.

Use only competent testers, assessed and certified by the CFA Approved Tester scheme for testing. Provide documentary evidence of a tester's certification to the Contract Administrator at least 4 weeks prior to commencement of testing.

#### **2400 SERVICES SUPPORT AND SUSPENSION SYSTEMS (Y93)**

##### **2410 GENERAL ITEMS**

Provide for the support and/or suspension of services and the safe transfer of services dead load and dynamic load to the building structure. Support means holding in place from below the horizontal under compression stress and/or bending stress. Suspension means holding in place from above the horizontal under tension stress and/or bending stress. Allow for all shear stress and lateral loadings as may occur subject to physical arrangements implemented.

The transfer of supported and suspended loads must not adversely affect either the structure or fabric to which it attaches nor the performance of the service being supported or suspended.

All support and suspension systems must ensure both the initial and ongoing safety of the supported and/or suspended services.

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The support and suspension system must not diminish the thermal, acoustic or mechanical performance of the suspended or supported service. The support and suspension system must not introduce condensation nor facilitate its formation.

Install the support and suspension system to transfer loads thus:

- ~ (A.) From the service or, (AA.) from associated intermediate physical support (eg cable tray, ductwork hanger, pipework clamp)
- ~ (B.) To and via the support or suspension component (eg threaded rod, wire rope, catenary system, channel (unistrut))
- ~ (C.) To the fixing with the structure/fabric

Structure includes all secondary support and access steel work designed, fabricated, supplied and installed to support the engineering services within this works package. A requirement for Installer to provide secondary steelwork, where not specifically detailed on the Structural Engineering drawings, is set out in Section A20 Preliminaries / General Conditions.

Design, specify, procure, install and test the support and suspension system and all its component parts to comply with BS 8539 as applicable. (BS 8539 is considered to be an appropriate standard because it refers to applications vulnerable to progressive collapse including suspended ceilings, and suspended services such as pipework, ductwork or cable tray.)

Ensure that the support and suspension system is designed, specified and installed to prevent progressive collapse and the potential risk to human life in the event of such collapse. Commission specialist design services from manufacturers or other competent professionals to ensure that the support and suspension system as installed eliminates all material and unmanageable risk of progressive collapse.

Design, specify, procure and install all component parts to comply fully with manufacturer's instructions for design and installation.

#### **2411 Loadings**

Provide all suspension and support components with sufficient Safe Working Load (SWL), Working Load Limit (WLL), or other approved loading classification sufficient to support all design loads.

Ensure that all fixings and fixing points to the building structure or fabric are approved or otherwise classified as fit for purpose and correctly installed to maintain such approval or classification.

Ensure that all suspended and supported services have sufficient strength and appropriate rigidity at each point of suspension and/or support for transfer of its loads to the suspension and/or support system.

Use suspension and support components in accordance with the manufacturer's instructions taking due account of all:

- ~ Vertical loads
- ~ Lateral loads
- ~ Dynamic loads
- ~ Tensile, compressive and shear loads

Include for loads arising from fluid content, insulation, acoustic quilt and installation, maintenance and servicing loads eg persons inside ductwork performing cleaning activities.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

Subject to receiving normal maintenance, as recommended by the manufacturers, and in-service use in accordance with the design conditions provide all support and suspension systems to sustain their design performance properties throughout their expected service life.

#### 2412 Support & Suspension elements

Support services from below and include the following main components:

- ~ Fixing to structure or fabric eg anchor or clamp
- ~ Support element such as Unistrut, angled bracket or threaded rod
- ~ Attachment to or around service such as ductwork support eg circular duct ring; profiled straight channel, cable tray profiled hanger.

Suspend services from above and include the following main components:

- ~ Fixing to structure or fabric eg anchor or clamp
- ~ Suspension element such as wire or threaded rod
- ~ Attachment to or around service such as ductwork support eg circular duct ring; profiled straight channel, cable tray profiled hanger.

Use solid wire, wire rope, threaded rod or similar products designed specifically, or otherwise approved by manufacturer, for supporting suspended loads.

Do not joint wire rope, or other similar continuous reel supplied suspension elements to increase their length. Use only continuous reel length suspension elements.

Joints to any non-continuous support or suspension element, such as threaded rod, must be made with products designed specifically, or otherwise approved by manufacturer, for securely jointing and holding supported or suspended load.

#### 2413 Support & Suspension terminations

Provide all hooking loops within wire rope systems with a solid thimble eye.

Use closed eye fixings on suspended services. Where closed eye fixings are not practicable for application use double loop (Pigs tail) open hook fixings.

Attach a ferrule or other such means to the loose end of any wire rope to prevent fraying.

Protect all sharp edges and corners with corner saddles.

#### 2414 Types of structure

Liaise with the project Structural Engineer to ensure that the structural elements to be used for supporting services loads are capable of this.

Only attach the suspension system to the following types of structure after confirming suitability:

- ~ Exposed primary steelwork (eg main structural columns and beams)
- ~ Exposed secondary steelwork (eg light gauge steel such as roof purlins, facade side rails)
- ~ Profiled/composite decking



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#### **V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION**

- ~ Concrete
- ~ Other structural elements

Do not drill any structural steel work without permission from the Structural Engineer.

Do not attach suspension system to the following:

- ~ Any non-suitable structure or fabric
- ~ Any structural engineer/architect barred structures

#### **2415 Catenary Systems**

Confirm building suitability with structural engineer before using horizontal catenary support system suspended between two building fixing points. Allow for all lateral, compressive, tension, and shear loads.

Install catenary support wires with the straight line between their two end support points within plus or minus 5 degrees of horizontal.

Ensure all items attached to catenary support wires are designed to be non-slip, self-gripping or otherwise prevented from slipping by locking devices specifically designed for prevention of slippage on catenary wires.

Use only trained competent installers experienced in the design and installation of catenary support systems.

#### **2416 Installation**

Design, install and adjust the suspension system to fix services to the required design height and orientation.

Where mechanical lifting assistance is required provide, in accordance with HSE ACOP L113, all necessary temporary suspension arrangements during installation of the suspension system as required. Transfer the mechanically lifted load to the suspension system gradually and evenly.

Locate fixings directly above the suspension point. If this is not possible then check with the manufacturer the suitability of the fixings to accept lateral loads at the angle involved.

Use only parts from the same manufacturer for each independent suspension system. Only mix different manufacturer parts if all are fully compatible without degradation of performance or manufacturer warranty.

Use components from a single manufacturer.

Ensure that all suspension rods, wire ropes and other suspension components are evenly tensioned with no nicks, cuts, fraying, twisting, deformation, or deflection of wire ropes by other objects.

#### **2420 ATTACHMENT TO STRUCTURE**

##### **2421 Methodology**

Attach the suspension support system building structure by one or more of the following methods providing in all cases that the manufacturer's instructions, BSRIA COP and standards are adhered to:

- ~ Direct attachment e.g. cable looped over a beams

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- ~ Expansion anchors and screw fixing to concrete
- ~ Adhesive bonding anchors
- ~ Holorib or composite system eg embedded channel in slab for use with wedge fixings, T-head bolts, or similar fixings on the underside
- ~ Powder fixing (where such use is permitted)
- ~ Clamps and clips
- ~ Other

Ensure that reinforcement bars are not damaged, cut or otherwise affected as part of the attachment fixing. Report all damage to the Structural Engineer.

Comply with BS 5080 for all fixings in concrete and masonry.

Select and install fixings in accordance with BS 8539 Code of practice.

Provide slip restraints where rope wire attachment to structure is not perpendicular to structure.

#### **2430 APPLICATION SPECIFICS**

##### **2431 Safety Margin and Redundancy**

Provide a minimum level of redundancy that will ensure the transfer of suspended load to immediately adjacent supports in the event of failure of any single system component. The immediately adjacent support must sustain the additional load.

##### **2432 Fire Rating**

All elements of the support and/or suspension system used for fire resisting ductwork must be capable of bearing the load of the ductwork under specified fire conditions relating to such ductwork. Guidance set out in the following Association for Specialist Fire Protection Blue Book publications show the factors relevant to supporting fire resisting ductwork:

- ~ Fire Resisting Ductwork: classified according to BS EN 13501 Parts 3 & 4
- ~ Fire Resisting Ductwork: tested to BS 476 Parts 24.

All elements of the support and/or suspension system used for support and/or suspension of services must be capable of bearing the load of the service under any specified fire conditions relating to that service.

Provide all such certification and other manufacturers evidence of the fire rating for different exposure times under conditions of standard fire test procedures.

##### **2433 Corrosion resistance**

Provide details of proposed materials and corrosion performance of suspension components at tender stage to Contract Administrator for comment.

All suspension components in zones to be galvanised / hot dipped galvanised / grade A2 Stainless Steel / grade A4 Stainless Steel / special alloy of Stainless steel for use in swimming pools.

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##### **2434 Proof testing**

Perform proof tests on a representative sample to at least 2.5% of fixings. Provide details of the proposed proof testing with the tender submission.

In the event of any fixture failing under test, double the test sample size. Investigate and determine the cause of failure and ensure the elimination of failure cause from all other fixings of the same type. Where the cause cannot be eliminated use alternative fixings and subject those to proof tests.

Undertake proof testing in accordance with BS 8539 and CFA Guidance Note: Procedure for site testing construction fixings.

##### **2500 TESTING AND COMMISSIONING (Y81)**

##### **2510 GENERAL (APPLICABLE TO ALL TESTING AND COMMISSIONING PROCEDURES)**

Carry out inspection and tests to comply with any British or European standards as necessary on all equipment and installations.

Comply with all aspects of section A32 (Management of the works) of this specification.

Where a LV switchgear, generator, UPS system or Motor Control Centre(s) have been completely assembled at a manufacturer's works, arrange for the employer's representative to inspect and witness tests on the completed equipment at the works. Give the employer and Contract Administrator at least 14 days' notice of the tests so that they can attend if they wish.

For on-site testing give the employer and the Contract Administrator at least 7 days' notice of the tests so that they can attend if they wish.

Whether or not this opportunity is accepted by the employer provide the complete set of test results and inspection reports to the Contract Administrator after the tests have been completed and before the equipment is installed.

Retest on site any such item of equipment that has been partially dismantled for transportation, unless otherwise agreed with the Contract Administrator.

Prepare and submit a fully detailed programme and method statement for the test, commissioning and demonstration of each system stating exactly how these are to be carried out and whether they interface with other systems. Programme to include a schedule of tests to be applied to the system to demonstrate that the fault diagnostic routines function as required. Submit the programme and statement to the Contract Administrator for comment one month in advance of the test. Notify manufacturers or specialists of the dates as appropriate.

Arrange for the attendance of a tester to carry out all required tests. Ensure that this tester is not the same person who made the installation, unless agreed with the Contract Administrator.

Supply all test instruments. Ensure they are calibrated immediately prior to commencement of testing and operated by trained personnel. Arrange for all calibration certificates to be available for inspection at the time of the tests. Prior to commencement of tests ensure the Contract Administrator is asked to comment on the suitability of the proposed test equipment and methods of testing being adopted.

Provide all specialist equipment, to test and demonstrate the various systems as required.

Arrange and carry out disconnection or similar operations to satisfy the requirements for testing, etc, and the reinstatement of the installation after tests.

Carry out the test procedures in the following clauses in addition to any tests required by the particular system section, or any other 'Y' section, of this specification, as a minimum.

Provide certificates for all testing and commissioning carried out. Include all recorded test results in the operating and maintenance manuals as a record of commissioning prior to contract completion.

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Ensure all control arrangements, settings and sequences on completion of commissioning and demonstration are recorded, added to the Record Drawings and included within the operating and maintenance manuals.

Provide two days of training, on completion of the installation, for nominated clients representatives in all aspects of the installation operation which are the user's responsibility.

#### 2520 PARTICULAR TEST PROCEDURES

Carry out the following procedures as necessary in accordance with the relevant British or other standards and, if appropriate, the relevant Health Technical Memoranda (HTM).

Ensure that the Work's test engineer controls all tests undertaken at the manufacturer's works.

Ensure that, in the presence of the employer's representative, all tests undertaken at site are controlled by the installer/manufacturer.

#### 2521 LV switchgear

Inspect and test switchgear fully in accordance with BS EN 61439, and in particular BS EN 60439-1 to comply with type testing or partial type testing.

Ensure that all switchgear has been ASTA type tested, approved and certified.

Ensure that all meters fitted to any switchgear have a valid calibration certificate.

Carry out routine tests for:-

- ~ Inspection of the assembly including inspection of wiring
- ~ Electrical operation test
- ~ Dielectric test.
- ~ Checking of protective measures and electrical continuity of the protective circuit

Ensure that the settings of all ACBs and MCCBs are in accordance with the design settings as detailed in the schedules.

Verify the correct functioning of all residual current devices.

During commissioning ensure that all switchgear and distribution boards have been correctly labelled and all distribution board schedules are correct and in place.

#### 2522 LV switchgear functional tests

Submit verification documentation in accordance with BS EN 61439 for all switchgear and controlgear assemblies to the Contract Administrator when the panel and assembly drawings are submitted for comment.

Clearly mark all equipment with the standard to which it complies. Provide type test certificates, for the class of switchgear to be supplied.

Include in the tender all costs for inspection visits to the manufacturer's works by the Contract Administrator. Give the Contract Administrator two weeks' notice of each test.

Carry out functional tests on switchgear to verify correct operation of the following:

- ~ motorised operation of any switchgear
- ~ contacts, whether volt-free or not

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ power factor correction including sequencer and contactors
- ~ G59 isolation testing of both mechanical and electrical interlocks
- ~ Castell key operation
- ~ any other control function on the switchgear

In carrying out the above tests ensure that interlocks and keys effectively prevent any cross phasing, paralleling of unintended action by the switchgear.

#### 2523 Protection tests

Within all switchboards, test every protective relay to ensure it functions correctly.

Verify the action of all such relays by secondary injection methods.

Check that the system has been graded and that the correct settings have been set up.

Check that the grading settings have been correctly recorded in test sheets and that these settings are recorded in the operation and maintenance manual.

#### 2524 LV cables

Test all installed LV cables fully in accordance with BS 7671.

The installer or his designated tester shall carry out the insulation, continuity and conductor resistance tests required. The conducting of the tests and the subsequent recording and certification of the results remain the responsibility of the installer. Ensure that, throughout all such tests, both ends of every cable are monitored by a competent person.

When testing long cables that probably have considerable capacitance, be aware of the dangers of stored energy and the need to earth down, in a controlled manner, all cores after each test.

On every paper insulated cable carry out the “crackle test” on the impregnated bindings before making each joint, to ensure that they contain no water moisture.

For large section circuits consisting of more than one conductor per phase, verify the equality of load current sharing between the parallel conductors.

#### 2525 Fire alarm

Arrange for the manufacturer or their representative to test and commission the complete fire alarm system fully in accordance with BS 5839 and this specification.

#### General

Carry out, on completion of the installation works, together with the selected specialist equipment manufacturers, the complete testing, commissioning and demonstration of the system operation as detailed below.

Make available suitable operatives, familiar with the fire detection system, as may be required to assist the manufacturer throughout the commissioning period.

Ensure that CAD record drawings of fire alarm systems are completed and available on site to manufacturers prior to commissioning commencement.

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Ensure that the tests are largely composed of simulated faults that are artificially imposed on the system. Check all visual units, alphanumeric displays, and printers to establish that all programmed messages are displayed correctly. Ensure all control panel switches undergo functional demonstration of correct operation.

Complete and produce the commissioning and test certificate for scrutiny before any part of the project can be handed over and accepted.

Ensure that 'As Fitted' drawings and manuals are available before the demonstration and instructions.

Fully demonstrate the complete operation of the system to the satisfaction of the Contract Administrator and, where appropriate, the Fire Officer.

#### Tests to be conducted prior to commissioning

Prior to commissioning carry out the following tests:

- .1 Carry out a visual inspection of the whole of the installation, including equipment and cabling in subways, walkways, crawlways, ceilings and floor voids where accessible.
- .2 Check insulation resistance tests cover all circuits forming part of the system and made between phases, phase to neutral, phase to earth and neutral to earth. Ensure that the method of undertaking insulation resistance tests do not adversely affect any sensitive system components, and if required, isolate sensitive devices prior to undertaking the tests.
- .3 Check correct polarity of the alarm devices, bells sirens, klaxons, etc, and all items where correctness of polarity is essential
- .4 Check the programming of the fire alarm system to ensure all detectors are in the correct zone. Base the zoning arrangement on the arrangement shown on the drawings and/or as required by the British Standard. Allow for making minor adjustments to the zoning arrangement to suit the final position of the fire doors and other zone boundaries. Agree all such adjustments with the Contract Administrator.

#### Tests to be carried out during commissioning

During commissioning carry out testing in accordance with the requirements of BS 5839 and BS EN 54, and is to include, but not be limited to, the following:

- .1 the operation of all panels, accessories and items of equipment and a check for proper function, including such items as may have been supplied by others but wired under the electrical installation. Carry out these tests under normal operating conditions, including the discharge and recharging of the 'battery' system, and the results noted.
- .2 functional test of all manual "break glasses"
- .3 functional test of all smoke detectors by use of an approved smoke generator testing device
- .4 functional test of all "fixed temperature" or "rate of rise" heat detectors, by an approved heat source testing device
- .5 simulated tests for fire or fault alarm at detectors and manual contacts as may be instructed by the Contract Administrator, with all tests agreed and recorded onto a system check list to be approved prior to any witness testing being carried out
- .6 testing of all sprinkler sensors and fusible link units
- .7 testing of all visual indicators under simulated operational conditions with sounders out of circuit
- .8 testing of auxiliary signals to remote panels and via British Telecom lines, etc

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- .9 five simulated faults, at randomly chosen locations on each loop circuit and sounder interface secondary circuit, for each of the following type:
  - .1 open circuit
  - .2 short circuit
  - .3 sensor removal/alarm device removal
  - .4 earth fault
- .10 simulated charger and battery faults for all power supply units (panels, interface units, etc), followed by a battery discharge test (i.e. 24 hour quiescent detection of the full alarm system, followed by 30 minutes alarm operation)
- .11 simulated operation of mechanical plant where such faults (if any) are required to operate fire alarm system (e.g. fire/smoke dampers)

Ensure that during routine fire alarm system test, certain functions are inhibited, i.e. gas supply shut-off valve, smoke damper operation, etc. Provide suitable key switch facilities.

#### **Audibility tests**

Carry out, prior to full commissioning of the rest of the system, the following tests:

- .1 Fully test the fire alarm system audible alarm facility to ensure that the correct audibility levels are achieved as required by the relevant Standards.
- .2 Carry out tests on completion of the installation when all mechanical plant is fully functioning to ensure that realistic results are obtained, including all normal background noise levels.
- .3 Measure and record the sound pressure level in each room, area or plant space. Carry out a number of tests and record in each area to obtain average values.
- .4 Inform the Contract Administrator, in writing, of any areas where the required audibility levels are not achieved.

Arrange for the manufacturer to carry out the audibility tests twice. Carry out the first test on completion of the system when all mechanical plant is fully functioning to ensure that realistic results are obtained. Carry out the second test approximately six months later when the building is operating under normal conditions. Carry out both tests in the presence of the Contract Administrator.

Include within the tender cost for the provision of any additional sounders and wiring required following audibility testing.

#### **Documentation**

- .1 Provide the required fire alarm system test certificate(s), to be issued by the specialist manufacturer, in the forms, as detailed in BS 5839 and other relevant standards.
- .2 Record all audibility test results, present in tabulated form and include in the operation and maintenance manuals.
- .3 Provide a full set of zoning diagrams to depict the exact zoning arrangement as required by the British Standards. Frame, glaze and mount adjacent to the main panel and repeater panel in agreed positions to facilitate clear recognition of alarm condition location.
- .4 Maintenance contract - Provide full details and include within your tender for the provision of a full 12 months system maintenance and system inspection and test as recommended by BS 5839.



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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### 2526 Access control

###### General

Arrange for the Installer / specialist security-company to carry out the testing and commissioning of the system in accordance with the requirements as detailed below, and in the specification.

###### Tests

Obtain all permissions and consent as might be necessary to remain compliant with the requirements of the General Data Protection Regulation.

On completion of the installation, undertake full technical and performance tests on the entire system. Include as a minimum the following tests.

- ~ All wiring is correctly terminated and labelled.
- ~ All equipment is correctly labelled.
- ~ Correct supply voltage at all parts of the system.
- ~ The system continues to work when the main power supply is disconnected.
- ~ Correct operation of all devices.
- ~ Correct operation of manually operated devices.
- ~ Correct operation of annunciation devices, and measurement and recording of sound levels.
- ~ Operation of all software functions.
- ~ Operation of any remote monitoring and control via the LAN.
- ~ Effectiveness of access level settings.
- ~ Tamper protection of devices, enclosures, and wiring where appropriate.

###### Commissioning

Undertake the following commissioning procedures:

- ~ Test all reader devices and demonstrate that the system meets with the overall operation and control functional requirements detailed.
- ~ Calibrate all field devices.
- ~ Provide a hard copy print out of the events recorded during the commissioning.
- ~ On completion of the commissioning and testing, provide a certificate of conformity.
- ~ Access level security on the integrated system.
- ~ Alarm annunciation on the PC and at the remote site.
- ~ Fully demonstrate software graphics.
- ~ Ensure that site plans used by the computer software are current.
- ~ Check release times for each door.
- ~ Check door held open signal.

###### Communication link

Where a remote monitoring centre is used, ensure that the alarm communication link to the remote centre is fully tested and commissioned as follows:

- ~ Check the link before connecting the system.
- ~ Warn the remote centre of the test.
- ~ Initiate the alarm and contact the remote control centre/ station and confirm that the alarm condition has been received.
- ~ Confirm the end of testing once the system links have been fully commissioned.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### Interfaces

Commission every system scheduled below independently and as an integrated, co-ordinated system as detailed within the specification:

- ~ Access control system
- ~ Closed circuit television system
- ~ Alarm monitoring system
- ~ Intercom facilities
- ~ Fire alarm system
- ~ BMS
- ~ Vehicle traffic light system
- ~ Lighting control

Commission the access control system under normal power supply conditions, followed by a simulated power failure that proves that the backup UPS supports the system.

Test, prove and commission the interfaces with the following systems under normal and emergency power modes:

- ~ Fire detection and alarm system
- ~ BMS

Ensure all control arrangements, settings and sequences on completion of commissioning and demonstration are recorded and added to the Record Drawings and included within the operating and maintenance manuals.

##### 2527 Lighting and power installations

For all lighting and power installations, inspect and test the complete installation fully in accordance with BS 7671.

Carry out the inspection and tests in the same sequence as set out in BS 7671, and in such time to allow any remedial work to be completed within the contract period.

Prior to void-closures, carry out as a minimum, insulation resistance testing to all mains voltage cabling and supply the results to the Contract Administrator for comment.

Ensure tests also include any part of an existing installation related to the new work. Carry out the following BS 7671 tests before making the system live:

- ~ visual inspection, including:
  - the cable containment is supported adequately
  - all luminaires are complete with lamps and accessories
  - lamps are of the correct colour, rating and manufacturer selection
  - control devices have been correctly installed
  - all switch plates align straight and true
  - all required labelling has been provided
  - luminaires and lamps are in clean condition
- ~ continuity of protective conductors including main and supplementary equipotential bonding
- ~ continuity of ring final circuit conductors
- ~ insulation resistance

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ site applied insulation resistance
- ~ verification of protection by separation of circuits
- ~ verification of protection against direct contact by barrier or an enclosure provided during erection
- ~ electrical resistance of floors and walls that provide protection against direct contact.
- ~ polarity
- ~ earth electrode resistance

Carry out the following BS 7671 tests after making the system live:

- ~ earth fault loop impedance
- ~ prospective fault current
- ~ functional testing (testing of RCDs, RCBs, interlocks, etc)

Test and commission the lighting system in accordance with CIBSE Commissioning Code L.

Set up, prove the operation and function and fully commission all individual control devices including switches, presence detectors, photocell sensors, and contactor/relay units, etc.

Carry out adjustments and calibration of all automatic control devices and systems to demonstrate optimum performance and operation.

Record all control arrangements, settings, sequences and functions on completion of commissioning and demonstrations.

Demonstrate the operation of all control functions to the entire satisfaction of the Contract Administrator and employers' representative after commissioning has been fully completed.

Provide out of hours attendance, as necessary during periods of darkness, for the demonstration and verification of operation and function of particular lighting systems.

Make average illuminance measurements of the installed lighting system, as recommended by the CIBSE Code for Lighting, throughout all areas of the building. Incorporate the results on the lighting system 'Record' layout drawings.

Test the installed lighting system progressively during construction and upon final completion of the whole installation. Test the complete lighting system, including luminaires, control devices and all associated equipment in accordance with the manufacturer's recommendations.

#### **2528 Earthing and bonding**

Carry out full impedance/continuity testing of all service carriers prior to connecting to the earthing system, to the Contract Administrator's satisfaction.

On completion of the Contract Works, carry out all necessary tests to prove the effectiveness of the complete earthing system. Ensure that the earth electrode system achieves an overall resistance as detailed in section W51 noting the requirement to provide additional electrodes if the systems fail to meet the specified resistance to earth.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

##### **2529 Lightning protection & Surge Protection**

Fully test, commission and document the system in accordance with BS EN 62305 and specification section W52.

##### **25210 Telecommunications**

###### **Telephony**

Where external and internal telephone wiring is installed, carry out testing fully in accordance with the telephone service provider's (TSP) specification and section W10 of this specification.

Where internal and site-wide telephone and data wiring form one integral wiring system, test it as detailed in the Data section of this specification.

Carry out the following tests:

- ~ visual inspection, including:
- ~ the cable containment is supported adequately
- ~ control devices have been correctly installed
- ~ all cabling is correctly installed and secured.
- ~ all required labelling has been provided
- ~ continuity of protective conductors including main and supplementary equipotential bonding
- ~ verification of protection by separation of circuits
- ~ verification of protection against direct contact by barrier or an enclosure provided during erection

###### **Structured cabling**

Thoroughly test the cabling installation to confirm that the components and installation practices meet the defined standards.

Carry out all tests in accordance with an agreed methodology.

Maintain full records of all testing carried out and the results of the tests.

###### **UTP cable tests**

Test all UTP horizontal and riser cables, following installation, for:

- pair polarity
- crossed pairs
- continuity
- short circuits
- length
- attenuation
- cross talk (near and far end)
- PS-NEXT
- EL FEXT
- PS-ELFEX

## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- propagation delay
- delay skew

Check the results against declared published results for the types of cable used and notify the Contract Administrator of any variations.

Ensure each pair in each link is tested from both ends and the worst pair results used as the test result.

#### Test equipment

Provide a valid calibration certificate, which is less than six months old, for each item of test equipment which is brought to site to measure performance data; the calibration certificate may be inspected on site.

Ensure UTP test equipment can provide Level II accuracy for both channel and basic link in accordance with requirements of EIA/TIA TSB67.

#### Test failures

Rectify each failure identified during testing by replacing the faulty cable or component.

Do not use in-line cable joints or flexibility points outside patch cabinets.

Remove all damaged cables and components from site.

#### Notification

Inform the Contract Administrator, at least ten working days, in writing, before commencing any tests.

Provide a programme for testing and agree the programme with the Contract Administrator.

#### Witnessing

All cables and components or a random selection will be witness tested. The extent of the witness testing will be at the discretion of the Contract Administrator.

#### 25211 Radio and television aerial systems

For all television and radio reception systems, comply with specification section W20 and the testing requirements therein.

#### Commissioning

Obtain all permissions and consent as might be necessary to remain compliant with the requirements of the General Data Protection Regulation.

After testing has been successfully carried out, demonstrate all functions to the Engineer, including but not limited to the following:

- ~ All wiring is correctly terminated and labelled.
- ~ Camera and lens fitted correctly for each position to achieve the desired field of view.
- ~ Effective operation of all cameras in different light levels.
- ~ Correct setting of all pan and tilt limits and associated automatic control.
- ~ Correct supply voltage at all parts of the system.
- ~ Effective operation of supplementary lighting.
- ~ Operation of recording systems under alarm and steady-state conditions.

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ Recording and display of the system under all alarm conditions.
- ~ Walk tests with any volumetric device operated cameras.
- ~ The system continues to work when the main power supply is disconnected.

#### 25212 Thermal imaging/acoustic vibration testing

In locations where voltage tests suggest unexpected volt drops on smaller boards, or noise is experienced on any board, the Client or Contract Administrator may opt for a thermal image survey of all cable terminations, bus bar field connections and general switchboard components or an acoustic vibration test.

Carry out the survey using a thermal imaging camera capable of producing a hard copy or of producing a digital image that can be viewed on a computer and printed therefrom.

Arrange for the survey to be carried out by a specialist company or for the camera to be operated by a person specifically trained in its use.

Carry out an acoustic vibration survey to ascertain the origin of any unusual or unacceptable noise.

#### 2530 INSTRUMENTATION

Supply all test instruments for the tests required. Ensure that all such instruments are calibrated and supply the current calibration certificate for each. Ensure that all such instruments comply with BS EN ISO 10012.

#### 2540 CERTIFICATES AND SCHEDULES

Ensure that all completion certificates, test certificates, schedules and reports required by the relevant BS or European or other standards are recorded and produced before hand over of the project.

Ensure copies of all completion certificates, test certificates, schedules and reports are included within the operation and maintenance manuals at completion of the project.

#### 2600 SCHEDULE OF INSTALLER'S SUBMISSIONS

##### 2610 General

For all systems, submit for the Contract Administrators comment:

- ~ Schedule of design submissions for any design items for which the contractor is responsible.
- ~ Installation and builder's work drawing production schedule.
- ~ Installation drawings, including schematics, wiring diagrams, and details, for all systems to be provided under the contract.
- ~ Associated builder's works drawings.
- ~ Technical submissions encompassing full technical specifications, details, pictures and installation details for the proposed equipment and any software, including manufacturer's details.
- ~ List of samples to be supplied, for agreement and indicated when and where each will be available for review.

## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ Samples of all equipment, fittings and devices to be supplied under the contract and as agreed.
- ~ All documentation necessary to comply with the requirements of The Electromagnetic Compatibility Regulations.
- ~ Testing, commissioning and completion documentation.
- ~ Details of instruction and training programme for the employer's staff in accordance with specification section A37.
- ~ Installation and commissioning programme
- ~ Installation method statements and proposals for the supply and installation of all equipment
- ~ Record drawings.
- ~ Schedule of recommended spares, consumables and special tools and as specified by specification A37.
- ~ Documents and drawings as otherwise required by the specification.

For the systems listed, submit the following for the Contractor Administrator's comment:

#### **2620 Low voltage distribution system**

At tender submission stage, provide details of the physical dimensions, weights and lifting instructions of all major LV systems components (eg main switchboard whole or split in sections) to the Structural Engineer.

For all LV assemblies provide details of BS EN 61439 verification documentation when panel assembly drawings are submitted for comment.

Provide copies of all type test certificates for all equipment supplied as part of the LV distribution system.

#### **2630 Lighting**

##### **2631 General**

- ~ selected manufacturer's design proposals
- ~ lighting system samples, if requested
- ~ lighting design input data and calculation output sheets
- ~ manufacturer's test certificates to verify compliance with Category TP(a) for luminaires specified with thermoplastic diffusers

##### **2632 Emergency lighting**

###### **Tests**

Fully test and commission the complete system at Practical Completion and provide all test results and printouts for inclusion in operating and maintenance instruction manuals.

Carry out testing including operational and system duration tests.

Operate the test functions for the emergency lighting and verify satisfactory operation of the test facility and of the emergency lighting.



## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

At such positions and quantum as agreed with the engineer, take suitable measurements of the illuminance level at the initiation of the changeover to emergency lighting and at the end of the rated duration of the system. Record these measurements accurately upon record drawings and present to the Contract Administrator for comment.

Verify that all batteries are in a condition of charging prior to and after duration tests. Prior to duration tests, ensure the batteries are fully charged.

#### Documentation

Complete and provide the design, installation and verification declarations, system certification and log book to the Contract Administrator and include copies in the operating and maintenance instruction manuals.

Comply fully with the requirements of BS 5266-1 and annexes in respect of ensuring sufficient information is provided upon the testing, commissioning and completion certificates.

Ensure the emergency lighting system log book is compliant with BS 5266-1, BS 5266-8 and annexes thereof.

#### 2640 Containment system

- ~ Cable and containment support system sizing calculations (additionally and specifically refer to BS 8519 annex E where appropriate)

#### 2650 Fire alarm system

- ~ details of panel construction
- ~ details of proposed field device locations
- ~ cause and effect diagram
- ~ zone diagram

Issue a signed copy of the BS 5839: Installation Certificate immediately on completion of the installation.

Issue a Commissioning Certificate within seven days of completion of commissioning, and ensure that the certificate clearly indicates any requirement for a period of soak testing.

#### 2660 Lightning protection system

- ~ soil survey report and earth resistivity measurements
- ~ specialist's lightning protection risk assessment determining protection level
- ~ specialist's design and installation drawings for the entire LPS and SPM clearly showing the location of every component of the system(s) and details of all fixings, including those to building structure, reinforcement of concrete, and building fabric
- ~ samples of all components that are visible after installation
- ~ details and specifications of all surge protection devices (SPDs) to be used within the installation

## SAINSBURYS RELOCATION, VICTORIS SQUARE WOKING

### MEP ENGINEERING SYSTEMS

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ all test results and a test certificate to confirm that the system, as tested, complies fully with the BS EN 62305
- ~ CAD record drawings

#### **2670 Services support and suspension systems**

Provide to the Contract Administrator at least 4 weeks before implementation, details of all proposed support and suspension systems to include the following:

- ~ details of any suspension or support systems specialist to be used and the nature of their engagement
- ~ details of the proposed systems and how they comply with this specification
- ~ details of system manufacturers' certification of proposed system components
- ~ details of any consultation and agreement with the structural engineer where required eg in respect of lateral loads imposed by catenary systems
- ~ details of physical layout and orientation of all systems elements

#### **2700 OPERATING AND MAINTENANCE MANUALS**

In addition to the general requirements in section A37 of this specification, provide the following:

#### **2710 Low voltage distribution system**

Submit operating and maintenance instructions manuals for:

- ~ distribution system
- ~ main switchboard
- ~ meters
- ~ testing and commissioning certificates
- ~ terminal imaging results
- ~ inspection details

Complete the respective distribution board schedules with measured test values for each site location, include copies at the respective item of switchgear and within the O&M.

Provide specific information as follows:

- ~ fault levels at all main, sub-main and distribution boards
- ~ final earth loop impedance values at equipment locations for all circuits
- ~ test information and records at installation completion. These are required for future use by the Client's electrical maintenance engineers in meeting their obligations on maintenance and periodic testing as required by BS 7671

#### **2720 Fire alarm system**

Provide operating and maintenance instructions for all items of equipment including:

- ~ control panels
- ~ monitoring devices

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#### V90 ELECTRICAL SERVICES – SELF-CONTAINED SPECIFICATION

- ~ autodiallers and modems
- ~ detection devices
- ~ manual alarm devices
- ~ alarm devices
- ~ backup systems
- ~ fault monitoring systems
- ~ system testing

#### 2730 Lightning protection system

- ~ a logbook for inclusion within the project O & M manuals, including full instructions for testing procedures and intervals, and with pages for recording test measurements and results

#### 2800 DIVISION OF RESPONSIBILITIES

The Main Contractor shall be responsible for all aspects of the MEP installation.

TH main Contractor shall liaise with Sainsbury's regarding specialist contractors engaged by Sainsburys to undertake works on the behalf.

Achieve proper control and function of systems, equipment and components.

Coordinate with other installers to ensure correct provision and inter-operability with other systems. Where required for the operation of the specified systems and in addition to the provisions set out in the service specific specification sections:

The electrical installer shall provide and install,

- ~ power supplies as required, for each and every item of equipment, including those items installed by other trades
- ~ all primary containment
- ~ all earthing and bonding
- ~ minor electrical heating

The IT installer shall provide and install,

- ~ data outlets
- ~ network switches
- ~ other network equipment
- ~ network cabinets
- ~ cabling
- ~ patching

The fire detection and alarm installer shall provide and install,

- ~ mains and extra low voltage relays and interfaces controlled by the fire alarm system

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The security installer shall provide and install,

- ~ CCTV recorders, monitors and PCs

The controls installer,

- ~ all controls/BMS/BEMS wiring points, and as required by the other trades. Eg. Metering outputs.
- ~ interconnection of controls/BMS/BEMS with the fire and security systems

**END OF SECTION V90**