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Henry Williams

Points Heating Control Cubicle
[PHCC]

Operation &
Maintenance Manual

Document Ref: HWPHCC Issue: 5.0

Version 5.0: March 2023

Issue and Revision Record

Rev	**Date**	**Originator** (Print) (Signature)	**Checker** (Print) (Signature)	**Description**
1.0	06/01/16	D Hughes	C Stephenson	First Issue
2.0	25.10.17	C Stephenson	D Hughes	Updated
3.0	26.03.19	C Stephenson	D Hughes	Updated
4.0	10.09.19	P Davies	C Stephenson	Updated
5.0	14.03.23	P Davies	C Stephenson	Updated

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Chapters and Appendices

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1 Introduction

This document is designed for use by the maintenance staff to maintain (fault find, repair or replace) components of the Points Heating Control Cubicle (herein abbreviated to PHCC) and associated components.

Throughout this document, references will be made to other essential information and documentation either prepared by Henry Williams Ltd or provided from the equipment supplier/manufacturer.

After safety issues are discussed in Chapter 2 this manual follows a logical path from Description of the relevant components, equipment installation, repair/replacement, routine maintenance and finally a spare parts listing.

- **Chapter 2 Safety**
  Gives details of any relevant safety issues to be observed in the use and disposal of the equipment.
- **Chapter 3 Details of PHCC Equipment**
  Gives details of the PHCC enclosure and equipment.
- **Chapter 4 PHCC Installation**
  Gives details on installation of the PHCC and the power cables.
- **Chapter 5 Maintenance**
  Details the recommended maintenance checks required to ensure the ongoing correct operation of the system.
- **Chapter 6 Part Numbers**
  Lists the main parts of the PHCC System complete with Supplier and Part numbers to aid in the re-ordering of spare parts.

1.1 Maintenance Policy

The PHCC system comprises highly reliable components. However should a fault occur, the unit can be repaired.

1.1.1 Component Repair

Repair of the PHCC is assumed to be limited to replacement of either failed components or wiring replacement as necessary.

To summarise, the maintenance policy is one of “Repair by Replacement” since:

- The majority of the internal components are relatively inexpensive with respect to the cost of fault diagnosis and repair.
- Most internal components are interchangeable although some disassembly may be required for access.
- Note the safety precautions which must be observed prior to any attempt to repair or replace any of the PHCC components. See Chapter 2
- Note that only fully trained and competent personnel should carry out fault finding and repair of this equipment. See Section 1.2

1.2 Competencies and Training Requirements

Staff with the responsibility for installation and maintenance of PHCC equipment must hold the required Network Rail licenses.

The training will provide the skills and knowledge needed to identify faulty modules/components and the correct procedures for their replacement. Training for the repair of line replaceable units (modules) is not available. Line replaceable units, where appropriate will be returned to the manufacturer for repair or replaced from spares where repair is not practical.

1.3 Glossary of Terms and Abbreviations

A	Amps
CT	Current Transformer
DB	Distribution Board
GRP	Glass Reinforced Plastic
HWL	Henry Williams Limited
ID	Identification
Kg	Kilograms
Kw	Kilowatts
KwHr	Kilowatt Hours
mm	millimetres
PHCC	Points Heating Control Cubicle
THD%	Total Harmonic Distortion (%)
V	Volts
VAC	Volts (AC) Alternating Current

1.4 Drawing References

Each individual PHCC manufactured will be delivered with a set of drawings. These will consist of the following:

- 1 set of General arrangement drawings – these will show the layout of the cubicle and where each part is installed. Part numbers will also be shown on these drawings. It will also detail the fixing arrangements for installing on a concrete base (where applicable)
- 1 set of Electrical schematic drawings – these will give details regarding the internal control and power wiring.

As each PHCC may be different, it is essential that the correct drawings for each panel are consulted when work or fault-finding is to be carried out.

2 Safety

2.1 Isolation and Risk of Electrocution

Points Heating Control Cubicles are designed to work with voltages up to (and including) 400VAC and as such there is a danger of electrocution once any of the covers are removed.

All electrical power feeds to the PHCC MUST be ISOLATED and LOCKED OFF BEFORE removal of any of the internal covers.

Supply voltages typically of 230VAC & 400VAC are commonly used inside these PHCC cubicles, and any personnel working with these units should be appropriately trained.

Personnel working on the PHCC system should be appropriately trained to work with dangerous voltages and be fully conversant with the power circuitry. All connections are shrouded to prevent accidental contact with personnel (fingers etc.) however voltages may be exposed when using tools such as screwdrivers etc.

Once Isolation has been carried out, it is essential that a proved* voltage indicator is used to recheck that all electrical equipment is dead prior to any works being undertaken.

* It is recommended to use a proving device with the voltage indicator to check for correct operation both before and after checking that the equipment to be worked upon is dead.

2.2 Live Equipment Internal Enclosures

All internal live equipment is housed in substantial (steel painted) internal enclosures which are individually covered, secured with screws, and fitted with highly visible warning labels.

To provide further protection, these internal enclosures are mounted inside the main outer enclosure.

2.3 The Main (Outer) Enclosure

The outer enclosure is manufactured to our Network Rail approved design, manufactured from either from Stainless Steel or GRP, with lockable outer doors for secure access.

The outer enclosure provides a very secure and highly protective environment for the contained electrical equipment. The outer enclosure also has large Warning and Identification labels clearly visible from all sides.

2.4 Lifting & Trapping

The PHCC Unit is very heavy (approx 400 - 450Kg) and lifting equipment must be used when moving this unit. The Manual Handling Regulations should be taken into account when lifting heavy items.

There is a risk of trapping of fingers in the doors and hinge area. There is also a risk of trapped fingers when the PHCC cabinet is lowered onto the base during installation of the unit.

Care should be taken, and installation personnel made aware of any trapping/nipping points. These depend upon the nature of the works being carried out and the risks should be assessed beforehand.

2.5 Disposal of Equipment

Due consideration must be given when disposing of equipment.

Environmental regulations and standards are continually being updated and therefore a risk assessment must be undertaken at the time of equipment disposal.

Although the materials used in the equipment are designed to release low smoke and less toxic fumes when burnt, burning of this equipment, as a means of disposal is not appropriate.

The equipment must be disposed of in accordance with the Waste Electrical and Electronic Equipment (WEEE) Regulations

2.6 Fuse Ratings

All fuses installed into the fuse carriers must be rated to the correct current and operational voltages as shown on the electrical schematic drawings.

2.7 Earthing Arrangements

Note that the product is designed to accept a Class I feed voltage system. As such the system relies upon both insulation and also the integrity of earthing arrangements to afford the protection against electric shock.

Note that all earth straps and cables must remain intact and not be removed or disturbed in any way such that the safety of the system is jeopardised.

All outer metal surfaces of the main housing are connected to the main earth bar using 35mm² copper cables or equivalent braids. This is essential to enable the flow of very high fault currents which can be experienced in Overhead Line Electrified areas.

3 Details of the PHCC Equipment

3.1 General Information

Electric point heaters are critical for the operational integrity of the railway network during adverse weather conditions. Their purpose is to keep points and associated mechanisms operating satisfactorily during all but exceptionally sever adverse weather conditions.

The Henry Williams Point Heater Control Cubicles house all of the necessary equipment required to distribute and regulate the power to the local points heating transformers.

As well as the control and switching of the power it is also capable of monitoring the power consumption which can be used to generate alarms should any faults be found with the operation of the system. Information and alarms can be logged and transmitted to the Network Rail Intelligent Infrastructure system via the optional datalogger unit.

The Henry Williams PHCC has been designed to fully comply with Network Rail standard Ref: NR/L2/ELP/40045 MODA.

There are two styles of PHCC, these are as follows:

A Location Case Version
It is housed in a robust stainless steel enclosure very similar to a Network Rail approved location case standard and has Ingress Protection rating to IP 54.

The unit is designed to be installed onto a standard Network Rail approved large location case cast base [CAT No. K004/104273]. Note that this CAT no. also includes the fixing kit required to fix the enclosure.

The PHCC has been designed in a modular format so that the power, control circuits, and outgoing feeds are segregated. This allows one area to be investigated whilst the other modules remain safely covered.

The modular approach to design allows the incoming and outgoing field cables have their own termination chambers and separate glanding plate arrangements. This greatly assists the installation team in the fitting and termination of the field cabling.

DNO Enclosure Version (Stainless Steel or GRP)
This is the Classic version, that is installed into a Network Rail approved DNO style enclosure and has Ingress Protection to IP 54.

The unit is designed to be installed onto a suitably sized concrete base.

The PHCC has been designed to fit onto a back plate, with various items of equipment housed into enclosures.

The design allows the incoming and outgoing field cables have their own termination chambers and separate glanding plate arrangements. This greatly assists the installation team in the fitting and termination of the field cabling.

3.2 PHCC Layout/General Arrangement (A Location Case Version) - Front

The photograph below shows the general layout of the front of the PHCC.

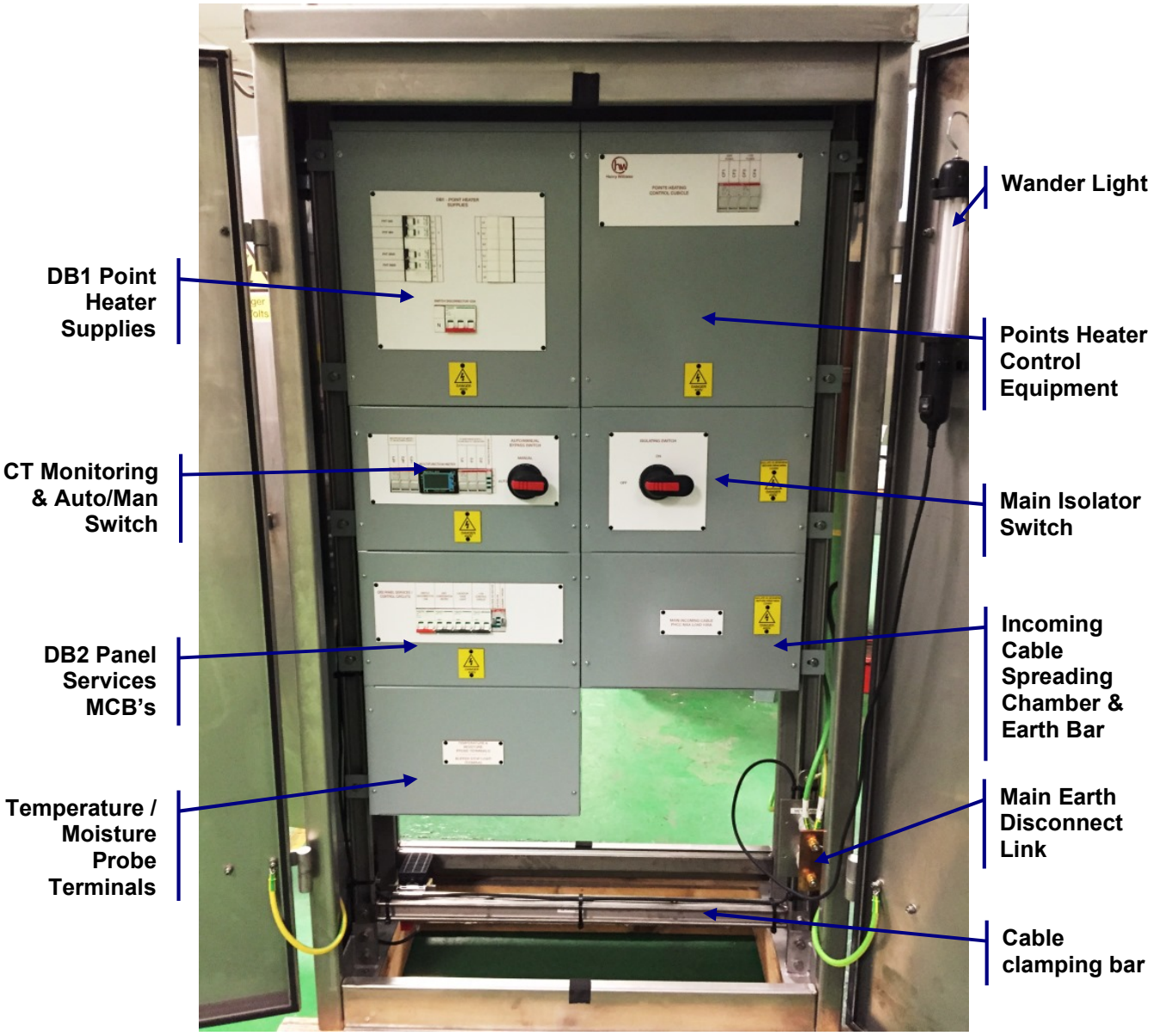


Figure 1: PHCC (A Style Location Case) Front Layout Arrangement

3.3 PHCC Layout/General Arrangement (A Location Case Version) - Rear

The photograph below shows the general layout of the rear of the PHCC.

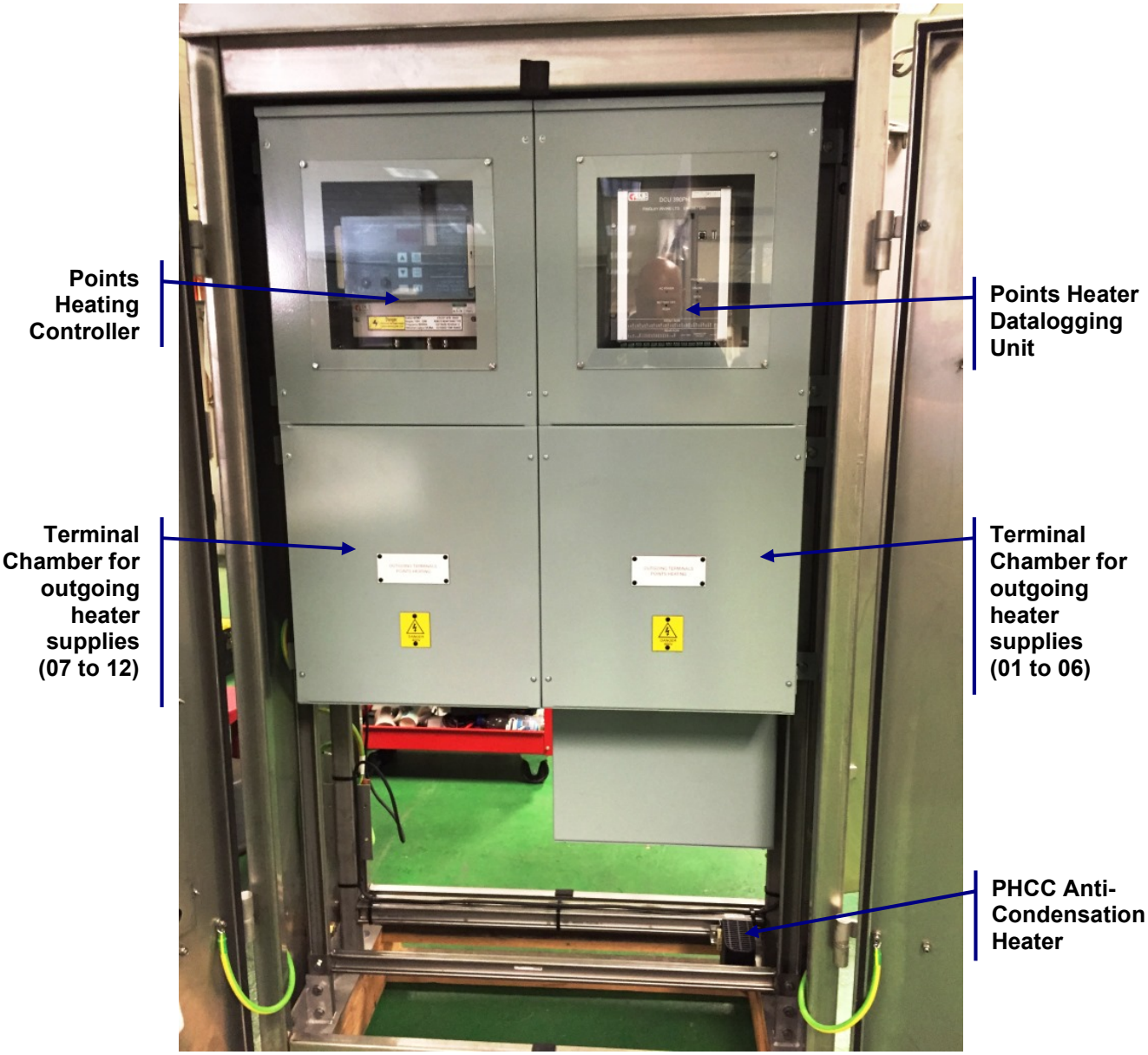


Figure 2: PHCC (A Style Location Case) Rear Layout Arrangement

3.4 PHCC Layout/General Arrangement (DNO Enclosure Version)

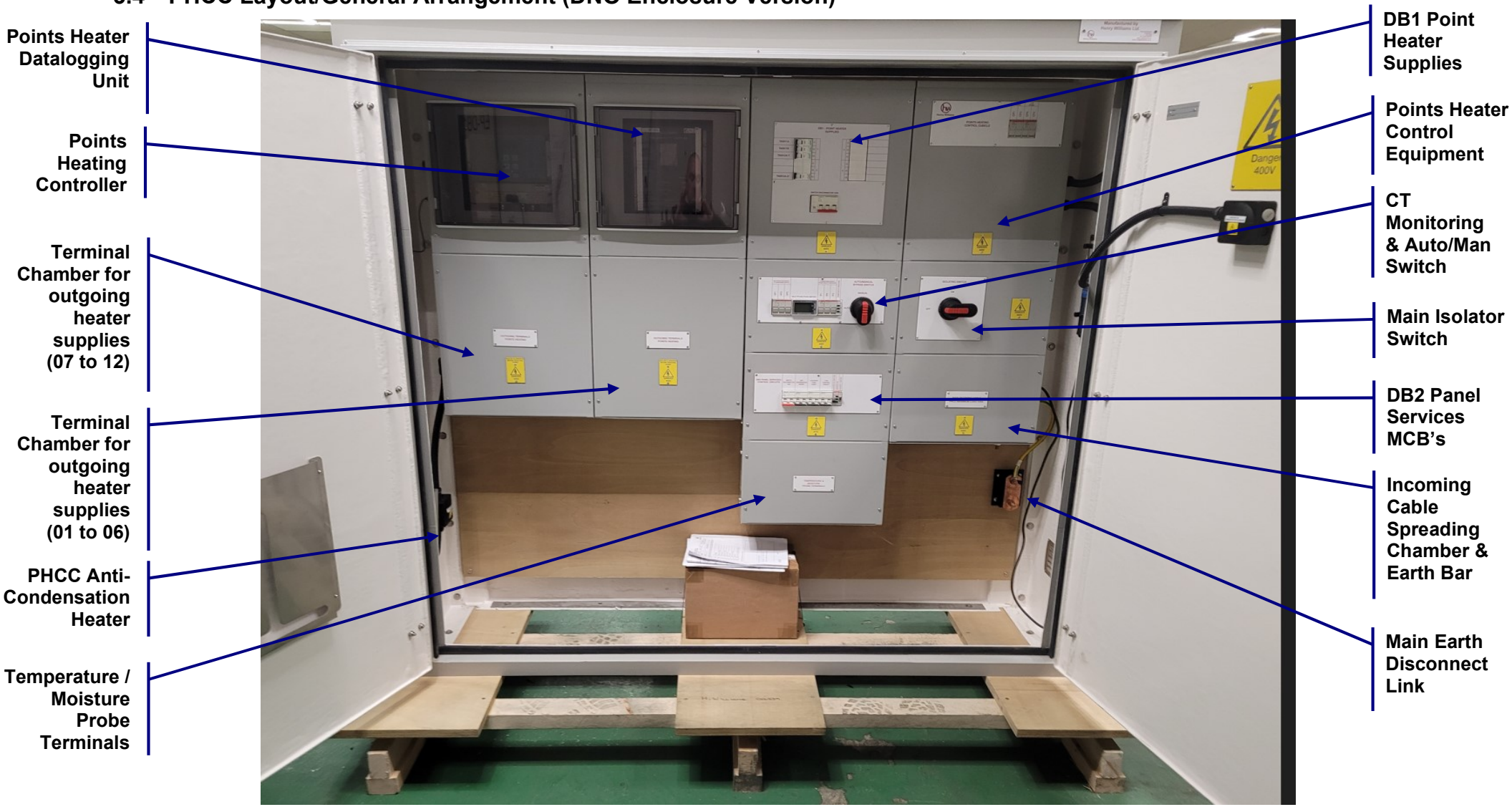
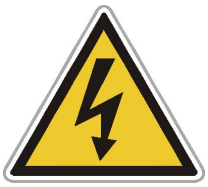


Figure 3: PHCC (DNO Style Version) Layout Arrangement – Stainless Steel or GRP

4 PHCC Installation

The following sub-sections detail the instructions for installation of the PHCC.

Prior to the removal of any internal covers or any work being undertaken, the PHCC Power Feed supply must be isolated and Locked Off.



Once Isolation has been carried out, it is essential that a proved* voltage indicator is used to recheck that all electrical equipment is dead prior to any works being undertaken.

4.1 Installation of Cubicle onto the Base

4.2 A Style Location Case PHCC

The PHCC has been designed to be installed directly onto a standard approved Network Rail concrete base. The base is the type normally used for large size location cases. The base required is specified by the following description & catalogue no:

- Base Assembly for Large Apparatus Case, Complete with Corner Units, 2 Filler Blocks and Fixing Kit (Cat No. K004/104273)

Note that the cubicle weighs between 400 to 450Kgs and should only be lifted and manoeuvred into position using lifting equipment and the lifting brackets provided on each the side of the case.

The standard base has 4 off large threaded bolts which are cast into the concrete. Remove any nuts and washers fitted onto the threads before installing the PHCC cabinet.

The PHCC cabinet should be lowered onto the base carefully lining up the pre-drilled holes in the cubicle base with these bolts.

The cubicle shall be securely fixed to its permanent base. Appropriate sealing shall be provided between the cubicle and its fixing position. At the cubicle base, methods shall be adopted to prevent vermin and moisture ingress. Adequate facilities for water drainage shall also be provided.

4.3 DNO Style PHCC (Stainless Steel or GRP)

The PHCC has been designed to be installed directly onto a suitably sized concrete base.

Note that the cubicle weighs between 400 to 450Kgs and should only be lifted and manoeuvred into position using lifting equipment and the lifting brackets provided on the case.

Certified lifting chains should be attached to the lifting plates.

A Spreader Bar is recommended to distribute the lifting load.

A lifting plan should be carried out by the contractor who is conducting the lift.

The PHCC cabinet should be lowered onto the base carefully lining up the pre-drilled holes in the cubicle base with these bolts.

The cubicle shall be securely fixed to its permanent base. Appropriate sealing shall be provided between the cubicle and its fixing position. At the cubicle base, methods shall be adopted to prevent vermin and moisture ingress. Adequate facilities for water drainage shall also be provided.

4.3.1 GRP Enclosure Lifting Plates

Lifting plates are secured to the enclosure as per the drawing pack provided with PHCC.

During transportation these lifting plates are usually loosened off and rotated down to reduce the overall height of the unit. It this has been carried out the lifting plates will need to be re positioned as per the attached drawing and tightened.

4.4 Installation of Incoming Power Cable (with Power OFF)

It is essential that the PHCC is fully isolated and locked off from all supplies before any terminal covers are removed.

The PHCC has been designed to accommodate in incoming power cable up to 185mm². The terminal studs on the incoming isolator are M8 and the correctly sized cable lugs must be fitted to suit both the cable type/size and the terminal studs.

The diagram below gives the detail required for the connection of the main cable to the main isolator.

Note that the incoming cable will need to be connected to the bottom of the isolator, not the top side as shown in the detail below. All other dimensions/settings are the same.

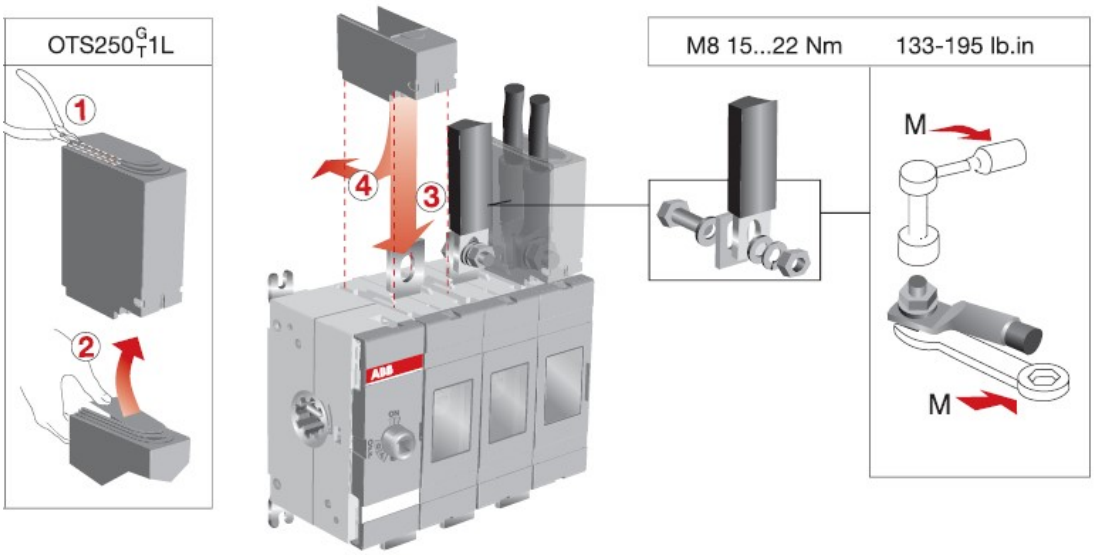


Figure 4: Connections to Main Isolator

Note on Aluminium Cable

If the incoming cable is Aluminium, then correctly sized aluminium to copper fused lugs must be used.

Under no circumstances must aluminium cables be directly connected to the main isolator terminals.

Installation Sequence:

For the following steps refer to Figure 4 and Figure 5 in this manual:

1. Remove the gland plate from the bottom of the terminal chamber.
2. Install Stripped Cable into gland, through gland plate and tighten.
3. Install gland plate back onto the bottom of the terminal chamber.
4. Fit crimp lugs loosely onto terminals and mark cable for correct cut length to main isolator connection studs.
5. Remove gland plate fixings for easier access to cut cable tails to length as required.
6. Strip & crimp cable tails.
7. Refit gland plate to bottom of the PHCC enclosure.
8. Install cable lugs onto terminals, fit washers/nuts & tighten – see Figure 4.
9. Refit terminal protective covers.
10. Refit and secure the terminal chamber outer cover.

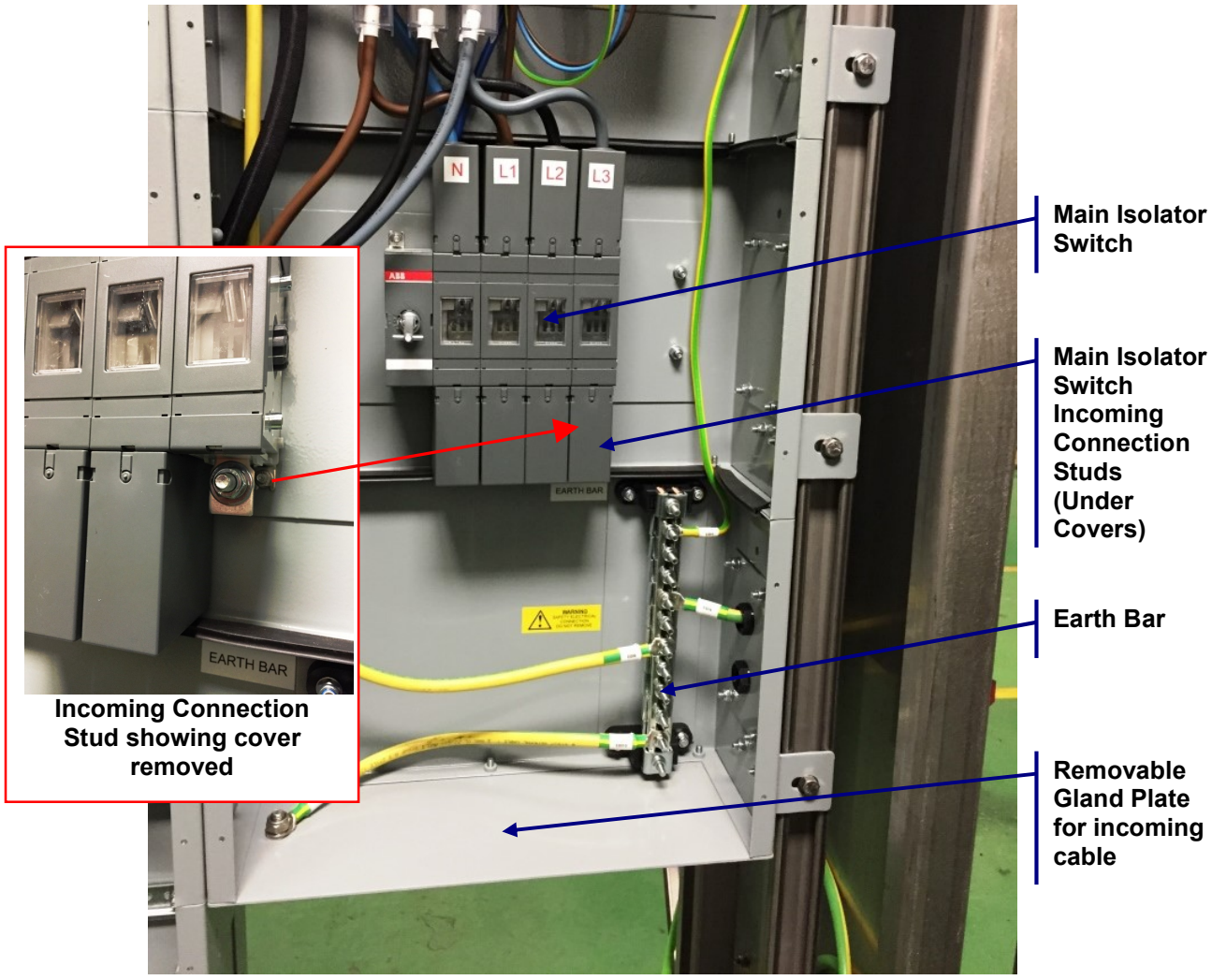


Figure 5: Detail for Incoming Cable Connection

5 Installation of PHCC Load Circuits Wiring

Outgoing terminals are provided for connection of the point heating transformer wiring within the PHCC. The outgoing cables are connected to these terminals.

These outgoing terminals are labelled to correspond with the electrical schematic diagram for the relevant model. The electrical schematic diagram (which matches the model being installed) must be consulted before terminations are carried out to ensure the correct connections are made.

The outgoing terminal chamber modules have a removable steel gland plate. These are to be removed and drilled to accommodate the glands for the outgoing heating transformer cables.

It is essential that the PHCC is fully isolated and locked off from all supplies <u>before</u> any terminal covers are removed.

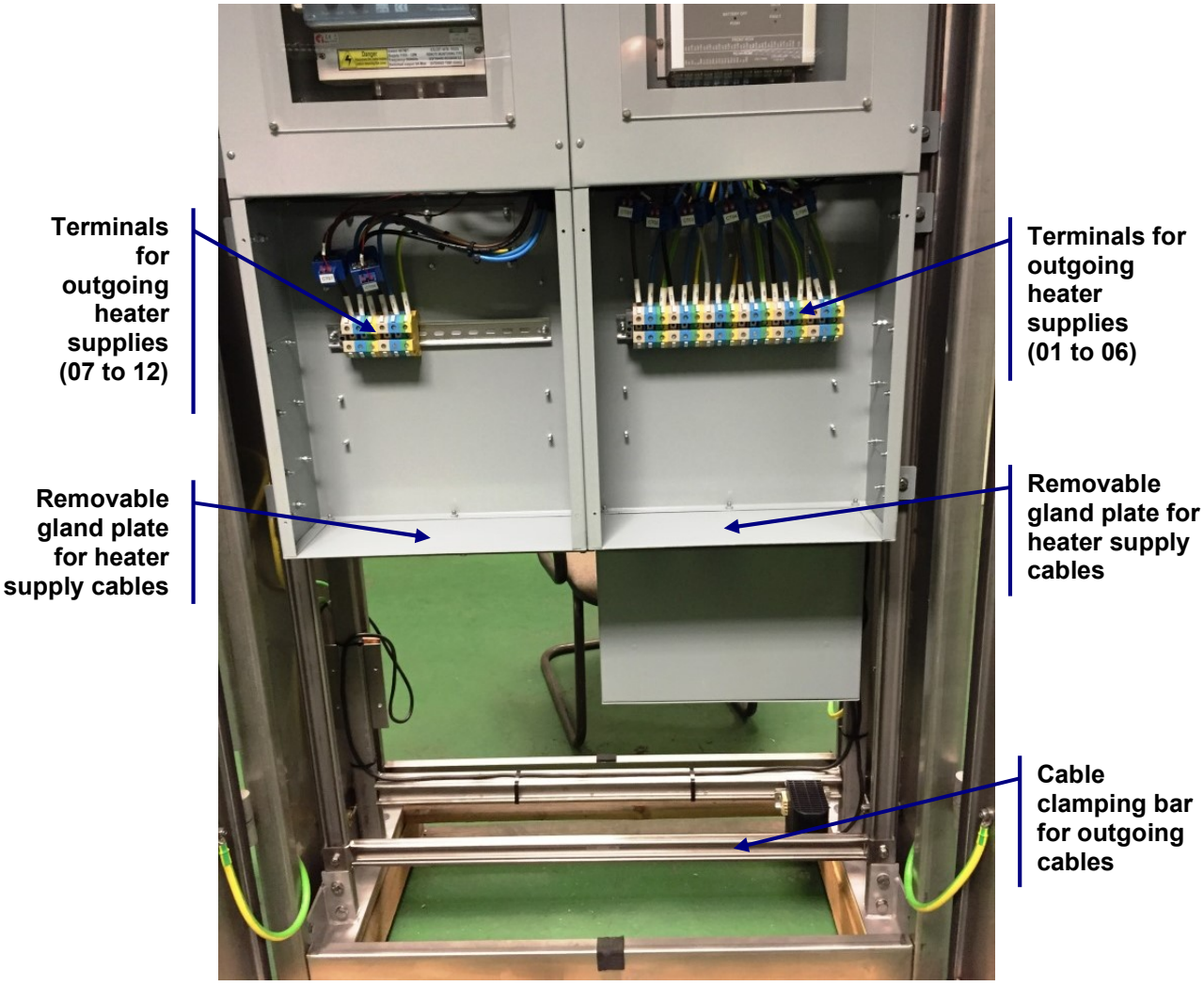


Figure 6: The PHCC Outgoing Terminal Chambers (A Style Location Case shown)

6 Installation of COLD and HOT Rail Sensor Wiring

The PHCC's internal controller (Findlay Irvine – Icelert 470M) is designed to function with two rail probes. These probes are connected to the track and provide the temperature information to the controller.

- The **COLD** probe is attached to a section of the rail which <u>is not affected</u> by the switch heating.
- The **HOT** probe is attached to a section of the rail which <u>is affected</u> by the switch heating.

The above probes require connection to the PHCC. Terminals are provided within the PHCC to accommodate the probe connections.

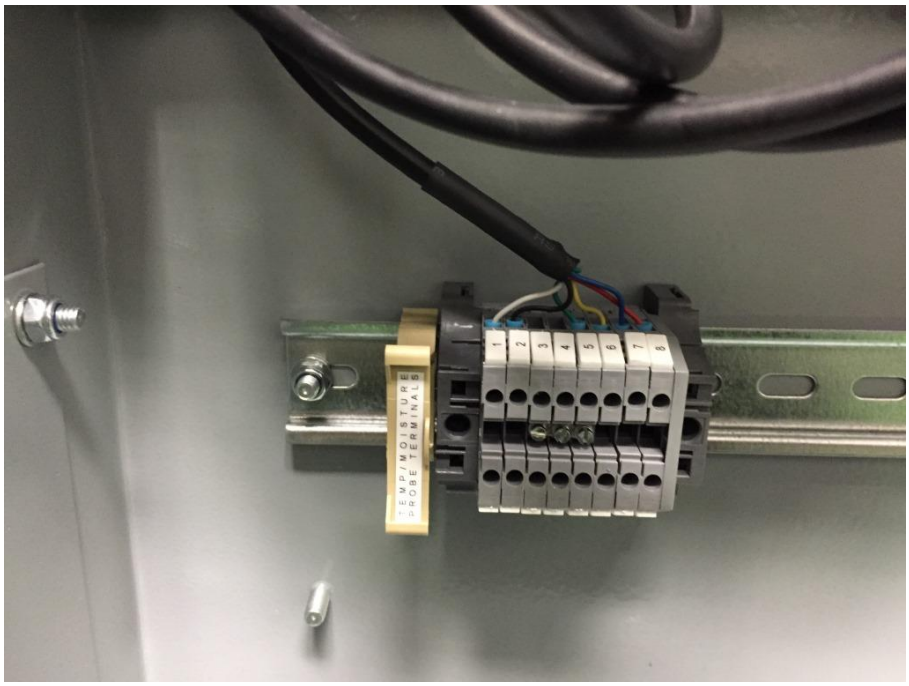


Figure 7: Hot/Cold Probe and Precipitation Sensor terminals

6.1 Installation of Precipitation Sensor

The Precipitation Sensor is designed to detect both falling rain and snow. The PHCC has a mounting boss which is installed onto the roof of the cubicle.

The sensor comes pre-fitted with cable which should be passed through the mounting boss. The sensor can then be screwed onto the mounting boss.

Figure 8: Installation of Precipitation Sensor

The PHCC electrical schematic drawings should be consulted to identify the correct connection details of the wire core colours and the terminal numbers.

7 Operation of the PHCC

7.1 Operation and Set-up of the PHCC Controller

The internal points heating control of the PHCC is carried out by a Findlay Irvine Icelert 470M. In order to understand the operation and for information of setting up the parameters for this device please refer to the Operation Manual as detailed below:

ICELERT 407M

RAILWAY SWITCH HEATING CONTROLLER

OPERATING INSTRUCTIONS

FI 380300

A copy of this manual is included with the PHCC and also available from Findlay Irvine Ltd or Henry Williams Ltd.

7.2 Auto/Manual Switch

Under normal operation the Auto/Manual switch should be in the Auto position.

- **AUTO** – In this position the main heating power is controlled automatically by the points heating controller via the main contactor. Pressing the Test Pushbutton will temporarily override the controller and energise the main contactor.
- **MANUAL** – In this position the main heating power contactor is bypassed and mains power is applied directly to the point heaters (via the point heater distribution board).

7.3 Summer/Winter Switch

Under normal operation the Auto/Manual switch should be in the Auto position.

- **SUMMER** – In this position the main heating power is controlled automatically by the points heating controller via the main contactor.
- **WINTER** – In this position the main heating power contactor is bypassed and mains power is applied directly to the point heaters (via the point heater distribution board).

7.4 Multifunction Meter & Current Transformer (CT)

The SmartRail X835 multifunction meter is a modern design power monitor which measures and displays electrical power quality parameters.

This unit measures and displays the characteristics of single phase two wires (1p2w), three phase three wires (3p3w,) and three phase four wires (3p4w) networks. The measuring parameters include voltage (V), frequency (Hz), current (A), power (kW/Kva/Kvar), Imported, exported and total Energy (kWh/kvArh).

The meter is pre-set to match the points heating control system and the supplied CT with the following parameters:

- **Power Network**: 3 phase 4 wire
- **CT Ratio:** 250/1
- **CT Secondary:** 1A
- **Primary Voltage (PT1):** 230V
- **Secondary Voltage (PT2):** 230V

All/any of the above parameters can be change to suit as required.

Should any multifunction meter settings require changing, please consult the detailed user manual for this device which is supplied with the PHCC.

7.4.1 Viewing Voltage & Current Measurements

Each successive press of the above button cycles through the following display screens:

- Phase/Neutral Voltages
- Current on Each Phase
- Phase to Neutral THD%
- Current THD% for each Phase

7.4.2 Viewing Frequency, Power Factor/Demand Measurements

Each successive press of the above button cycles through the following display screens:

- Frequency & Power Factor (total)
- Power Factor of each Phase
- Maximum Power Demand
- Maximum Current Demand

7.4.3 Viewing Power Measurements

Each successive press of the above button cycles through the following display screens:

- Instantaneous Active Power (KW)
- Instantaneous Reactive Power (KVAr)
- Instantaneous Volt-Amps (KVA)
- Total KW, KVAr, KVA

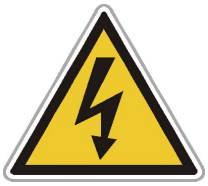
7.4.4 Viewing Energy Readings

Each successive press of the above button cycles through the following display screens:

- Imported Active Energy (KWh)
- Exported Active Energy (KWh)
- Imported Reactive Energy (KVArh)
- Exported Reactive Energy (KVArh)
- Total Active Energy (KWh)
- Total Reactive Energy (KVArh)

8 Maintenance

Prior to the removal of any internal covers or any work being undertaken, the PHCC Power Feed supply must be isolated and Locked Off.



Once Isolation has been carried out, it is essential that a proved* voltage indicator is used to recheck that all electrical equipment is dead prior to any works being undertaken.

8.1 Replacement of Components

The internal components can be replaced with new on a like-for-like basis as required. For reference, the part numbers for the main components used within the PHCC are given in the parts table in section 9.

8.2 Annual Procedure

It is recommended that the following work be carried out yearly:

- Isolate and lock-off the incoming supply. PROVE VOLTAGE INDICATOR!
- General visual inspection as to the condition of the enclosure and components within (including wiring).
- Check presence & legibility of all I.D. labelling and warning notices.
- Check all cable connections and crimps are secure and do not show any sign of excessive heat/burning.
- Check that all fuses are present and of the correct size (and voltage rating) as detailed on the electrical schematic diagrams.
- Remove, inspect, and re-insert fuses. Check carrier tightness and for signs of any burning.
- Check that the cubicle inspection “Wander” lamp or Panel Lamp is in working order.
- Check that the cubicle thermostat & heater are operational. The thermostat is designed to switch on the heater at 5ºC and off at 15ºC.
- Check cables and gland enclosures for damage or evidence of water ingress.
- Give the equipment a general clean and remove any build-up of dust/debris using a brush or small vacuum.

9 Part Numbers

The table below details the part numbers for the main component items used in the Points Heating Control Cubicle along with a description and supplier for each item.

Description	Supplier	Part Number
Points Heating Control Unit	Findlay Irvine	Icelert 407M : I996031 CAT (055/056008)
Rail-mounted Temperature Sensor	Findlay Irvine	I990101 Specify Red or Blue Sleeve (Cold Rail – Blue Sleeve) (Hot Rail – Red Sleeve)
Precipitation Sensor	Findlay Irvine	I993768
Datalogger (English Region)	Findlay Irvine	DCU390PH English Region : 991744
Datalogger (Scottish Region)	Findlay Irvine	DCU390PH Scottish Region : 991944
Datalogger Antenna	Findlay Irvine	I683012
Current Transducer	LEM	AT 50 B420L
Heaters ON Test Pushbutton	ABB	2CCA703162R0001
1Pole C/over switch (Cubicle Light) (Summer/Winter)	ABB	2CCA703040R0001
3 LED Indication Lamp Green 230VAC (Phase Healthy) (Heaters ON)	ABB	2CCA703901R0001
Contactor 115A 110V 3Pole + (1 N/o, 1 N/c)	Schneider	LC1D1156F7
Contactor Suppressor Module	Schneider	LA4DE2U

Description	Supplier	Part Number
Contactor Connection Shrouds	Schneider	LA9D115703
Transformer 230V/110V Centre Tapped Earth 55-0-55 (500VA)	TIC	CL500U1FCT
Multifunction Power Meter	SmartRail	SMPSRX835
3 Phase CT – Smart Connect (3*250A/1A 1.5VA)	SmartRail	SMPCT335-SC
125A 3P Switch Disconnector (Bypass Switch)	ABB	OT125F3/1SCA105033R1001
Gland Plates (undrilled) (pack of 2)	Henry Williams Ltd.	HWPHCC2GP01
Protection Devices/Holders		
Camaster Fuseholder (32A)	Cooper-Bussman	CM32F
Redspot Fuseholder (32A)	Redspot	RS32P/BLK
System pro M compact fuseholder (32A)	ABB	E91/32 Range

10 Disposal

All electrical equipment must be disposed in accordance with local authority regulations & the WEEE (Waste Electrical & Electronic Equipment) Regulations. A summary of the WEEE regulations is given below. For further information contact the Environment Agency.

Summary of Waste controls for people who handle WEEE

The storage, transport, treatment and disposal of WEEE is covered by waste legislation. The main requirements are summarised below:

- An operator of a site that accepts WEEE to dismantle or treat for parts or materials will need an appropriate Environmental Permit. Information is available from our website at: www.environment-agency.gov.uk/epr

- An exemption from environmental permitting can be registered with us for sites that store WEEE prior to recovery elsewhere, and a chargeable exemption is available for sites that refurbish WEEE.

Everyone that handles WEEE or other waste, including the waste producer, has a Duty of Care. This aims to look after waste from 'cradle to grave'. A business must:

- store their waste properly to prevent it from harming the environment;
- only pass it to someone authorised to deal with it;
- pass a written description of the waste (Waste Transfer Note or Hazardous Waste Consignment Note) to the waste carrier, this note accompanies the waste and helps others know how to handle the waste.

Waste producers should also check that all wastes leaving their site are taken to a properly authorised site. You can check with the environment agency if you have any doubts. If your waste later caused a problem (e.g. it was illegally dumped) you would need to be able to show that you had taken all reasonable steps to ensure it was properly managed.