Client:-
PRIVATE CLIENT

17 Branch Hill
Hampstead
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Section V

Electrical Specification

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Inspire Ref: IC-01016–D6

November 2016

DOCUMENT HISTORY RECORD

Doc No. IC-01016–D6

Title: 17 Branch Hill – Electrical Specification

Rev	Date	Description/Reason for Issue	Original	Checked	Approved
T1	4 Nov 2016	Issued for Tender	RE	SB	AS
T2	16 Feb 2017	Supply to vehicle turntable & vehicle charging point added. Surface water pumpstation previously called Rainwater pumpstation. Supplies to electric towel rail heaters added. Minor clarifications. Issued for Tender	RE	SB	AS

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SECTION V
PARTICULAR SPECIFICATION FOR THE ELECTRICAL SERVICES

5.1 Brief Description of the Works

5.1.1 Introduction

The development entails construction of a three-storey residence on an existing site, following demolition of the existing main building and removal of unneeded materials from site. The site has a significant slope.

Elements of the services installation works are required to be 'phased' to meet requirements and limitations due to the sequencing of works on the site, excavation for the lower ground levels and the floor plates being split across different levels. The timing and phasing of works shall be in accordance with the construction programme.

The buildings, their finishes, fixtures and fittings have been designed and shall be constructed to the highest of standards to enable delivery of a highly prestigious domestic residence to the Client.

It follows that similar standards have been applied to the design of the M&E Services installations and it is incumbent on the Mechanical and Electrical Subcontractors to apply similar standards of services installation and workmanship to the various systems to be installed.

Storey heights range Lower Ground level to First Floor level, and the building incorporates a central full height open hallway & stair case with feature glazing and skylights. The bulk of the services equipment is to be installed in a dedicated plant room at lower ground level, and the services installation design and routing strategy is driven by there being two distinct wings (nominally west & east) with little scope for interconnection across the central hallway.

The building will utilise concrete frame construction up to and including Ground floor and 1st floor slab, and steel frame construction for 1st Floor.

Understanding of the building will be aided by studying the Architect's sections as well as the M&E package drawings (which are predominantly plan views).

Care has been taken to try to ensure that the mechanical and electrical services have been co-ordinated with the architect's riser details and reflected ceiling plans. The appointed services contractor(s) shall also undertake due diligence to ensure that the installed mechanical and electrical building services are fully co-ordinated with these requirements.

While the Electrical & Mechanical Installations have, with the best intent, been fully designed and co-ordinated, it shall be the responsibility of the appointed M&E Subcontractor to work closely and in harmony with the Engineer and the Architect to ensure that the electrical design intent is fully transposed into an acceptable installation.

During the installation works the Subcontractor shall (or alternatively the Main Contractor may) take record photographs of the services installed within the areas to be concealed prior to concealment. These are to be provided within the Record information as a CD/DVD with suitable descriptions to enable the areas to be easily identified.

The associated tender drawings, in conjunction with this specification, shall be developed by the appointed services contractor into full working and co-ordinated installation drawings and these drawings shall be submitted for comment and approval prior to the commencement of any installation works being undertaken on site.

5.1.2 Obligations

M&E Subcontractor obligations shall include, but shall not be limited to:

- The planning/refining of service routes to the designs, with due consideration of the need to accommodate mechanical services and imposed constraints relating to available space and riser location. The M&E Subcontractor shall include for an element of flexibility in his electrical containment and/or cable routing.
- Considering on a regular basis, and providing to the Employer (at no longer than 3-monthly intervals), a risk register relating to any design elements of the work and to all site related activities.
- The provision of supplementary builder's work information to the Builder to allow the installations to be installed.
- Providing all final builders work requirements.
- Designing and installing all hangers & support systems for containment, cables and electrical equipment.
- Working drawings, Installation drawings and Shop Drawings.
- Provision of record drawings, test certificates and information for the O&M manual.

Pre-Testing and Commissioning

It should be anticipated that the works programme will require the early installation of some services that are to be concealed within the building fabric, i.e. within ceiling voids or wall spaces, and to which ongoing access during the works will not be available.

The appointed contractor shall ensure that pre-commissioning functional tests are undertaken on ANY services that are to be buried or concealed either below ground or within the building fabric. Where such concealed services are for connection to mechanical equipment requiring similar pre-commissioning or functional proving, the M&E Subcontractor shall allow for temporarily energising the power supply cables from a source arranged by the relevant mechanical subcontractor or specialist.

The pre-commissioning tests shall include the testing and recording of continuity, insulation integrity and, wherever possible, loop impedance and full functional circuit testing. All testing and pre commissioning works shall be completed prior to the completion of any concealment works within the respective walls or ceiling spaces being undertaken.

The contractor is to ensure that due allowances have been included and that sufficient time is allowed and programmed for the pre commissioning works to be undertaken and this shall also include the required tooling, power supplies, documentation, method statement and associated risk assessments required to complete the pre-commissioning works.

The contractor is to make due allowance, within his pre commissioning works, to allow for the Client's Representative to witness any such testing and commissioning and to also allow for any re-commissioning works that are deemed necessary in the event that the attempted tests fail to produce a compliant installation or to satisfy the Client's representative.

Failure to comply with the above requirements may require the buried services to be exposed / uncovered to enable the required inspection and commissioning works to be undertaken and the associated costs of these works may be placed onto the services contractor.

All pre- testing / commissioning works shall utilise calibrated instruments to ensure accurate readings are taken and recorded. The contractor is also to ensure that the same testing equipment is utilised when and if any witnessing / inspections by the client's representative are to be undertaken.

The contractor is to take due allowance that any pre-commissioning tests are to prove that the buried systems shall function as per the design requirement but will not be accepted as the final commissioning information until the full and completed systems have been tested and commissioned correctly.

5.1.3 Overall Project Health & Safety File

The Employer will maintain a Health and Safety File for the overall project. This will be produced and administered by the Principal Designer named for the purposes of the CDM Regulations 2015.

The Health and Safety file will be revised periodically to reflect the latest risk information available to the designers and installers of the various works, and the M&E Subcontractor is required to both:-

- Regularly review the contents of the Health & Safety File, in order that he benefits from knowledge of risks identified by other members of the Design and Construction Teams, and:-
- Maintain his own Design Risk register, and submit copies to the Principal Designer after any significant piece of design work is complete and at least every 3 months, in order that risks he identifies are made available to other members of the teams and for future reference.

5.1.4 Scope of Work

The Electrical Services Installations shall comprise the supply, delivery, installation, commissioning and testing of the following integrated systems;

- Incoming Electrical Supplies
- Electrical distribution
- Small power installation, including provision of power to mechanical plant, CHP system, dumbwaiter (trolley hoist), ***vehicle turntable,*** gate mechanisms, security shutters and specialist equipment
- Lighting installation and lighting controls
- Security Alarm (containment & physical cable installation)
- Fire detection and alarm (containment & physical cable installation)
- Communications & Data (containment & physical cable installation)
- CCTV, Door Access (containment & physical cable installation)
- TV/Satellite signal distribution (containment & physical cable installation)
- Audio Visual system (containment & physical cable installation)
- Home Automation (Liaison, integration with lighting control pads)
- Lightning protection

- Earthing and bonding
- Testing and commissioning

Note that the Mechanical & Pool plant installers will be keeping clear an accessway within the plant room to facilitate future replacement of major items of plant (even if the steel stair outside must be dismantled for the purpose). The electrical, AV and security installations shall be effected and cabled so as not to compromise this strategy.

Specialist Design Services

It shall be the responsibility of the M&E Subcontractor to supervise and liaise with the following Specialists to ensure complete co-ordination of the specialist packages of work with other trades.

- Luminaires; these shall be as specified by the Lighting Designer but shall be purchased and installed by the M&E Subcontractor.
- Lightning Protection System, this shall be designed, supplied, installed and commissioned by an agreed specialist.
- Fire Alarm
- Security (Intruder alarm, security screens & CCTV)
- Door Entry, Audio-Visual systems & Whole house automation for :-
    - Audio to multiple rooms
    - Distributed HD TV/Satellite, Video/Home Theatre
    - IP Gateway and data/communications systems
    - Automatic blind control
    - Lighting control to multiple rooms
    - Mechanical systems interface
- The Control of all systems indicated below shall be within the Mechanical Subcontractor's package, but the system shall interface with the electrical installation and with the Whole House Automation/AV package :-
    - Comfort cooling & heating systems
    - Mechanical ventilation
    - Towel Rails
    - Domestic Hot Water
    - CHP (Combined Heat & Power) system
    - Metering & Data Logging

Coordination with Separately Appointed Specialist contractors

It shall be the responsibility of the M&E Subcontractor to liaise with the separately appointed suppliers/installers of the following specialist equipment to ensure complete co-ordination of their specialist packages of work with other trades. The specialists will be employed separately by the Employer or Main Contractor. This list is not exhaustive, and the electrical scope of works includes containment or installation services for some of the items listed.

- Pool plant, spa and Pool Hall Air Handling installation
- Dumbwaiter Supplier/Installer
- Gate, ***vehicle turntable,*** kitchen installation, kitchen extract, ***vehicle charging station,*** etc as featuring in the main contract works.

5.2 Incoming Electrical Supply

The M&E Subcontractor shall be responsible for liaising with the Electricity Utility Company (UKPN) for the installation of the incoming electrical supply. The Client has enquired for the supply connection, the application having been made for 75kVA. Details of the application and of the payment made may be obtained by request through the Contract Administrator. ***The reference number allocated by UKPN to the quotation is 3500026764, and the enquiry reference was 8500045439.***

It will be necessary to confirm the location for the Intake, Meter and primary distribution Board with the Utility Company prior to installation. (Proposed entry route is from the north east, with intake apparatus located in the Lower Ground plant area - please refer to the Electrical & plantroom Drawings). ***The M&E Subcontractor shall assist the Main Contractor with advice in respect of laying cable sleeves/ducts for the Utility Company power cables, particularly with regard to use of steel sleeves where the cables sleeves are to be encased in concrete or within the plantroom (the former condition which might arise if the cable cannot be laid deep enough to pass entirely beneath the foundation of the vehicle turntable).***

The M&E Subcontractor shall allow within his tender for all attendance on the Electricity Utility Company, and for co-operation in respect of inspections, connections, obtaining MPAN references and meter installations. He shall also allow for ensuring sufficient incoming ducts have been provided by the Main Contractor and confirm he is satisfied that these are water tight and safe.

5.3 Distribution

The M&E Subcontractor shall allow within his tender for a metalclad Three Phase Main Distribution Board (proposed location is within the plant room) from which individual supplies shall be fed to main items of Plant and to individual metalclad Distribution boards elsewhere in the building. Specific attention shall be paid to any adjustable earth leakage device requirements and settings, as may be indicated in the schedules or on the drawings.

At the main distribution board and/or at other suitable points, sub-metering shall be provided on outgoing circuits for recording the energy consumed by the main plant board, pool plant, small power boards, lighting boards, ancillaries board and all mechanical plant. The metering is envisaged as being at the main distribution board but, for small power boards and subject to the Contract Administrator's approval, it may be at the respective distribution boards. The meters shall be no worse than Class 3 accuracy rating and shall include a signalling card (M-bus, Modbus or other agreed protocol) or impulsing contact (details to be coordinated with the Controls Specialist appointed under the Mechanical Works) so that meter readings can be transmitted to a central location, summated automatically and processed in a form which allows for storage/display on a desktop computer and ongoing management of the property's energy use.

Note the main incomer shall be fitted with a multi-function meter, of no worse than Class 1 accuracy rating, arranged as a check meter on the incoming Utility Supply. The meter shall provide for local display of at least the following: kW, kVA, Volts, Amps (individual phases & neutral), cumulative kWh & cumulative kVARh. In addition, it shall incorporate signalling outputs at dedicated terminals to provide metering data for remote summation/processing/data logging by the Controls Specialist appointed under the Mechanical works. The output shall be either a serial data output (such as M-bus or Modbus protocol) or impulsing kWh contact, and the details shall be coordinated with the Controls Specialist.

For incorporation of an electrical infeed from a small CHP plant on the site, the main distribution board shall be constructed to accommodate such CHP plant as may be installed under the mechanical works. The final requirements are to be co-ordinated by the M&E Subcontractor, but may be expected to involve:

- Fitting of a second incoming device (for the CHP unit and envisaged as a 4-pole 32A mccb or a 4-pole switch-fuse unit with 3 x 32A fuse and 1 by link)
- Installing 3 x metering CTs free-issued by the CHP specialist, or alternatively, providing removable busbar links on the incoming section of the board onto which metering current transformers (CTs) can be installed by the CHP specialist.
- Fitting 3 x 6A fuseholders and 1 x 6A link for a metering circuit required by for the CHP installation,
- Provision of suitably labelled terminal blocks in agreed positions on the main distribution board for cable terminations by others (the CHP installer) in respect of metering & power connections for the CHP plant,
- Any CT installed but not in use shall be short circuited at the terminal block and earthed on one leg.

The manufacturer of the Distribution Boards shall be Schneider, MEM, or equal and approved. (Tenderers may note however that Distribution Boards designed to serve specifically Lighting will be supplied by others – these will be free-issued to the Contractor for installation and cable termination).

All sub main cabling shall be XLPE/SWA/LSF and the M&E Subcontractor shall ensure that segregation is maintained: power cables (and power wiring) shall be not less than 300mm from telecommunications, data or audio visual cabling except where final outlets necessitate otherwise (notwithstanding that under BSEN 50174-2 and the other standards identified in clause 444.1 of BS 7671, IET Wiring Regulations, 17th Edition, 2008 and incorporating amendment 3 (2015), separation may seem acceptable at 200mm, or less where accepted screening measures are applied).

Surge protection for the power services shall be installed in compliance with17th Edition IET Wiring regulations BS 7671 (reg 534) and to match the design parameters used in the lightning protection risk assessment calculation. It is envisaged a surge protection device will be located adjacent to the electricity intake point or included within the main distribution board – others may if required be incorporated in the sub-distribution boards for lighting and small power.

5.4 Power for Mechanical/Fixed Plant

Power supplies shall be provided to all items of Mechanical plant required for the project, including those not covered directly by the M&E Works.

The design and installation shall include for

- a primary (central) supply to plant in the Lower Ground Plant Room
- dedicated cabled supplies for the dumbwaiter and the pool plant
- further (distributed) cable supplies to other plant & equipment (i.e. systems/ plants which are physically remote from the plant room, eg condensers & fans)
- pumping stations, as may be specified under the drainage works (eg foul water)
- supplementary supplies, through the small power wiring system, for minor items of distributed mechanical, sanitary equipment, cavity drain pumps, CHP ancillaries etc.

In respect of the primary plant supply, this shall be to the Plant MCCP (mechanical control panel) as installed in the Lower Ground level plantroom by the BMS/Controls Specialist working under the Mechanical Contractor. The MCCP energy consumption shall be

metered at the relevant outgoing way of the Main Distribution Board. The M&E Subcontractor shall liaise with the BMS Specialist to confirm the MCCP includes a lockable incoming isolator, onto which he shall terminate his supply cable (XLPE/SWA/LSF).

In respect of the pool plant supply, this shall be to a lockable 4-pole isolator to be located in the pool plant area of the plantroom in co-operation with the separately appointed Pool Specialist Contractor. The pool plant energy consumption shall be metered at the relevant outgoing way of the Main Distribution Board.

In the case of the dumbwaiter (trolley hoist), the M&E Subcontractor shall supply and install a lockable isolator located to the requirements of the respective Installer (envisaged 4-pole with earth terminal brought out).

In respect of other plants, where physically remote from the intake room and largely self-contained, these shall be supplied by means of armoured cable (XLPE/SWA/LSF) to lockable isolators supplied and installed by the respective Mechanical Installer. Other plant, for the purpose of this section, shall include condensers, fans, heat recovery units, foul water pumpstation, **surface** water pumpstation, kitchen extract fan (if applicable), ***rain water harvest system***, etc.

The Electrical works shall include co-ordination and installation of local power supplies to suit the needs of ancillary mechanical equipment and specialist supplied equipment. Under this category, installation of local isolators, fuse connection units and/or flex outlet plates is envisaged, with supplies derived from local power & lighting boards. Unless otherwise indicated, there will be no need to meter such individual local supplies (it having been assessed that any local distribution-board metering will suffice).
The equipment likely to be covered by this requirement includes fan coil units, cavity drain pumps, water treatment devices, dedicated toilet extract fans, projector screen mechanisms, CHP ancillaries, trace heating, leak detection systems, Irrigation controller, water heaters (back-up immersion elements), boiler controls, tubular space heaters, sanitary fittings, ***vehicle turntable, vehicle charging station, ~~garage door~~***, Audio-Visual rack, electrical underfloor heating, motorised valves, manifold units, coldroom, ***electric towel rail heaters*** etc. The isolator or connection point for each item shall be suitably weatherproof for the intended location (minimum IP54 for outdoors). The final connection to such equipment will be the responsibility of the mechanical, plumbing or other specialist installer.

The various mechanical, pool or other equipment installers shall be responsible for supplying and connecting the cable or flexible conduit/wiring from the isolator to the respective plant panel or drive. (Where the MCCP or plant panel includes an incoming isolator, rather than a separately mounted isolator, the M&E Subcontractor shall terminate the supply cable to the terminals of the incoming isolator).

Power supplies to sump pumps (foul water or ***surface*** water) and cavity drain pumps shall be monitored for loss of supply & undervoltage. Alarm contacts shall be made available for connection into the BMS system. If the facility is not incorporated within the respective sump pump or cavity drain pump controller panel, the M&E Subcontractor shall install a monitoring relay at an agreed location (near the pumpset unless otherwise agreed) and wire it to the pump circuit to detect if the supply is removed or lost, and a volt-free changeover contact shall be wired to terminals on which the BMS Specialist may terminate his alarm detection cable.

In respect of cavity drain pumps, and on the basis that connections will be made via fused connection units located at positions to be agreed with the Architect, the M&E

Subcontractor shall fit a local fuse of the rating stipulated by the Supplier (selected according to pump model number).

In respect of the vehicle turntable, the electrical works includes only the provision of a power supply point (13A socket unless otherwise agreed) and the sleeves/cableways to suit the interconnecting wiring. [The specialist will install, cable and connect his control panel (envisaged in the lower ground plant room), motor drives & LED lights, emergency stop button, Wi-Fi antenna etc.]

For an electric vehicle charging station (by Employer or others), the electrical works shall include the provision of a 32A 4 pole isolator (minimum IP54 enclosure) to be located in the carport.

In respect of equipment in the Lower Ground level plantroom, the M&E Subcontractor shall not be responsible for the power cabling between the MCCP and any items of equipment fed from it (nor for any controls cabling). Neither shall he be responsible for any containment required for such field wiring (power and controls) unless so indicated on the tender drawings or subsequently agreed. These aspects of the installation fall within the Controls package, and will be undertaken by the BMS/Controls Specialist.

Control/commissioning of all mechanical plant is to be by others.

Cable calculations/sizing is to be provided for approval prior to installation if cable lengths or load allowances are not as shown within the Distribution Board Schedules.

5.5 First Fix Items

The works shown on the tender drawings requires the supply and installation of electrical services and/or containment to be installed in some instances in concrete slabs/stairways and in other cases in readiness for the floor insulation and then underfloor heating prior to the floor screed. The M&E Subcontractor shall make due allowance for attendance and materials to allow these works to proceed in accord with the Main Contractor's programme. These points/conduits shall be set out and installed by the M&E Subcontractor (shuttering by others) and, where relevant, shall be incorporated into the underfloor heating layout to ensure that the heating pipework provided does not restrict the installation of the floor outlet boxes/luminaires. Refer also to sections on small power and lighting.

Any damp proof membranes [DPM] shall be supplied and installed by the appointed main contractor and these shall be laid prior to the underfloor insulation.

Any services that are required to be installed within the floor insulation layer shall be laid directly onto the floor DPM but shall not be fixed through it.

The floor insulation shall be trimmed 'on site' to suit the pre-installed services and the Floor Screed supply and installation shall be carried out by others.

All conduits shall be metal flexible Kopex or equal and approved.

5.6 Small Power

5.6.1 General

The Electrical Tender drawings show indicative arrangements for small power outlets. The locations shown upon the drawings for equipment are liable to change due to outside factors and the M&E Subcontractor is to allow in his tender price for all of these locations being altered by a distance of 3 metres from those shown. Before commencing

installation, the M&E Subcontractor shall refer to the latest drawings issued by the Architect and the Interior Designer and, where outlet positions vary from those on the Tender drawings, the Architect's and Interior Designer's drawings shall take precedence over Tender drawings. Any queries however should be directed to the Contract Administrator (CA).

In addition, the M&E Subcontractor shall provide power to any/all items of mechanical plant, controllers, security alarms, fire alarms, audio-visual equipment, access control, entry-phones, doorbells, water-softeners, wine coolers, kitchen & laundry appliances, bar fridges, coldroom, sanitary ware, etc as needed to make operable any of the equipment being supplied under the M&E scope or under that of nominated specialists (whether or not such points are indicated on the issued drawings/schedules). All final circuits shall be arranged to meet compliance with BS7671.

All cabling shall be either single core/multi-strand or twin-and-earth LSF. Wiring systems and containment shall provide for physical protection of conductors per BS 7671, IET Wiring Regulations, 17th Edition, 2008 (clause 522.6 of the version incorporating amendment 3 (2015)). Subject to other requirements , conduit selections shall include for no less than PVC Conduit where concealed, or galvanised steel conduit where exposed. Where cabling is installed in walls and is not otherwise physically protected, metal capping shall be applied. **Any exposed conduit shall be approved by the CA prior to installation.**

Primary containment has been shown on the drawings for the final circuits cabling. This is required in ceiling voids and within risers. It is at the contractor's discretion whether further containment is required, however in all events the cabling system shall be rewireable. Where further primary containment is not provided, cable clips/ supports shall be used so that no cables are left unsupported.

Certain areas within the building incorporate electrical floor outlet boxes and/or in-floor uplights/external feeds, floor temperature sensors, etc. These points/conduits shall be set out/installed by the M&E Subcontractor (shuttering by others) and shall be incorporated into the underfloor heating layout to ensure that the heating pipework provided does not restrict the installation of the floor outlet boxes/luminaires.

In escape routes the M&E Subcontractor shall design and install adequate supports/ fixings to prevent cables falling in the event of a fire (refer BS7671 – IET Wiring Regulation 521.11.201).

Separation of 300mm shall be maintained between mains power cable and telecommunications, data or audio visual cabling except where final outlets necessitate otherwise (notwithstanding that under BSEN 50174-2 and the other standards identified in clause 444.1 of BS 7671, IET Wiring Regulations, 17th Edition, 2008 and incorporating amendment 3 (2015), separation may seem acceptable at 200mm).

In respect of containment, the M&E Subcontractor shall allow for conduit routes to permit the placing of thermostats on walls and temperature sensors within floor surfaces to serve the requirements of the underfloor heating installer.

Any Tray/Basket installed shall be cross bonded.

Outlets for the AV ***rack*** equipment are anticipated as being grey 3-pin sockets and plugtops to BS EN 60309 (Commando style), but the outlets (quantity and type) shall be agreed with the AV Specialist and Architect prior to ordering.

The M&E Subcontractor shall supply all accessory plates and, in a bid to avoid colour variations between batches, he is required to supply also those plates required for data, AV and security. (But, refer to section 5.10, excluding the media/data plate inserts & modules). The M&E Subcontractor shall free-issue to the AV and Security Contractors in time for their respective 2nd fix works all relevant accessory plates. Before ordering, the M&E Contractor shall agree with the Architect and the specialist Contractors the make, range, types and final quantities of face plates required. The Architect shall, at the time, be invited to instruct any spare units he believes may be required.

Unless otherwise instructed, light switch plates (other than where touch panels or push-button pads are used) shall be of Buster and Punch brand (B&P), metal plates, as indicated in the Concept proposal sheet appended in IC-01016-D18 – Electrical Accessories. Socket outlets and other accessories shall be from the Focus SB Horizon Range http://www.focus-sb.co.uk/en/Flat-Plate-Ranges/horizon :

Finishes and colour detail shall be selected against the following principles:

Location	*Manufacture/Range*	*Finish*
Front of house (lounges, study, bedrooms, dressing rooms, hallways, lobbies, boot room, gym) and all locations other than below	As below/metal finish	a, b
Playroom (room LG.02)	As below/metal finish	c, d
WC (room G.03)	As below/metal finish	c, d
Study (room LG.03) on Joinery units only	As below/metal finish	d
Study (room LG.03) generally (excl joinery)	As below/metal finish	a, b
AV Cupboard	MK / Logic Plus white plastic	e
Outlets if located within risers (out-of-sight)	MK / Logic Plus white plastic	e
Plantroom	MK / Metalclad Plus	f
Outdoor, IP rated	MK / Masterseal	g

Where

a =	Switch plates (B&P) to be finished in matt white with brass toggles (toggle numbers as required).
b =	Socket outlets & related accessories (Focus-SB) to be finished in matt white with white inserts.
c =	Switch plates (B&P) to be finished in satin black with brass toggles (toggle numbers as required).
d =	Socket outlets & related accessories (Focus-SB) to be finished in satin black with black inserts.
e =	Socket outlets and related accessories to be of white plastic, with top edge chamfered and other edges rounded. Switches to be double pole.
f =	Light switches, socket outlets & related accessories to be of steel, surface mounted, grey finish with white inserts. All edges chamfered, rounded corners, double pole switches. [Double socket outlets to be of type with outboard switches . eg cat no K2945ALM]
g =	Socket outlets, switches etc rated IP56 and impact resistant. Envisaged polycarbonate enclosure.

The M&E Subcontractor should anticipate that samples will be required, and he shall contact the respective suppliers and make arrangements for samples to be delivered to and later collected from the Architect.

Electrical connections to any ***towel rail heaters***, bidets, special TVs or other equipment in bathrooms shall be effected via switched fuse connection units mounted outside the bathroom with flex outlet plates positioned to suit the final connections within. ***In the case of electrical supplies to towel rail heaters, the fuse connection units shall incorporate indicator lamps to show when the load is energised.***

Where wall-mounted televisions are to be installed in areas other than bathrooms, the M&E Subcontractor should allow for installation of the power supplies on the basis of using a switched fused spur unit at normal socket outlet level to enable isolation of the power supplies to the TV, with a 13A outlet on a non-standard box fitted behind the TV set (through which hidden box the signal cables will also be routed). Note the requirement to provide for an overhead projector point in the playroom ceiling (though it is envisaged the projector itself will not be installed).

5.6.2 Kitchen Fit-out

Power supplies shall be installed for all items of kitchen equipment, and to general-purpose 13A switched socket outlets. The layouts indicated on the issued drawings might change when the kitchen design and equipment list for the kitchen is finalised. The M&E Subcontractor shall obtain from the Main Contractor the final kitchen design drawings and power/rating requirements before commencing installation of power circuits.

All 13A switched socket outlets or fused connection units shall be of make/model as indicated in the section above, it being noted that a higher grade finish is envisaged for 13A socket outlets and fuse connection units installed above worktops/counters than is required for those installed out of direct sight (such as behind full-height appliances or below-counter appliances (e.g. wine coolers & dishwashers). All kitchen outlets and accessory plates shall be installed with a suitable seal to prevent moisture ingress.

For primary items of kitchen equipment, isolators shall be set flush or semi-flush (into walls to be agreed with the Architect or within a designated cupboard compartment in the kitchen) in order that the electrical connections to the items of equipment may be routed via concealed sleeves & outlets to the respective equipment connection box. Isolator locations and finishes shall be agreed with the Architect. For under-counter appliances or full height appliances where the final outlet is not directly accessible, supplies shall be routed via switched fuse connection units or isolators similarly located in a cupboard or on tiled walls and subject to Architect's agreement. In all cases, where isolators, fuse connection units or sockets are provided to serve specific items of kitchen equipment, the plates shall be indelibly engraved to identify the appliance or item of equipment served.

5.6.3 Laundry Fit-out

Power supplies shall be installed for all items of laundry equipment, and for general-purpose 13A switched socket outlets as indicated on the tender drawings. Before commencing his electrical installation, however, the M&E Subcontractor shall seek verification from the Main Contractor that washing machines have been or are being ordered to suit the single-phase connection assumed and as indicated on the circuit schedules. If not, the Electrical Contractor shall propose revised circuiting, connection arrangement, cable size and protective devices for approval by the Contract Administrator.

All 13A switched socket outlets or fused connection units shall be of make/model as indicated in the section 5.6.1, it being noted that a higher grade finish is envisaged for

13A socket outlets and fuse connection units installed above worktops/counters than is required for those installed for below-counter connection of appliances and out of direct sight (such as washing machine & tumble dryer).

5.6.4 Blind Controls & Shutter Controls

Provision shall be made for installation & control by others of security shutters and automated blinds (or curtains).

The windows for which these facilities are required are shown on the tender drawings, but the M&E Subcontractor shall check the Architect's latest drawings before commencing his installation for these, and shall treat the Architect's latest drawings as superseding the tender information.

Notwithstanding that 230V fused connection units are indicated on the drawings as being required adjacent to the windows, the M&E Subcontractor shall coordinate the final supply points and containment requirements with the Interior Designer, the Security Specialist and the AV Specialist. This is especially important for the security shutters, where it should be anticipated that the system will include battery back-up and that the 230V supply points may be at agreed locations remote from the shutters. Similarly, it is envisaged that for automated blinds the AV Specialist will design for operating power and control, and may need 230V fuse connections remote from windows or may even feed the power from the lighting boards (in which latter case the circuit ways indicated on the power boards may be left as spare equipped mcb ways).

The M&E Subcontractor shall make due allowance for installing a minimum of two x 3 core-and-earth cables from the relevant Lighting Panel to EACH window where automated blinds are indicated on the issue drawings. The cabling requirement is to be confirmed with the AV Specialist prior to installation.

5.7 Internal Lighting

The lighting scheme for the house has been designed by a specialist lighting designer (Re:Light Limited). The scheme is based on a mix of luminaires, controlled mainly by 0-10V dimming and phase dimming systems. Layouts and luminaires have been specified by the specialist.

The schedules issued with this tender include (at document D13) a Lighting Circuit and Controls Schedule, produced to allocate luminaire groups and loads to wiring circuits and protective devices, together with the base schedules & specifications generated by the lighting design specialist (at document D17).

The Lighting scheme depicted on the tender drawings may be updated by the Lighting Designer when a number of the luminaire selections are confirmed or better defined. A provisional sum is allowed in the tender pricing schedule to cater for this and for any instructed purchase of luminaires where selections are currently marked 'to be advised'. In the event that any revised light fittings draw loads exceeding those indicated in schedule D13, the M&E Subcontractor shall check that the designed cable size is still adequate, and if in doubt should refer the query to the Engineer.

The split of responsibility for the lighting installation is:

- The lighting design and selection of luminaires/control is by the specialist.
- The AV Specialist will supply free-issue lighting boards/control panels for installation by the M&E Subcontractor.
- The M&E Subcontractor shall procure, install and connect the luminaires and all necessary power and signal wiring back to the respective Lighting Boards. He shall obtain the latest version of the Lighting Designer's drawings,

schedules and shall comply, in conjunction with this specification, with the requirements of the Lighting Design Specialist's specification.
- The M&E Subcontractor shall allow for meeting the Lighting Designer and Interior Designer at site, to agree the location and access arrangements for LED driver units and any remote emergency packs.

In respect of boundaries for lighting control, the M&E Subcontractor shall check that he and the AV Specialist have co-ordinated their installations and test programmes so that:
- The lighting boards being manufactured are metalclad
- Individual RCBO's shall be provided by the AV Specialist for each dimmable or switchable circuit and each group of 0-10 volt circuits at the lighting control panel.
- Cabling of lighting power cables and associated control cables is the responsibility of the M&E Subcontractor, though he shall take account of any cable types specified in the Lighting Designer's information,
- Emergency lighting is incorporated correctly in the respective works, including arrangements for testing the emergency fittings,
- Testing of lighting cables for continuity and insulation integrity shall be done by the M&E Subcontractor before connections are made in the lighting boards/panels by the AV Specialist and commissioning performed by the AV Specialist.

Certain areas in the building (notably the central hall/atrium) require that light fittings be recessed into concrete or into the underside of stairs, or set into walls/floors as skirting or uplighters. The M&E Contractor shall allow for all work required in assisting the Main Contractor to cast pockets and concealed conduit-ways for the fittings, drivers and cableways, and he shall coordinate all such points with the underfloor heating layouts to ensure that the heating pipework provided does not restrict the installation of the floor outlet boxes/luminaires.

Some areas are to be constructed with no deliberate ceiling void (particularly the 1st Floor), and for such areas the M&E Subcontractor shall design his containment/wiring routes to run as far as can be achieved within the spaces between joists to minimise drilling or cutting joists/roof supports/ceiling supports etc. Where services must cross joists, holes or notches may be allowed, but each shall be subject to the approval of the Structural Engineer (who will stipulate general principles such as keeping notches as near as possible to the supported ends of joists, and drilling holes at mid-depth of joists). This requirement applies to his own power and lighting installation together with that of appointed specialists for whom he installs cabling, e.g. security, CCTV, AV, fire alarm etc.

For lighting in furniture units, cabinets or wardrobes, the M&E Subcontractor may assume that the furniture item will be supplied complete with built-in lighting, and with sensor-switches or door-switches if applicable. The Electrical Contractor shall therefore be required to coordinate with the Main Contractor the connection location/connection method (which unless otherwise agreed shall be via a 6 Amp lighting socket and matching plug top) and to make the connection for the furniture installer, using the cables provided in the joinery units by the manufacturers.

Emergency lighting shall be provided in selected areas as indicated on the issued drawings, to illuminate escape routes and to provide a measure of safety (anti-panic) lighting. The emergency lighting installation shall be installed and tested in accordance with BS 5266 and shall provide 3 hour operation in event of mains failure. The M&E Subcontractor shall select and install cable with the requisite number of cores to operate the relevant emergency fittings (whether integral to general fittings or stand-alone) and he

shall propose, for agreement by the Architect, the locations of emergency test key-switches.

Where touchscreen lighting control panels or television connections require back boxes which are of non-standard depth or size, these will be free issued by the AV specialist to the M&E Subcontractor and installed by the M&E Subcontractor.

All final circuits shall be arranged to meet compliance with BS7671.

Where additional technical information is required during the tender period the tenderer is invited to make contact with the relevant lighting designer/specialist, and should copy his query to the Quantity Surveyor and the Engineer. Lighting designer contact details are :-

- Lighting design – Re:Light Limited, Bristol BS3 1WS, contact Mr Dominic Triggs, Tel: 01179 633404 / 07779 162505.

The Architect and Interior Designer will specify mounting heights for switch-plates and accessories to which operating access is required. In the event that none is specified, switch-plates and accessories shall be mounted so their centre-line is between 450 and 1200mm above finished floor level (to satisfy Building Regulations Part M).

All cabling shall be concealed within the fabric of the building with the exception of plant rooms, for which locations the cabling shall be run in galvanised conduit or trunking. Where cables are concealed within the fabric of the building they shall run within the 'safe zone' of the wall (as described in BS7671 IET Wiring Regulations, clause 522.6.202), and shall be RCBO protected or physically protected by earthed metallic screen, conduit or other mechanical barrier method.

In respect of DALI lighting if applicable, the Contractor may elect whether to install separate power and signal cabling (both insulated for mains voltage levels) or to install a combined power+signal cable, such as a 5-core cable (e.g. Belcom 5 core 'EasyStrip' 300/500V LSZH Firefighter wiring cable). All other cabling shall be either single core/multi strand or twin and earth LSF. Containment to final outlets and switches shall be via PVC Conduit where concealed, or galvanised where exposed. **Any exposed conduit shall be approved by the Contract Administrator prior to installation.**

Primary containment has been shown on the drawings for the final circuits cabling. This is required in ceiling voids and within risers. It is at the contractor's discretion whether further containment is required, however in all events the cabling system shall be rewireable. Where further primary containment is not provided, cable clips/ supports shall be used so that no cables are left unsupported. Any tray/basket installed shall be cross bonded.

In escape routes the M&E Subcontractor shall design and install adequate supports/ fixings to prevent cables falling in the event of a fire (refer BS7671 – IET Wiring Regulation 521.11.201).

Note that a requirement will exist for connecting lighting and audio-visual signal cables to the Pool Plant panel in the lower ground plantroom or a junction box in the undercroft in order that underwater effects can be utilised in the respective schemes. Only the containment and cable installation for this link falls under the M&E Subcontractor's work.

Separation of 300mm shall be maintained between mains lighting cables and telecommunications, data or audio visual cabling except where final outlets necessitate otherwise (notwithstanding that under BSEN 50174-2 and the other standards identified in

clause 444.1 of BS 7671, IET Wiring Regulations, 17th Edition, 2008 and incorporating amendment 3 (2015), separation may seem acceptable at 200mm).

The internal lighting controls are expected to require setting in at least 3 areas (pool and others) to maintain low level lighting or to receive signals from (and operate automatically in conjunction with) the internal CCTV or intruder detection systems. The Contractor shall ensure cabling is installed for such trigger signals and prompt the AV Specialist to include for these link facilities in his lighting panel commissioning.

5.8 Emergency Lighting

As described above, Emergency Lighting shall be provided to serve selected areas. Where emergency packs are integral to a luminaire serving as part of the normal lighting scheme, the pack shall be factory fitted by the manufacturer.

5.9 External Lighting

5.9.1 Facade/Security Lighting

The M&E Subcontractor as part of his tender shall allow for the supply and installation of lighting in lightwells and at the access doors, as indicated on the drawings.

The luminaires will be served from the boards which also serve the internal lighting, and be switched/dimmed according to regimes programmed by the AV Specialist into the lighting controls.

The facade/security lighting controls are expected to receive signals from (and operate automatically in conjunction with) the CCTV and intruder detection systems. The Contractor shall ensure cabling is installed for such trigger signals and prompt the AV Specialist to include for these link facilities in his lighting panel commissioning.

The split of responsibility shall be as for internal lighting, i.e

- the control panel will be free issued to the M&E Subcontractor for installation,
- luminaires will be selected by others,
- the luminaire procurement and all other parts of the installation will be the responsibility of the M&E Subcontractor.

5.9.2 Landscape Lighting

A landscape lighting scheme for the garden and driveway is to be developed by and will be described in the Lighting Designer's drawings and schedules.

Before commencing installation, the M&E Subcontractor shall obtain from the Lighting Designer the latest layouts and luminaire/control requirements. The M&E Subcontractor shall review the landscape lighting requirements against any circuits, cables and controls originally allowed, and will be required to agree with the Contract Administrator a price for the luminaires and supplementary work/materials. Any resulting instruction will be handled against the provisional sums allowed.

Outgoing cabling for landscape lighting shall generally be of armoured cable (XLPE/SWA/LSF) but final connections may be of weatherproof PVC construction. Proposals for cabling types, connection boxes and any jointing/connecting of cables shall be submitted for the approval of the Contract Administrator. Landscape lighting cables shall, where they pass beneath paths, paving or the driveway, be installed complete with ducts.

The landscape lighting controls may be expected (in part) to receive signals from (and operate automatically in conjunction with) the CCTV and intruder detection systems. The

Contractor shall ensure cabling is installed for any such trigger signals specified and prompt the AV Specialist to include for these link facilities in his lighting commissioning.

The split of responsibility shall be as for internal lighting, i.e

- the control panel will be free issued to the M&E Subcontractor for installation (expected to be the same panel as for internal lighting),
- luminaires will be selected by others,
- the luminaire procurement and all other parts of the installation will be the responsibility of the M&E Subcontractor.

The M&E Subcontractor shall allow for meeting the Landscape Designer, Lighting Designer and Architect at site, to agree the location and access arrangements for LED driver units

5.10 Audio-Visual/Home Automation

The M&E Subcontractor will be required to co-operate with an Audio Visual (AV) Specialist Contractor. The AV Contractor is to be separately appointed to design and install a full audio visual system and a full home automation/technology system for the house and to interface it with the BMS (controls) system.

A separate tender pack has been prepared by others and is issued herewith in order that the Tenderer may establish the scope and extent of the AV Works, but it may be expected to comprise at least the following:

- Integrated AV system for distribution of satellite TV and other video signals,
- multi-room audio (with audio feed also to the pool),
- Rack mounted Crestron controller and video & audio equipment,
- control by touch-panel controllers (integration with lighting controls, security, CCTV etc),
- Satellite dish at roof level or on an external wall.

In principle, the AV system will be based on a rack mounted Crestron multi-room system with control via touch screens in selected rooms, with central amplifier linked to the Crestron system to feed audio to speakers in all rooms of the house other than hallways, storage and plant areas. It is envisaged that the main rack is to be located within the Lower Ground A.V. room, and that all AV cabling will be run from or to this room.

It is envisaged that home automation will be provided to control directly, or in conjunction with the security system or the BMS system described under the mechanical works (refer clause 5.17 and Document D12), at least the following:

- Control of lighting, including signalling to pool lighting,
- Operation of window blinds,
- Operation of security shutters,
- Interface with the BMS for changing setpoints/behaviours of the heating and other environmental services, and for identifying when/if any alarm conditions are received by the BMS system.

The M&E Subcontractor shall allow for all necessary containment/back-boxes/power supplies, whilst ensuring a minimum of 300mm segregation between AV cabling and electrical mains voltage cabling. Before commencing the installation of containment and cabling, however, the Contractor shall check with the appointed AV Specialist that the containment routes and sizes shown on the issued tender drawings meet with the AV Specialist's approval, and that his working drawings have been generated to match/support the indicated routes. Where touchscreen panels or television connections require back boxes which are of non-standard depth or size, the M&E Subcontractor may assume these boxes will be free-issued to him by the AV specialist.

Apart from non-standard back boxes, the M&E Subcontractor shall supply all containment, fixings and in particular the accessory plates (but excluding media/data plate inserts & modules, which sub-elements remain the responsibility of the AV Contractor). The M&E Subcontractor shall free-issue to the AV Contractor in time for the latter's 2nd fix works all media/data accessory plates, and these will be installed by the AV Contractor. Before ordering, the M&E Contractor shall agree with the Architect and the AV Contractor the make, range, types and final quantities of face plates required.

The faceplates are, unless otherwise instructed, to be from the Focus SB Horizon Range http://www.focus-sb.co.uk/en/Flat-Plate-Ranges/horizon and finishes shall be matt white or satin black (same principles as described for small power accessories). For information, the AV Specialist will be expecting to supply corresponding inserts from the same or an approved alternative source.

The cabling for the audio visual systems shall be selected and supplied by the A.V. specialist but shall be installed by the M&E Subcontractor (on the basis of free-issue cables by the AV Specialist and use of the latter's cable schedule) with terminations and commissioning by the AV Specialist. The AV tender pack appended to this specification includes a schedule to indicate the types of cabling envisaged, and may be expected to include CAT6, single core coaxial, five core coaxial and loudspeaker types. If the AV cable schedule does not provide the specific routings, the M&E Subcontractor may assume for tendering that almost all AV cables will be run to/from the AV Rack at the Lower Ground level.

The supply & installation of cabling for lighting circuits (both power & control) will be the responsibility of the M&E Subcontractor, but connecting and commissioning the link(s) between the Crestron system and the BMS remains the responsibility of the AV Specialist. Similarly for security shutters and blinds, with connection and commissioning of the link(s) between the Crestron system and the blind controls and security systems remaining the responsibility of the AV Specialist.

Note that a requirement will arise for connecting lighting and audio-visual signal cables to the Pool Plant panel in the lower ground plantroom or a junction box in the undercroft in order that underwater effects can be utilised in the respective schemes. Only the containment and cable installation for this link falls under the M&E Subcontractor's work. (Details should be obtained from the AV Specialist's working drawings).

Lighting control panels are specified under the AV package (refer appended AV Tender pack), and these will be free-issued for the M&E Subcontractor's use with the lighting installation.

5.11 Communications & Data

The equipment for the telecommunications and data complete systems shall be supplied and installed by the AV Specialist, as part of the AV Works.

The Tenderer should establish the scope and extent of the communications Works by reference to the AV tender pack prepared by others and issued herewith, but it may be expected to comprise at least the following:

- Structured data cable network (CAT 6),
- Rack mounted router, data switches & patch panel,
- WiFi access points (likely to be 6 around the house) and possibly mobile phone signal boosters.

It is intended that the rack be located within the Lower Ground A.V. room, and it is envisaged that all wiring associated with communications and data cabling from fixed outlet locations will be routed back to this room.

The M&E Subcontractor shall allow for all necessary containment/back-boxes/power supplies, whilst ensuring a minimum of 300mm segregation between low voltage cabling and electrical mains voltage cabling. Before commencing the installation of containment and cabling however the Contractor shall check with the AV Specialist that the containment routes and sizes allowed meet with the AV Specialist's approval, and that his working drawings have been generated to support the required routes/sizes.

The M&E Subcontractor shall supply the accessory plates for data outlets (the plates only, not the media/data plate inserts & modules, which sub-elements remain the responsibility of the AV Contractor). The M&E Subcontractor shall free-issue to the AV Contractor in time for his 2nd fix works all media/data accessory plates, and these will be installed by the AV Contractor. Before ordering, the M&E Contractor shall agree with the Architect and the AV Contractor the make, range, types and final quantities of face plates required.

The cabling for the telecommunications systems shall be selected and supplied by the AV Specialist but shall be installed by the M&E Subcontractor on the basis of free-issue by the AV Specialist, with terminations by the AV Specialist. The AV tender pack appended to this specification indicates by way of a schedule the type of cabling envisaged. If the communications/data schedules do not provide the specific routings, the M&E Subcontractor may assume for tendering that almost all comms cables will be run to/from the Comms Rack at Lower Ground level.

The AV Specialist Contractor shall be responsible for registering the site with Openreach. He shall, at times to suit the overall project programme, seek from the Employer's intended telecoms provider a quotation for an agreed number of telephone lines, to include normal Direct Dial, Redcare lines (Fire & Security) and Broadband line (fibre shall be provided if available in the area).

The M&E Subcontractor shall make due allowance for all attendance/liaison/ regarding installation of incoming Ducts by the Main Contractor.

Surge protection for the telecommunications services shall be installed by the AV Specialist. In order that the correct selections may be made, however, the M&E Subcontractor shall notify the AV Specialist the design parameters and assumptions used in the lightning protection risk assessment calculation. It is envisaged a surge protection device will be located adjacent to the incoming telecoms service (assumed to be Lower Ground level, but subject to Specialist confirmation).

Wireless Access Points and a mobile phone booster system may be installed to ensure good internet and mobile phone signals are accessible throughout the House. Refer to AV Specialist's working drawings for locations and power supply requirements, it being assumed the AV Specialist's design will take precedence over the electrical tender drawings in this respect.

5.12 Security/ Intruder Alarm, CCTV and Access Control

The M&E Subcontractor will be required to co-operate with a Security Specialist Contractor. It is envisaged the Security Contractor is to be separately appointed to design and install systems providing intruder detection & alarm, CCTV monitoring & recording and access control for the property, and to integrate these with the AV/Home automation system.

The security system specifications, cable schedule and any issue drawings are appended to this Tender Document, as an indication of the scale of the work, and the types of cable envisaged for installation. Any drawings issued with the detailed security specification shall take precedence over the electrical tender drawings, and any working drawings and schedules produced by the Security Specialist Contractor during the works period shall take precedence over both.

Reference should be made to the schedules for full information but, the M&E Subcontractor should expect to provide coordination, containment, accessory plates as necessary and cable installation services for the Specialist's packages which may be expected to comprise and incorporate at least the following:

Intruder alarm system to include –

- contacts and vibration sensors on doors, windows & skylights, and signal inputs from pool barrier/enclosure
- PIR or microwave movement sensors in selected rooms and access routes,
- panic alarm buttons at selected locations,
- Security shutters, with controller(s) providing for automatic or manual operation, and complete with safety features, end limits and battery back-up,
- external movement detectors adjusted to not respond to foxes, dogs, etc,
- zoned operation to permit arming of the system in some areas whilst other areas are occupied (e.g. staff suite, pool/gym, lower ground playroom & study).
- Local audible alarm, with sounder and stroboscopic visual indication at the front of the house,
- multiple keypad control (arming & disarming) with codes which can be changed by the User, or fob readers,
- Capability of being connected to a remote monitoring service telephone
- Integration with the AV/Whole House Automation system
- Outgoing signal contacts used to signal an 'event' to the CCTV system, external lighting scheme and internal lighting for specific rooms.
- Control (and monitoring) of security shutters
- Facility for receiving signals from the fire alarm to initiate opening of security shutters under certain conditions (eg fire signal + intruder alarm not armed + security shutter control set to 'automatic' + home automation not set to 'away' mode or 'unoccupied' mode).

CCTV system to include –

- External cameras (POE) generally mounted on the building or outbuilding (12 envisaged)
- Indoor cameras (POE), mounted covertly to monitor pool and other rooms (3 envisaged)
- Associated recording and display equipment,
- Integration with security & internal lighting systems as necessary to provide sufficient illumination for internal CCTV cameras,
- Integration with security & external lighting systems to suit 'events' triggered by the intruder alarm system,
- Video link to an external camera mounted on or outside the main gate.
- Video link to the Crestron system, for display & selection of CCTV images on the overall AV system.

Access control to include-

- Battery back-up to provide a measure of support for operation during power fail conditions,
- Gate entry call panel with integral camera & sound system, numeric keypad, remote release facility and fob interface (envisaged BPT),
- Video entry response panel(s) located in specific room(s),
- Integration with the AV system to allow use of Crestron touch screens, iPads or smart phones as video entry response stations,
- Doorbell system from front door with at least two sounders in selected rooms,
- Facility to restrict access to the pool area by the provision of finger print readers or digital pass locks,
- Cabled and/or wireless Interfaces for sending 'open' and 'close' commands to the main gate drive mechanism controller (such signals not to override gate safety interlocks or maintenance lock-out switches),
- Facility for receiving signals from the fire alarm to initiate automatic gate opening under certain conditions (eg fire alarm unacknowledged/not reset after say 10 minutes).

The cabling for all the above systems shall be selected and supplied by the Security Specialist but shall be installed by the M&E Subcontractor on the basis of free-issue by the Specialist, with terminations by the Specialist.

The M&E Subcontractor shall allow for all necessary containment/cabling/power supply points/equipment whilst ensuring a minimum of 300mm segregation between low voltage and mains voltage cabling. All cabling should be installed and tested for continuity and insulation resistance, and the ends kept dry and safe pending final connections and commissioning by the Specialist. The M&E Subcontractor shall coordinate his and the Security Specialist's activities and the respective work programmes.

The M&E Subcontractor shall supply all accessory outlet plates needed for connection of the security/CCTV/access control systems (except at the external gate where the Security Specialist will be responsible for the direct cable termination). Where such accessory plates relate to power socket outlets or fuse connection units, the M&E Subcontractor shall install these as part of the small power wiring . Where such accessory plates are simply cable outlet plates or connection boxes for signal cabling, the M&E Subcontractor shall install these. Where however the connections require the use of data outlets, the M&E Subcontractor may expect the Security Specialist to supply and install the media/data plate inserts & modules. The M&E Subcontractor shall for these locations free-issue to the Security Specialist accessory plates ordered to suit media/data outlets, and these will be installed by the Security Specialist. Before ordering, the M&E Contractor shall agree with the Architect and the Security Specialist the make, range, types and final quantities of data outlet plates required.

5.13 Fire Detection

The M&E Subcontractor will be required to co-operate with a Fire Alarm Specialist Contractor. It is envisaged the Fire Alarm Contractor is to be separately appointed to design and install a system to provide cover under a 'protection of life' category and to integrate this with the BMS, security system and access control system.

The fire alarm system specifications, cabling information and any issue drawings are appended to this Tender Document, as an indication of the scale of the work, and the types of cable envisaged for installation. Any drawings issued with the detailed fire alarm specification shall take precedence over the electrical tender drawings, and any working drawings and schedules produced by the Fire Alarm Contractor during the works period shall take precedence over both.

The cabling for the fire alarm system shall be selected and supplied by the Fire Alarm Specialist but shall be installed by the M&E Subcontractor on the basis of free-issue by the Specialist, with terminations by the Specialist.

The M&E Subcontractor shall allow for all necessary containment/power supply points/equipment. It should be noted that although fire alarm trays/containment are not shown on the issued drawings, Tenderers are nevertheless required to allow for suitable containment and fixings.

The M&E Subcontractor shall allow for the provision of dedicated fused connection outlets to the main control panel as indicated on the drawings and distribution schedules, and for power supply to any other fire alarm devices as may require it. He shall allow also for co-ordinating the commissioning of the fire alarm system and the mechanical/electrical/specialist systems (see below), and for arranging witness tests with fire alarm specialist and other contractors all present.

Whether or not specifically mentioned in the appended fire alarm specification, the M&E Subcontractor should anticipate that:

- The installation is to be provided to meet the requirements of BS 5839 Part 6: 2013 and the design will include equipment suited to a Grade A system (with cover to Category LD2 or LD1 to be determined by others).
- The location of the fire alarm control/indication panel should be confirmed with the Architect.
- A measure of integration is expected with the AV/Home Automation system (expected to permit at least the display of fault or fire messages on multi-purpose graphic display panels or iPads)
- Manual call points may be provided to plant areas and adjacent to the fire panel.
- Sounders, whether or not integral to every detector, shall be sited to provide the required sound levels (dB) at all bedheads.
- Carbon monoxide detectors shall be supplied, installed and commissioned (refer next section of this specification).
- The fire alarm designer may produce a cause-and-effect schedule to represent the intended behaviour of the fire alarm system under various fire and fault conditions, and may make this available to the Contract Administrator and Building Controls Officer as appropriate or as requested.
- Aspirating sub-systems may be offered for some areas of the house (this should be taken at tender stage as just an option)

Further, and again regardless of whether or not specifically mentioned in the appended fire alarm specification, it should be expected the following actions/interfacing will be required/implemented when a ‘fire condition’ arises:

- Stop all mechanical ventilation plant, and stop any chemical dosing in the pool plant,
- Signal the CHP to enter standby mode (the preferred condition prior to closure of gas solenoid)
- Cut off gas supplies,
- Signal the BMS panel in order that mechanical plants can be shut down or inhibited from starting,
- Interrupt power to any gas or mechanical equipment which cannot be shut down directly through a monitored signal contact,
- Signal the Security Panel, in order that a ‘fire’ mode behaviour can be initiated if required,

- Signal the AV system, such that it may replace any playing videos with a visual message warning of fire alarm operation, or may display messages to controller screens or iPads,
- Signal the Crestron/lighting panels; to restore dimmed lighting to full brightness, and switch on the lights in notional escape routes (if not already on)
- Signal the fire condition over a telephone line to a third-party accredited company (Redcare facility or approved equivalent),
- Switch the access control system/sub-systems/main gate into programmable 'fire' modes, such as would permit, for example,
    - main gate to open automatically if :- fire alarm has gone unacknowledged for say 7 minutes
    - security shutters to open automatically if :- intruder alarm not armed + fire alarm activated + security shutter control set to 'automatic' + home automation not set to 'away' mode or 'unoccupied' mode),
- A spare signal contact shall be available in case panning CCTV cameras are used and it is chosen to direct cameras to predetermined orientation under a pre-programmed 'fire behaviour' mode.
- Signal the Home Automation system so that other behaviours can be initiated.

5.14 Carbon Monoxide Detection

The Fire Alarm Specialist will be expected to supply and install a Carbon Monoxide detection system in compliance with BS EN 50291:2012 & Gas Safe Recommendations in all rooms where a gas/combustible fuel appliance is installed.

The M&E Subcontractor shall install 230V ac power points to locations as required.

5.15 TV/Satellite

TV/Satellite installation will be undertaken by the AV Specialist as part of his package. The M&E Subcontractor shall support the AV Specialist by helping establish a route for cables to a satellite dish location on a roof or wall, and by installing suitable containment. Any power supply requirements are covered under the Audio-Visual section.

5.16 Lightning Protection

By employment of a specialist, the M&E Subcontractor shall obtain a Full Risk Assessment, with Recommendations, and a price to design/supply and install in accordance with the specialist's recommendations an appropriate lightning protection system.

The risk assessment element of the works is required 30 working days after appointment of the M&E Subcontractor, and shall be delivered to the Contract Administrator and with a copy sent to the Engineer. In the event that the risk assessment suggests installation of a lightning protection system is not necessary, or in the event that the Employer decides not to install one, the M&E Subcontractor and the Lightning Protection Specialist shall understand that any priced element for design and installation of a lightning protection system will be omitted from the contract.

Specialist lightning protection companies acceptable to the Employer are W J Furse, Omega Red or J W Gray. Other lightning protection specialists may be proposed, but the Employer makes no undertaking to accept alternative specialists. If the Contractor wishes to use an alternative specialist, he shall make written application to the Employer for such dispensation, and if the Employer rejects such application the Contractor shall use one of the listed specialists without any increase in price.

The lightning protection system shall comprise a system of roof mounted Aluminium Strike plates as Air Terminations and horizontal PVC Covered Aluminium tape roof conductors.

Down conductors shall be PVC covered tape and shall be routed so as to be concealed behind rain water down pipes wherever possible. All details of the proposed protection system, and the colour of PVC covered conductor, is to be confirmed with the Architect/Employer prior to installation.

From the down tapes, connections shall be made to an earthing system which may comprise reinforcing bar in concrete foundations and/or earth rods or buried conductors, with connections made in proprietary earth pits.

The contractor shall ensure that suitably low impedance is achieved in accordance with the latest British Standards by the use of earth rods and conductors (Ground enhancement material is not favoured, but may be used if required). An unconnected reference earth rod and pit shall be installed, at a location to be agreed, to facilitate future comparative testing of the system's resistance to earth. This shall be designated an earth-test-reference point on the plans, and a measurement of the combined system earth resistance shall be made from this point at time of commissioning and recorded in the log book.

The system shall be provided in accordance with BS EN 62305:2006. It shall be ensured that exposed metalwork of the building is bonded to the lightning protection system. If dissimilar metals are used for the system, it shall be ensured that bonding connections are electrolytically compatible.

The contractor shall be responsible for employing an agreed lightning protection specialist to carry out the design and commissioning of the Lightning Protection system to the Building and submitting full design/installation drawings for approval, and for providing a site log book for recording of periodic tests and inspections.

Surge protection for the power and telecommunication services shall be installed in compliance with 17th Edition IET Wiring regulations BS 7671 (reg 534) and to match the design parameters used in the lightning protection risk assessment calculation.

5.17 Electrical Supplies and Signals for the Controls Package

A BMS system is to be designed, installed and set to work under a controls package described under the mechanical works.

Under his works, the M&E Subcontractor shall

a) Install power supplies as required for the various control stations (master~ and outstations), providing such supplies via isolators or fused connection units as agreed with the Controls specialist,

b) Procure electrical equipment capable of providing signals wired out to terminals as described in other clauses (volt-free contacts unless otherwise agreed), and which will permit at least the following status/alarm conditions to be monitored.
   - Surge diverter operation (mains)
   - Metering output signals (impulsing contacts or serial transmissions (eg M-bus or Modbus) as to be agreed with the Controls Specialist appointed under the Mechanical Works
   - Power fail/isolation on circuit to Foul Water Pumpset or other sump pumps
   - Power fail/isolation on circuit to Cavity Drain Pumps

c) Make provision in cabling & containment capacity to accommodate future signals (or signals from Others' equipment) such as:
   - Surge diverter operation (telecomms)
   - Rainwater sensor serving central hall rooflight mechanism(s)

- Alarm/overload on Foul Water Pumpset
- Dumbwaiter machinery alarm condition
- CHP alarms, status signals, emergency stop signals and metering impulses
- Garden Irrigation Pump power switched to 'Off'
- Security system fault condition
- Fire alarm fault
- Fire alarm detects fire condition

The BMS system being procured under the Mechanical Controls package may be expected to include an Uninterruptible Power Supply (UPS) with sufficient capacity to keep the BMS master panel energised during a short power failure and to transmit a power fail & critical alarms message to a mobile phone. In case the BMS system is supplied without such UPS, a provisional sum has been allowed in the Pricing Schedules to permit its procurement through the electrical works and for adapting the power supply arrangements as may be needed.

5.18 Labelling

Labelling of the Distribution Boards and electrical equipment/isolators shall be proposed by the M&E Subcontractor for approval by the Architect, but should provide for no less than the following :

- Distribution Boards:
  - Board number/name/ID : Engraved plastic labels, fixed by machine screw, letter height no less than 8mm
  - Source of supply, compartment ID or other secondary labels: Engraved plastic labels, fixed by machine screw, letter height no less than 6mm
  - Circuit identification : Plasticised numeric characters identifying board ways and phase, supported by a typed schedule with functional description of equipment and/or areas served

- Isolators/Supply points (back of house):
  - Isolator ID or name of equipment served : Engraved plastic labels, fixed by machine screw, letter height no less than 6mm
  - Source of supply : Engraved plastic labels, fixed by machine screw, letter height no less than 5mm
- Faceplates on visible isolators serving under-counter appliances (e.g. washing machines, dish-washers, water purifiers, waste disposal units, refrigerators) or serving appliances in cupboards (e.g. microwaves, coffee machines): Faceplate to be engraved with appliance descriptor, black text on the plate finish, character height to suit (2.5mm or similar).
- Faceplates on fused connection units (only those where the connection to equipment is not obvious, e.g. towel rail heaters) : Faceplate to be engraved or screen printed with appliance descriptor, black text on the finish, character height to suit (2.5mm or similar)

5.19 Technical Submittals

The M&E Subcontractor shall allow, in his programme and in his costs, for submitting to the Contract Administrator for comment details of any designs for which he is responsible, allowing 2 weeks for return of the comments.

Unless otherwise agreed, the Contract Administrator or his authorised representative will comment on designs, returning comments according to the following system:

Status 'A' – reviewed, no comment. Installation or manufacture may proceed as per drawings

Status 'B' – reviewed with comments. Installation or manufacture may proceed subject to incorporation of comments.

Status 'C' – rejected.

5.20 Fire Stopping

The M&E Subcontractor shall include for fire-stopping builderswork holes as may be necessary to maintain integrity of any fire compartments inherent in the building layout. This activity shall be performed after installation of all cables or other services and before fitting of ceilings. All fire-stopping materials and methods used shall be to the approval of the Contract Administrator, and any decision on whether or not fire-stopping is necessary for a particular location shall be vested in the Contract Administrator.

5.21 Electrical Earthing/Bonding

Earthing of the complete Electrical installation and bonding of extraneous metalwork shall be carried out in accordance with BS7671. Bonding shall be provided to all incoming services, and to the lightning protection system earths.

Additionally, an insulated earthwire (green/yellow) of no less than 16mm^2 shall be run to an agreed position in the Lower Ground AV Room, and left terminated on a post insulator (as provision for any needs of the AV Specialist).

5.22 Testing and Commissioning

All first fix cabling shall be tested for continuity/insulation resistance prior to plastering/closing in of ceiling spaces.

The Electrical Installation shall be tested and commissioned in accordance with BS 7671 Requirements for Electrical Installations (the IET Wiring Regulations), IET Guidance Notes Number 3 Inspection & Testing and other British Standards as appropriate.

Supply Characteristics

Obtain information called for in BS 7671 about supply characteristics from Supplier, other than where to be measured as part of testing procedure.

Design Information

Obtain all design assumptions, calculations and any other information to enable compliance with BS 7671 to be verified.

Witnessing

Due notice of a minimum of two working weeks shall be given to the CA to enable the Engineer to carry out witnessing of test results, at which time a copy of the Test Instruments calibration certificate shall be made available for the record documentation.

5.23 Record Information / Manuals

Full record information and systems' Documentation/Instructions shall be provided in an easy to understand prior to taking over and occupation.

Operating and maintenance instructions shall comprise the following (all contained in volumes strongly bound in flexible covers and suitable for heavy usage over a long period) written to be read in conjunction with the Record Drawings:-

- A general description of the scope, purpose and manner of working of each system and the apparatus forming part of the Works,
- A detailed description of the scope, purpose and manner of working of each system of automatic controls,
- Data on general design parameters and associated normal operating conditions, based on the commissioning tests,
- Clear and comprehensive instructions for the starting up, running and shut down of each system or apparatus,
- Clear and comprehensive instructions for dealing with emergency conditions for each system or apparatus,
- Electrical Test Certificate, fully checked, signed and dated,
- Calibration certificates for the test instruments used,
- Distribution & Lighting board schedules,
- Electrical 'as-built' drawings (small power, lighting, fire-alarm, security etc layout plans),
- List of electrical equipment, with clearly marked model numbers, as installed in the works, and original supplier names (to include MCB information such as current ratings and trip curve on which the design was based),
- Technical literature for distribution boards, miniature circuit breakers/protective devices, Earth-leakage devices, lighting controls, dimming equipment (if applicable), movement detectors, photocells, luminaires, exterior lighting, telephone/data plates, etc. The literature shall include operating & maintenance recommendations and, where applicable, instructions for adjusting the settings. In cases where the literature covers a range rather than a particular item, the literature shall be marked to clearly identify the model or the version of equipment installed. (Markings shall not rely on highlighter colours, as these may not photocopy correctly). Names & contact numbers should be provided for purposes of obtaining spares/replacements.
- Operating instructions, safety procedures, diagrams and maintenance recommendations for any specialist equipment/systems.
- Lightning protection test results, earth resistance measurements etc and recommendations concerning periodic re-testing.
- Instructions as to the nature, extent and frequency of servicing necessary, properly to maintain the Works in good condition, and also as to the material to be used for the purpose. This information shall be supported by maintenance instructions provided by the suppliers of particular component apparatus, and shall include procedures for treatment of any equipment whose use is seasonal.
- Any recommended spares, or suggested sources of spares,
- A schedule of Names, Addresses and Telephone Numbers of all Contracting Firms and Manufacturing Firms responsible for the installations or supply of equipment Items comprising the Works, also a list of Manufacturers and catalogue/reference numbers of all luminaires.
- Recommendations on periodic re-testing of the installations.

Draft copies of all record drawings and instruction manuals shall be made available in advance of the completion date in order that the Contract Administrator has the opportunity to comment, and corrections / amendments may be incorporated in the manuals before completion of the Works.

5.24 Standards

The design/installations shall comply with all-relevant British Standards and Codes of Practice (whether listed herein or not), and with all other relevant statutory instruments and regulations current at the date of tender (unless stated otherwise in this Specification) and in particular with the following: -

i. 17th Edition IET Wiring regulations BS 7671 incorporating the latest amendments

ii. CIBSE Design Guides to Current Practice & CIBSE Commissioning Codes.

iii. BS 5266 Emergency Lighting

iv. BS 5839 Fire Detection and Fire Alarm systems

v. BS EN 62305 Protection against Lightning

vi. Health and Safety Executive (HSE) and Commission (HSC) Guidelines.

vii. Current edition of the Building Regulations and Associated Approved Documents.

In addition the installations shall be installed in accordance with the latest British Standards and Codes of Practice and shall comply with legislation and regulations of the local Building Control Office.

Labelling of the complete Mechanical and Electrical installations shall be carried out in accordance with CIBSE recommendations.