Hampton Electrical Systems Limited

Melrose House
54 Windmill Road
Minchinhampton
Gloucestershire
GL6 9EB

Electrical Operation and Maintenance Manual
For the radiant heating at
St Laurence Church
Stroud
Glos

Volume 1

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Contents:

1. Introduction

The purpose of this manual is to offer the personnel concerned with the operation and maintenance of the services within the church maximum assistance in the performance of their duties. It is intended that this manual will be used to assist in providing a working knowledge of the various systems installed within the church.

All information contained herein is valid at the time of preparation and the date of issue. Changes arising in building usage, legislation etc. will necessitate revision to be made in order to retain the manuals validity and usefulness. Any revisions should be recorded in the Health and Safety File.

It should be noted that this manual is not intended to supersede or conflict with any standard maintenance/ inspection routines already in use for the church.

2. Contract Directory

Electrical Works:

Hampton Electrical Systems Ltd
Melrose House
54 Windmill Road
Minchinhampton
Glos
GL6 9EB

Contact: Andrew Nott
Tel: 01453 886007, 07770 858707
Email: a.nott@hesl.net

Lighting Design:

Herschel Infrared Ltd
Units 6A – 7A Boundary Road
Access 18
Kings Weston Lane
Bristol
BS11 8AZ

Contact: Liam White
Tel: +44 (0)117 325 3858
Email: liam.white@herschel-infrared.com

Heating Design
Herschel Infrared Ltd
Units 6A – 7A Boundary Road
Access 18
Kings Weston Lane
Bristol
BS11 8AZ

Contact: Liam White
Tel: +44 (0)117 325 3858
Email: liam.white@herschel-infrared.com

3. Residual Risk Assessment

Please refer to Equipment Schedules throughout document for Residual Hazards.

4. General Scope of Electrical Works

The project involved the design and installation of electrical circuits for the radiant heaters within the Church. The electrical switchgear and distribution were upgraded to help balance loads and prepare for the incoming supply to be uprated to 200 amps per phase at a future date.

Works comprised the performance, design, supply, installation (including strip out and preparatory work), testing and commissioning associated with the following:

1. New heater supply cabling fromm the Slype to 8 no. points in the Nave clerestory (above the centre of each arch).
2. Additional switch wires added to the existing lighting circuits to support individual switching of the Halo chandeliers ‘up’ and ‘down’ lights.
3. Replacement of low voltage distribution system in the Slype consisting of a 100 amp MCCB incoming main switch (temporary measure until a 200 amp upgrade of the supply is installed), a main panel board complete with main switch and outgoing MCCB’s to feed the four existing church distribution boards plus the new heating distribution board (DB5), a new heating distribution board (DB5), the Herschel heater APX control panel and the Herschel touch ‘smart’ switches.
4. All builders work in connection (BWIC) with the works.
5. Testing & inspections including complete certification in full compliance with BS7671 2018 Amended to 2022.

5. Electrical Services

5.1. Contractor

For electrical services:
Hampton Electrical Systems Ltd
Melrose House
54 Windmill Road
Minchinhampton
Glos
GL6 9EB

Contact: Andrew Nott
Tel: 01453 886007, 07770 858707
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Contact: Liam White
Tel: +44 (0)117 325 3858
Email: liam.white@herschel-infrared.com

5.2. Design Criteria

The electrical services design was based upon a full survey of the church, studying of the existing Electrical Installation Condition Report followed by a full design package produced from Trimble ProDesign 18th Edition software.

5.3 Scope of Works

5.3.1. LV Distribution

The church is supplied by a three phase and neutral LV supply through BS1361 Type II cartridge fuses rated at 63 amps and located outside the Slype in an external meter box.

The existing metering equipment has been retained and new 200-amp meter tails have been installed to the meter box from the new switchgear and terminated at 'tail blocks' where they connect to the existing meter tails. The existing meter tails are currently 16mm c.s.a which is a limiting factor in the supply fuse rating. The church is to arrange for the meter tails to be uprated to 25mm c.s.a and the main fuses uprated to 100 amps in the near future as a temporary measure until the 200-amp supply is installed.

5.3.1.1. Final Circuit Distribution Boards

The church's final circuit distribution boards are located in the Slype (2 off labelled as DB1 & DB4), Bell Tower (DB2) and Vestry (DB3). These distribution boards have been retained and supplied from the new panel board (DB MPB).

One new Distribution Board was installed as follows:

1. 160A Three phase and neutral 18-way Distribution Board in the Slype (DB5)

This board is provided with a main switch disconnector and miniature circuit breakers (MCBs) of the type and size for the task to which they are intended. A surge protection device providing T1 and T2 protection has also been installed.

For further details of the LV Distribution System refer to the Record Drawings as well as the Circuit and Equipment Schedule sections of this Manual.

5.3.2. Earthing and Bonding

All exposed conductive parts of the electrical installation and all extraneous metalwork have been bonded to earth strictly in accordance with the 18th Edition of BS7671 and IET Guidance on earthing codes of practice so as to ensure electrical apparatus or any other services do not give rise to dangerous voltages for persons in direct or indirect contact.

The church's original earthing system is TN-S and has been retained and extended to serve the revised Electrical Services.

Each final circuit wired in fire resistant FB200 Gold cabling (or equivalent) and includes an integral circuit protective conductor with the same cross-sectional area as the supply conductors.

The main equipotential bonding conductors are single core 6491X type cabling connected to the following services:

Supplementary equipotential bonds exist interconnecting all simultaneous accessible conductive parts to the protective conductor system. Supplementary bonding has been completed to all extraneous metal work such as:

1. Incoming water supply
2. Incoming gas supply

5.3.3. Containment and Wiring Systems

Wiring and Containment Systems have been installed as described in the table below to deliver the Electrical Services to the church in line with BS 7671 2018.

In general, the table below indicates the wiring and containment methodology that has been adopted:

System	Cable Type	Containment
LV Distribution.	PVC/PVC single core tails/ steel wire armoured cables/ Fire resistant FP200 Gold or equivalent.	Clipped direct to the fabric of the building or installed in metallic trunking.
General Lighting and Power Distribution.	Fire resistant FP200 Gold or equivalent.	Clipped direct to the fabric of the building or installed in metallic trunking.
Lighting Systems (power).	Fire resistant FP200 Gold or equivalent. PVC/PVC flexible cable to final connections	Clipped direct to the fabric of the building or installed in metallic trunking.
Heating Systems (power)	Fire resistant FP200 Gold. or equivalent. PVC single cables.	Clipped direct to the fabric of the building or installed in metallic trunking.

5.3.4. Lighting

The lighting design for illuminance levels was carried out by Herschel who provided both the chandeliers and the LED lamps (candle lamps for up lights and GU10 38-degree floods for down lights). The existing chandelier lighting wiring has been used to supply the new lights with the addition of switch wires to separate up lighting from down lighting.

5.3.4.1. Emergency Lighting

No emergency lighting has been installed within this contract.

5.3.4.2. External Lighting

Additional local wiring was installed to provide separation of the South porch interior light from the South porch exterior light. The exterior light was also fitted with a dusk till dawn photocell controller for complete automation.

5.3.5.1. Power for Mechanical Services

Power has been installed to serve the items of Mechanical Services as indicated on the Record Drawings and Circuit Schedules, summarised as follows:

1. 6 no. Halo heaters rated at 9.6kW each.
2. A further 2 heater circuits have been installed but not connected for future heaters in the NW and SW arches of the Nave. These cables have been terminated in junction boxes in the NW and SW clerestory and 'laid up' in the trunking below the APX control panel in the Slype.

Heating Control

The control of all heaters is via a control panel mounted in the Slype. There are 6 smart switches mounted below the control panel each with three touch sensitive buttons. The three buttons proved three levels of heating for each heater i.e. one button pressed will provide 3.2kW of heating, 2 buttons pressed will provide 6.2kW of heating and all three buttons pressed will provide the full 9.6kW of heating. The buttons connect to a programmable PLC within the control panel which provide the necessary logic to operate the heater contactors. The software logic programming was written by Heschel Infrared Ltd. The touch sensitive switches are also 'smart' switches and can be connected and controlled via an App entitled 'Smartlife' developed by Volcano Technology Limited.

The power supply wiring for the Mechanical Services throughout the church is via fire resistant FP200 Gold cabling or equivalent and clipped to the fabric of the building and in floor and ceiling voids.

5.4. Operating Procedures

5.4.1. LV Distribution

5.4.1.1. Recommended Strategy for Operation and Control

The Distribution Panel and Stand-Alone main switch are fitted with moulded case circuit breakers (MCCB's).
Each outgoing way in DB MPB is protected by an MCCB.
The Distribution Board DB5 is provided with incoming main switch (type MCCB).
Each outgoing way in DB 5 is protected by an MCB.

5.4.1.2. Start Up Procedures

The following operation list assumes that the electrical distribution system to the area has been shut down for a period or is to be brought into operation.

1. Check to ensure that the area around the electrical distribution boards is clear and free from obstructions.
2. Check to ensure that all access panels and doors are closed and secure.
3. Ensure that all special tools and safety equipment are serviceable and in their proper storage space.
4. Check that all plant control panel and equipment isolators are in the 'Off' position.
5. Check that all final distribution board MCB's and RCBO's are in the 'Off' position.
6. Inspect luminaires for cleanliness and for any external evidence of damage or defect.
7. Check settings of automatically switched lighting control circuits. Ensure that all lighting switch cover plates, ceiling PIR sensors, scene setting switch covers are in place.
8. Ensure that all lamps are installed.
9. Inspect all Halo heaters for external damage or defect.
10. Inspect small power outlets for external damage or defect.
11. Unplug, isolate or switch off all equipment connected to small power outlets.

5.4.1.3. Normal Operations

Switchgear associated with spare (unused) circuits should be operated at regular intervals to ensure that it will operate correctly when required for service.

1. Essential checks completed.
2. Low voltage mains supply available.
3. Low voltage distribution system prepared.
4. Lighting and small power circuits prepared.
5. Close the main supply to the Distribution Boards by operating the main switches/isolators.
6. Check supply available by metering, light or other local appliance.
7. Close local isolators on distribution boards.
8. Close outgoing MCB's and RCBO's as necessary. Check each phase, measure the load on each, log and compare with previous readings.
9. Close outgoing mechanical services protective devices as required.

IMPORTANT NOTICE
BEFORE CLOSING SUPPLY ISOLATORS PROVIDING A SUPPLY TO MECHANICAL SERVICES OR OTHER EQUIPMENT, FIRST CHECK THAT IT IS SAFE TO MAKE THE SYSTEM 'LIVE'.

10. Check operation of all luminaires and local switches.
11. Check operation of small power outlets, switch on, plug in test equipment, as required.

12. Check all time switches for correct setting and operation.
13. Check operation of all RCBO's installed using integral test button.

5.4.1.4. Shutdown

When it is necessary to shut down a distribution board or any item of distribution equipment, the load should first be disconnected by switching off the supply at all sub-circuits.

1. Either the individual circuits or the entire distribution board can be switched off and if suitable, locked off if working remotely to the source of the supply.
2. Church supervisory staff must be advised of a shut down and of the services affected by a shut down before the supply is disconnected.
3. Ensure that all sources are isolated including any backup or secondary forms of supply particularly on maintained supplies.

5.4.1.5. Testing

LV Distribution systems should be periodically inspected and tested in accordance with BS7671 2018 including any amendments and manufacturers' instructions. The maximum given period between inspections is 5 years.

5.4.2. Lighting

5.4.2.1 Start Up Procedures

1. Inspect luminaires for cleanliness and for any external evidence of damage or defect.
2. Check settings of automatically switched lighting control circuits.
3. Ensure that all lighting switch cover plates are in place.
4. Ensure that all lamps are installed.

5.4.2.2. Normal Operation

The main church lighting is controlled via a 24 gang and a new 8 gang switch located in the South Transept by the Vestry door. There is a switch legend to identify each switch mounted to the left of the switches.

5.4.2.3. Shutdown

Switch off lighting using the local switches, external lighting is isolated via the MCB at the relevant distribution board.
For total system shut down, switch off and isolate power supplies at the relevant distribution boards.

5.5. Care and Maintenance

5.5.1. LV Distribution

5.5.1.1. Full Details on How to Maintain the Equipment

Refer to manufacturers' literature.

5.5.1.2. Maintenance Timetable

Item	6M	1Y	A/R
Isolators, Switch Fuses and Fuse switches	X		
LV Distribution Board (MCB/RCBO)		X	X

D = Days, W = Weeks, M = Months, Y = Years, A/R = As required

5.5.1.3. Isolators, Switch Fuses and Fuse switches

Step	Detail	Frequency	Notes
1	Check for loose screws on the switch and mechanism parts, and also on the switch contacts and connections to the switch.	6 Months	
2	Check and if required lubricate all moving mechanical parts	6 Months	
3	Check for build-up of dust or contamination on the insulation surfaces and wipe clean. Wipe off any carbon deposits on the inside of the contact housing and arc shields.	6 Months	
4	Check contacts, fuse terminals and main terminal connections for discolouration due to overheating.	6 Months	Any suspect joint faces should be cleaned with emery cloth and properly tightened after wiping clean. This does not apply to silver plated main contacts.

5.5.1.4. LV Distribution Boards (MCB/RCBO)

General

1. Ensure that all equipment is isolated and made safe before undertaking maintenance work.
2. An inspection should always be made as soon as possible after a circuit fault.
3. Never assume that the Neutral that appears to be associated with the circuit in question is associated.
4. If replacing protective devices, ensure they are of the same rating and type.
5. The consequences of causing a short circuit on high capacity 400-volt systems can be very serious, as the current flowing into any arc can release a large amount of energy resulting in flame and damage.
6. Do not use cotton waste for cleaning purposes. Cloths should be dry, clean and free from loose fibres and metallic threads. Blower/ vacuum nozzles should be of non-metallic construction.

LV Distribution Board (MCB/RCBO)

Step	Detail	Frequency	Notes
1	Test RCD/RCBO using test button.	As required	
2	Clean exterior of all units and interlinking metal work.	1 Year	
3	Clean out interiors, check for signs of arcing or overheating of contacts.	1 Year	
4	Check all fuse bridges and carriers for signs of arcing. Check that the correct CPD is fitted.	1 Year	
5	Check tripping and overload settings.	1 Year	
6	Check that phase barriers and safety covers are in place and fitted correctly.	1 Year	

5.5.1.5. Fault Finding

Fault	Action
Power circuit trips	Has any item of equipment recently been installed? Power circuits provided with RCBO's monitor for earth leakage currents. This leakage current can be caused by some appliances in their usual course of operation. Check with the appliance manufacturer. Check operation of circuit protective device (CPD) at Distribution Board and Test Button if RCBO. Has any work been carried out in the vicinity of the failure, or along the route of the failed circuit prior to the failure? If CPD failed, disconnect all equipment from circuit and check continuity of conductors and insulation resistance of same. Remember never replace CPD and re-energise unless fault has been identified and rectified.
Equipment/ Appliance failure	Check condition of flexible cable and plug, if fitted. Check fuse in plug or connection unit has not blow and for correct rating. Was the appliance or component operating when it failed, or did it fail to start? Do other items of equipment on the same circuit still operate. Has the correct operating procedure been carried out? When was the last time the component/ appliance used? Had there been any signs of deterioration in the performance or any increase in noise levels from the appliance/ component? Has there been any maintenance work carried out prior to the failure? Has anyone else investigated the failure prior to those now required to do so and if so, what did they do and what did they find out? Remove appliance and consult service engineer/ manufacturer.

5.5.2. General Lighting and Power

5.5.2.1. Maintenance Timetable

Item	1D	1W	1M	3M	6M	1Y	3Y
Contactors/ Time-switches			X			X	
Lighting				X	X		
External light fittings		X				X	
Emergency lighting	X		X		X	X	X
Electrical accessories						X	

D = Days, W = Weeks, M = Months, Y = Years, A/R = As required

5.5.2.2. Full Details on How to Maintain the Equipment

5.5.2.2.1. Spare

5.5.2.2.2. Contactors/ Timeswitches

General

Ensure that any contactors are isolated at the respective distribution board including the control circuit by isolating the respective CPD serving the contactor / control circuit.

Contactors / Timeswitches

Step	Detail	Frequency	Notes
1	Check each contactor to ensure it is making contact when the circuit controlling them is operated.	1 Month	This can be done by listening and looking at each unit to see if the mechanism is responding to control.
2	Check the operation of the time switches to ensure they are functioning correctly.	1 Month	Check that the contactors operate for the pew heating (see above) and that

			the roof flood light illuminates.
3	Repeat the monthly checks	1 Year	
4	Clean contactor/ time switch casings of any dirt and dust.	1 Year	
5	Clean and lightly lubricate the contactor switch contacts with and electrical grade grease.	1 Year	

5.5.2.2.3. Lighting

General

Ensure that all luminaires are isolated and made safe by isolating the circuit at the relevant distribution board.

Lighting

Step	Detail	Frequency	Notes
1	Make a general examination of all lighting fittings for cleanliness	3 Months	Clean in accordance with planned maintenance schedule
2	Check lamps for signs of deterioration	3 Months	Renew as necessary
3	Check fixings and suspensions for security	6 Months	Renew and re-fix as necessary
4	Check all cable connections, externally and internally for security. Check for signs of arcing or burning	6 Months	Tighten/ secure as necessary
5	Check state of flexible down leads for deterioration	6 Months	Renew as required.
6	Check controllers, diffusers and reflectors are clean and correctly adjusted before assembly	6 Months	

Cleaning: -

<u>Diffusers and Plastic Controllers</u>

Cleaning should be undertaken when necessary or at the time of general maintenance and follow the procedure below:

1. Clean using a solution of warm water and a mild domestic detergent.

2. Rinse after cleaning.
3. Allow to dry.
4. For prolonged protection against dust, apply anti-static solution.

Error! Bookmark not defined. Reflectors

Reflectors require little or no maintenance when installed under normal environmental conditions. Correct handling of reflectors during installation is paramount to their effectiveness as an efficient light controller, and to this end, reflectors should always be handled using cotton gloves, thus avoiding finger marks on the reflector surface.

Painted finish surfaces

These should be cleaned using a cotton cloth to apply a solution of warm water and a mild domestic detergent, then wiped clean.

Care must be taken not to scratch paint finish.

Satin Anodised Aluminium Surfaces

Care must be taken, as this is only a surface finish and may be scratched if abrasive materials contact.

To clean use a soft cotton cloth and a solution of mild domestic detergent and warm water that will remove most stains.

Lamps

Disposal of Lamps

The Waste Electrical and Electronic Equipment (Producer Responsibility) Regulations 2005 require producers of Electrical and Electronic Equipment to pay for the treatment (including recycling) of separately collected WEEE. Lamps are classified as special waste under the Hazardous Waste Regulations 2005.

Lamp removal must be carried out using the correct access equipment and PPE to prevent inhalation, damage to eyes and skin due to glass splinters and airborne dust.

The Environment Agency is advocating that fluorescent and other mercury containing lamps should be sent for recycling as this promotes best practice in waste management. Every user of fluorescent or other mercury containing lamps has a 'Duty of Care' under legislation to dispose of them correctly.

Lamp Breakage

If lamps are accidentally broken then the debris must be collected, bagged and disposed of by one of the methods described above.

Low pressure sodium lamps contain sodium metal, which reacts with water, emitting heat. Some lamps, especially fluorescent tubes, may release powders when broken. The powder in itself is not especially harmful but it may be contaminated with mercury and the inhalation of any dust is not advisable.

5.5.2.2.4. External Lighting Fittings

General

Ensure that all luminaires are isolated and made safe by isolating the relevant circuit and/ or distribution board.

Step	Detail	Frequency	Notes
1	Make a visual examination of all light fittings for cleanliness	1 Week	Clean in accordance with planned maintenance schedule
2	Clean external luminaires	1 Year	Ensure risk assessments are made when working at height
3	Check all cabling connections, externally and internally for security. Check for signs of arcing or burning.	1 Year	Tighten/ secure as necessary
4	Check luminaires for corrosion	1 Year	Paint/ treat or apply protective coating as necessary

5.5.2.2.5. Not used

5.5.2.2.6. Emergency Lighting Installation

Not within the scope of this contract. All operating and maintenance should be provided by original installer and manufacturers.

5.5.2.2.7. Electrical Accessories

Step	Detail	Frequency	Notes
1	Check security and cleanliness of electrical accessories	1 Year	
2	Check connections to earthing and bonding of all portable equipment and check for mechanical damage	1 Year	
3	Check flexible leads to small power accessories and lighting fittings, etc.	1 Year	
4	Check that all plug tops fit securely and correctly into socket outlets. Check plug tops for damage	1 Year	
5	Check operation of all switched fused connection units	1 Year	
6	Check operation of switched socket outlets and ensure switches and shutters are functioning correctly	1 Year	
7	Check operation of all light switches	1 Year	

5.5.2.2.8. Fault Finding

Lighting

Fault	Action
Luminaire failure	Do other luminaires on the same circuit still operate? Check lamp has not failed and replace as necessary. Check circuit protective device (CPD) at distribution board or settings of time clock. Check PIR detectors, usually if the luminaires are constantly on, this will indicate PIR failure. Check control gear and if found to be faulty replace control gear or luminaire whichever is most economical.
Lighting timer/ PIR fails to operate or control	Check CPD at distribution board. Check if the lighting controller or PIR has a diagnostic LED. Refer to manufacturers literature for system diagnostics.

5.6. Emergency Procedures

5.6.1. LV Distribution

Emergency Operation

1. To shut down an individual final circuit switch off at the MCB/ RCBO at the outgoing way of the distribution board.
2. To shut down the entire board, switch off the main switch/ isolator serving the relevant distribution board.

5.6.2. Lighting

The emergency procedures are intended for guidance only, and an assessment must be made with regard to the degree of severity and the conditions prevailing at the time.

Never take risks in an emergency, for a risk can turn a minor emergency into a major one. The safety of personnel must always come first.

Any temporary repairs or arrangements made during or after an emergency must be correct as soon as practically possible.

5.6.3. Emergency Lighting

Not within the scope of this contract.

5.7. Parts List

Supplier	Description	Model	Part-No
Eaton Electric Ltd	Panel Board	6 way outgoing	EPBN1625
Eaton Electric Ltd	Incomer kit	Isolator metering	EPBKN1253M
Eaton Electric Ltd	Enclosure meter pack		EPBN1EX250M
Eaton Electric Ltd	Multifunction meter	Metering	EPBMETER1
Eaton Electric Ltd	MCCB Incomer	250A Incomer MCCB	NZMC2-A250-KCO
Eaton Electric Ltd	Door lock	Door lock	EPBDLK1
Eaton Electric Ltd	Outgoing MCCB	63A outgoing MCCB	NZMB1-A63
Eaton Electric Ltd	Outgoing MCCB	160A outgoing MCCB	NZMB1-A160
Eaton Electric Ltd	Outgoing MCCB	50A outgoing MCCB	NZMB1-1-AF50
Eaton Electric Ltd	Outgoing MCCB	40A outgoing MCCB	NZMB1-1-AF40
Eaton Electric Ltd	Shield blank	Blank	EPBN1BP1
Hager	MCCB and enclosure	100A MCCB main switch	JG29BM
Kablo	70mm c.s.a cable	70mm meter tails	6181YH-70.0
Kablo	35mm c.s.a cable	35mm single cable green/yellow	6491X-35.0-G/Y1
MK	6&8G surface box	Light switch box	K8893ALM
MK	Frontplate 8G	8 gang cover plate	K3498ALM
MK	Grid switch mounting frame 4g	4 gang grid yolk	K3704
MK	Grid switch	10A single pole grid switch	K4882WHI
Batt Cables	BS7629 4mm 4 core fire cable	Heating wiring	BATT 44243 SIL/CAM/ZHAL
Batt Cables	BS7629 1.5mm 7 core fire cable	Light switching wiring	BATT 44413 SIL/CAM/ZHAL
Prysmian	P clips white	Clip for fire resistant cable white	AP11
Eaton Electric Ltd	Distribution board	250A 18-way distribution board type B	EBM182

Eaton Electric Ltd	Lug incoming kit	250A lug incoming kit	EBMBT2503
Eaton Electric Ltd	MCB	20A triple pole MCB Type C	EMCH320
Eaton Electric Ltd	Blank module	Blank 1 module 18mm	EMBP
Eaton Electric Ltd	Surge protection kit	Surge protection for triple pole and neutral board	EM3SSK3T12
Herschel Infrared Ltd	Control panel	APX 6 heater control panel	APX
Herschel Infrared Ltd	Halo chandelier	9600 Watt infrared heater with up and down lights	IR-HALO-9600-D-L
Ketotek	WiFi smart switch	3 button smart touch switch	KTSS3NU
Newlec	Photo Cell	Electronic phot control kit for Porch outside light	NL5601

5.8. Residual Risks and Hazards

Refer to the Equipment Schedules for details of any particular residual risks or hazards.

5.9. Warranties

See Manufacturers Information Section 5.10

5.10. Equipment Schedule and Manufacturers Information

Detailed in Volume 2 of the Operation and Maintenance Manual are the manufacturer data sheets for each item of equipment installed to include instruction on correct use, care, maintenance, disposal and warranty.

5.11. Distribution Board Schedules

Detailed in Volume 2 of the Operation and Maintenance Manual are the Distribution Board Schedules.

5.13. Test and Commissioning Certificates

Detailed in Volume 2 of the Operation and Maintenance Manual are the test and commissioning certificates.

5.14. Record Drawings

Detailed in Volume 2 of the Operation and Maintenance Manual pages are the Record Drawings for the contract.

6. **Detailed Table of Contents**

Volume 1

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Volume 2

Davies Torres Design Ltd SK02/A Structural engineer specification for Halo suspension fittings
Hampton Electrical Systems Switchgear layout sketch
Hampton Electrical Systems connection schedule for Heater wiring
Hampton Electrical drawing showing Nave Halo positions, denotation and depth of arcade arches

Other Documents

Hampton Electrical Systems Ltd Project Risk Assessment
Hampton Electrical Systems IPAF Rescue Plan
Kevin Smith Diamond Drilling Risk Assessment/ Method Statement
Electrical Upgrade Detail (Author Ned Skelton)

Additional folder:
Halo lowering and raising procedure (Author Ned Skelton)