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Specialist Estates Services

Triennial Inspection Report of the Low Voltage Installation

at University Hospital Llandough

for Cardiff & Vale University Health Board

Date: June 2022

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NWSSP-SES Job No: CV/TAR2022-001

Report Date: June 2022

Authors: Nigel Bolan BSc (Hons) CEng MIET

Signed: .....

Authorised: Simon Russell BEng (Hons) CEng MIET

S Russell

Signed: .....

Contents

1.0 Summary 4
2.0 Introduction 5
THE SITE 5
3.0 Audit findings 7
3.1 AUTHORISED PERSONS 7
3.2 AUDIT TRAIL 8
3.4 SAFETY SYSTEM KEYS 12
3.5 EXTERNAL STRUCTURE 13
3.6 INTERNAL STRUCTURE 14
3.7 LV EQUIPMENT 16
3.8 COMMENTARY ON RESILENCE 18
4.0 Recommendations 20
Appendix A: Photographs 22

1.0 Summary

1.1 This report details the audit of the low voltage electrical systems and safe systems of work in accordance with HTM06-02: Electrical safety guidance for low voltage systems.

1.2 The audit was undertaken at University Hospital Llandough for Cardiff & Vale University Health Board by Nigel Bolan Authorising Engineer of NWSSP-SES on the 9th June 2022.

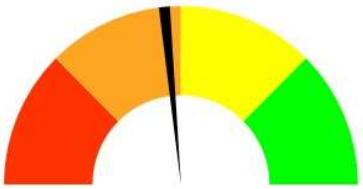
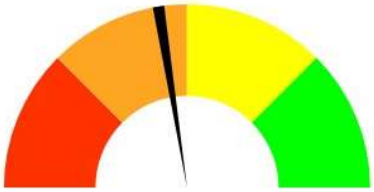
1.3 The management and implementation of the safe system of work for the low voltage system is not in full accordance with HTM 06-02, there are non-compliances as follows:

- Limited Authorised Persons (low voltage) (AP (LV)) coverage for this site.
- A number of Competent Persons (low voltage) (CP (LV)) appointments have expired, refresher training courses may be required before candidates can be reassessed.
- Safety documentation not being fully completed as shown in Table 2 of HTM 06-02
- Record information is not available for some parts of the low voltage distribution systems.

1.4 The general condition of the low voltage (LV) equipment is good to poor, with non-conformities with regard to the site condition listed in section 3 of this report.

1.5 The Authorising Engineer (AE (LV)) has deemed the compliance rating of the safe systems of work as detailed in HTM06-02 for the site as limited assurance as shown below in figure 1.

In addition, a rating is also provided on the level of resilience inherent in the system design (in line with WHTM06-01) considering the age of equipment and has assessed the overall resilience rating as limited assurance as shown below in figure 2.

Figure 1: Compliance rating	Figure 2: Resilience rating
	
Limited AP (LV) coverage for this site. A number of CP appointments have expired. Safety documentation not being fully completed as shown in Table 2 of HTM 06-02.	**Some obsolete switchgear, single point failures on main switchgear. Some ACBs & tripping batteries appear to have not been recently serviced & maintained. N+1 generation not provided for high risk clinical areas.**
Limited assurance	**Limited assurance**

2.0 Introduction

THE SITE

COMPLIANCE

2.1 University Hospital Llandough opened in 1933 and had 480 beds providing all major specialities which has now increased to 750 beds with the new adult mental health unit completed a few years ago.

2.1 The site now has two main incoming supplies from the electricity district network operator (DNO). The main site supply is located in a separate switchroom positioned adjacent to the main boiler house/estates department and feed local and remote distribution transformers via an open ring. The Hafan Y Coed development has a dedicated DNO supply and health board owned substation fed off the DNO network.

2.2 The main hospital main switchboard consists of DNO and health board switchgear of the withdrawable Hawk Gas 12 SF6 type. The DNO breakers feed the HB owned section of the switchboard with a bus section switching splitting the board. The health board owned section then feeds local boiler house transformers and high voltage (HV) ring which in turn feeds remote substations.

2.3 The LV switchboards are of varying age, generation provided locally at each substation but not all in an N+1 arrangement.

2.4 **Compliance**

2.5 Management and its nominated staff as “Duty Holders” are responsible for the safety of low voltage (LV) electrical systems on their premises. The Electricity at Work Regulations 1989 imposes duties on “employers” to comply with these insofar as they relate to matters that are within their control. These duties are in addition to those imposed by the Health and Safety at Work Act 1974.

2.6 HTM 06-02: Electrical safety guidance in Low voltage systems provides guidance intended to assist in meeting the requirements of the Electricity at Work Regulations 1989, which detail the precautions to be taken against risk of death or personal injury from electricity in work activities.

To satisfy these requirements, HTM 06-02 states that management should have:

- a clearly defined electrical safety policy and programme for the operation and servicing of their low voltage system(s) and equipment.
- means by which the policy and programme can be managed, implemented, monitored and reviewed.

2.7 Hazards may also arise from poor design, construction or installation, inadequate maintenance, or from misuse or incorrect operation of electrical systems.

2.8 University Hospital Llandough has confirmed that it should be operating the LV systems within its estate in accordance with HTM 06-02.

2.9 As part of the Authorising Engineer duties outlined in HTM 06-02, a site inspection should be carried out on a triennial basis and the report sent to the Designated Person for the Health Board with copies to the Authorised Persons.

2.10 This report details the second triennial audit of the low voltage safe systems of work and safety procedures at the University Hospital Llandough in accordance with HTM 06-02 the first triennial audit being carried out by NWSSP back in April 2018.

2.11 An audit was carried out on site in June 2022 broadly following the HTM 06-02 standard checklist and subdivided as follows:

- personnel and appointments.

- safety documentation.
- record information.
- building internal and external structure and associated control.
- LV equipment (main LV Switchrooms only).

2.12 Extracts from the audit check list are enclosed in the next section together with site photographs later in this report to illustrate the type of equipment and any issues which are also raised in the text.

3.0 Audit findings

LOCAL HEALTH BOARD	***CARDIFF & VALE UNIVERISTY HEALTH BOARD***
SITE	***UNIVERSITY HOSPITAL LLANDOUGH***
AUTHORISED PERSONS	***CHRIS WATTS & PETER COX***

3.1 AUTHORISED PERSONS

Item		Y	N	Comments
3.1.1	Is the AP currently certified?	■		*Yes:* *Chris Watts recommended for appointment 17/12/2021* *Peter Cox recommended for appointment 22/12/2021*
3.1.2	Is the AP due refresher training in HTM 06-02??	■		*No:* *Chris Watts refresher due October 2024* *Peter Cox refresher due August 2024*
3.1.3	Is the AP due for training in emergency first aid?		■	*Yes.* *Both Chris Watts & Peter Cox 1st aid training expires on 24th July 2022*
3.1.4	Is the AP carrying out duties on a regular basis?	■		*Yes, there was plenty of evidence to show safety documentation being used.*
3.1.5	Is the AP carrying out monitoring of work in progress?	■		*Yes*
3.1.6	Are sufficient APs' appointed?		■	*No, Additional APs' should be appointed to provide full cover during absence.*
3.1.7	How many other AP duties does the electrical AP undertake?	■		*Chris Watts:- HV, LV & Decontamination* *Peter Cox:- LV & Decontamination*

Commentary

3.1.8 Health Technical Memorandum (HTM) 06-02 defines the roles of personnel involved in low voltage systems. One role is that of an Authorised Person who has been appointed by the management on the recommendation of the AE (LV) who is responsible for the implementation and operation of this guidance with regard to work on, or the testing of defined electrical equipment.

3.1.9 The AE(LV) assess and recommends the appointment of Authorised Persons who must undergo suitable training and familiarisation and are also competent to take day to day control of the LV Electrical systems.

3.1.10 University Hospital Llandough currently has only two appointed AP (LV). For a hospital of this size and complexity, we would recommend there be a minimum of three APs' appointed. This would provide sufficient cover for annual leave and general absence. All AP's should meet the requirements laid down in HTM 06 before being nominated for appointment.

3.1.11 The existing electrical distribution system does not fully comply with the design requirement laid down in WHTM 06-01 which deals with design and operational requirements. This

shortcoming highlights the need for suitably qualified staff that are able to manage emergency situations.

3.2 AUDIT TRAIL

Item		Y	N	Comments
3.2.1	Does the safety programme follow the procedures in Tables 1 & 2?	■		*Yes, Safety Programme (SP 06/129369)*
3.2.2	Is the safety programme clear, legible and unambiguous?	■		*Yes*
3.2.3	Was the safety programme countersigned by an appropriate person?	■		*Yes*
3.2.4	Does the AP have sufficient items of safety equipment to carry out the Safety programme?	■		*Yes*
3.2.5	Is the Isolation and earthing diagram clear, legible and unambiguous?		■	*No, (Isolation & Earthing Diagram 06/105774)*
3.2.6	Was the permit to work clear, legible and unambiguous?	■		*Yes, (Permit to Work 06/174324)*
3.2.7	Was the permit to work issued to a Competent Person?	■		*Yes*
3.2.8	Was the Permit to Work cancelled correctly?	■		*Yes*
3.2.9	Has the LW1 form been used correctly?		■	*LW1 forms are not currently being used*
3.2.10	Have certificate of authorisation for live Working been used and approved by AP / AE (LV)?	■		*No certificates have been issued*
3.2.11	Are Limitation of Access forms being used regularly?	■		*Yes (Limitation of Access 06/106230)*
3.2.12	Were the site records updated on completion of the work?		■	*Only updated if included within the O&M manual provided as part of the contract.*

Commentary

3.2.13 An audit of the safety documentation was carried out to check compliance against the procedures detailed in table 2 of HTM 06-02.

3.2.14 The general standard of the safety documentation examined was generally in line with the requirements of HTM 06-02. Note however we would normally expect simple isolation and earthing diagrams to be completed on the DH approved sheets rather than extracts from AutoCAD / schematic drawings. In addition, the use of computer drafted safety programmes should be discussed with the AE.

3.2.15 HTM 06-02 provides a check list of "Protective and test equipment" for use by the authorised and competent persons (see page 47 Appendix 2). The hospital has a set of test equipment which is kept in the AP locker located in the estates department.

3.2.16 The AP (LV) should note some site logbook entries are missing and should be completed and show every switching carried out on the system even if carried out via a safety programme. All APs' (LV) should ensure they complete the logbook in accordance with HTM 06-02.

3.3 EXAMINATION OF RECORD DOCUMENTS

Item		Y	N	Comments
3.3.1	Are the documents kept in the lockable cupboard?	■		*Yes*
3.3.2	Does the Authorised Person have access to a controlled copy of HTM 06-02?	■		*Yes*
3.3.3	Are the single line network diagrams of the electrical distribution correct and up to date?	■		*Distribution Schematics being updated as part of the EICR framework.*
3.3.4	Has the LV protection grading chart been checked?	■		*A grading exercise was carried out in 2018.*
3.3.5	Are the "as-laid" cable route drawings correct and up to date?		■	*Only HV available*
3.3.6	Are the "as-fitted" drawings correct and up to date?		■	*As fitted drawing held for newer projects. Some older information is available but unsure of accuracy.*
3.3.7	Are copies of operation and maintenance manuals held for all equipment?	■		*For recent projects, copies are kept in the Archives Room*
3.3.8	Is there an operational procedure manual available?		■	*Yes, this manual needs to be updated in line with the requirements of HTM06-02 Chapter 10*
3.3.9	Is there an Electrical Safety Group?	■		*Yes*
3.3.10	Does the Electrical Safety Group meet regularly?	■		*Quarterly*
3.3.11	Are all events recorded in the logbook?		■	*No. Some switching operations detailed in the safety programme are not logged*
3.3.12	Are operational restrictions recorded in the logbook?	N/A		*No operation restrictions on site*
3.3.13	Is the authorise person due for training in the use of cable tracing		■	*Equipment on site, training on the use of tis equipment is waiting to be arranged.*
3.3.14	Is the register of competent persons up to date		■	*No, many CP appointments have expired.*
3.3.15	Is all of the distribution system included in the planned maintenance programme?		■	*No, some ACBs' were last serviced 2017*

3.3.16	Are main ACBs/MCCBs being maintained?		*There was some evidence of labels for some ACBs' dating back to 2017, however there are ACB's in service that have not or may have never been serviced.*
3.3.17	Are power factor correction units being maintained?		*Yes, there was evidence that the PFC was serviced October 2021, however the unit located within Substation 1 has been taken out of service.*
3.3.18	Is fixed wiring testing being carried out?		*There is a contract in place for fixed wiring testing with Guardian however the certificate audit was UNSATISFACTORY.*
3.3.19	Are supplementary bonding resistances being tested annually?		*Most of the fixed wiring did not require supplementary bonding at the time of installation.*
3.3.20	Are switchroom inspections being carried out every three months?		*Yes*
3.3.21	Are there any PPMs in place for the craftsmen e.g. switchrooms, MCB/MCCB boards etc		*Yes, this is undertaken using MICAD system*
3.3.22	Are there emergency contingency plans in place, including call out numbers etc.?		*Procedures are in place, with staff on call, this should be formalised and recorded in the operational procedure manual*
3.3.23	When was a loading study/site capacity check last carried out?		*Site load study has not been carried out recently*

Commentary

3.3.24 Operating records are an important aspect of electrical safety management to enable APs' to safely manage their sites. HTM06-02 chapter 10 details the specific requirements for what documentation should be maintained on site.

3.3.1 Emergency contingency plans should be produced and held in the operational procedure's manual. Suggested items to be included are:

- A list all current staff including emergency contact details
- Emergency contact details for all manufacturers including generator, UPS & IPS systems, main switchboards, lightning protection/earthing systems, fire alarm, security alarm, nurse call, lifts, lighting control, cable tracing, HV & LV switchgear and equipment
- DNO supplier, including contact name, contract number and telephone number.

3.3.2 The appointment and monitoring of Competent Persons (CP) is an important aspect and duty of the AP (LV). These duties include:

- maintaining a CP (LV) register to included details of each CP in terms of appointment date, training, competency, first aid and receipt of HTM 06-02 handbook.
- a CP File is required for each Competent Person to contain records of relevant training and appointment certificates.
- a system of 12 monthly monitoring of all Competent Persons should be implemented and recorded to the Operational Procedure Manual and Site Logbook.

3.3.3 Some LV switchgear is out of production, and spares and technical information may no longer be available. This could put the hospital at risk if failure of components were to occur.

3.3.4 A service contract needs to be put in place to carry out the maintenance and servicing of ACBs' there was little evidence of service sheets & labels on site and for those ACBs' that was afforded a service label it was dated 2017.

3.3.5 The power factor correction unit installed within LV Sub 1 has been taken out of service. Further investigation may be required to see how viable it would be to bring the unit back into service.

3.3.6 There is a contract in place for fixed wiring testing. Certificate audited was UNSATISFACTORY. A strategy needs to be agreed going forward, we would recommend consideration be given to testing areas 100% in their entirety and undertaking remedials at the same time as the test to limit the number of UNSATISFACTORY certificates being returned. (It may be prudent to include a schedule of rates for the top twenty common repairs as part of the tender process).

3.3.7 Up to date site schematics are essential for the safe operation of the electrical infrastructure. These should be produced in an electronic format so drawings can be constantly kept up to date.

3.3.8 LV grading and discrimination of protective devices has not been checked within the last five years and under fault conditions unwanted tripping or cascade tripping of devices affecting larger areas of site may occur. We would recommend an up-to-date grading exercise be undertaken.

3.4 SAFETY SYSTEM KEYS

Item		Y	N	Comments
3.4.1	Does the site have sufficient safety locks, safety key boxes and multihasps for the likely number of concurrent jobs?	■		*Yes*
3.4.2	Does the Authorised Person have sufficient caution and danger signs for the likely number of concurrent jobs?	■		*Yes*
3.4.3	Are the potential indicator and proving unit satisfactory?	■		*Yes*
3.4.4	Is the earthing equipment inspected at annual intervals?			*The lighting protection system is tested and inspected 12 monthly.*
3.4.5	Do the APs' have safety gloves and visor?	■		*Yes, additional sets may need to be ordered if additional APs' are appointed*
3.4.6	Are the LV switchgear working keys held on marked key plates and kept in a locked working cabinet?		■	*Switchgear located in shared plant rooms should be caged off or have working locks fitted to prevent unauthorised access/activation of devices. These keys need to be kept in a locked working key cabinet.*
3.4.7	Is there a safety key box with two locks (AP &CP) complete with name and serial number with keys kept in working key cabinet when not in use?	■		*Yes*

Commentary

3.4.9 LV test equipment has been issued to nominated Authorised Persons (LV). Competent Persons (LV) need to be appointed after receiving training on the requirements of HTM 06-02. They should also be made aware of the emergency contingency plans for the site.

3.4.10 The security of the electrical infrastructure is very important. All access doors to each switchroom should be kept securely locked when unattended. This is to prevent unauthorised access/accidental activation of the devices.

3.4.11 Switchgear located in shared plant rooms should be caged off or have working locks fitted to devices to prevent unauthorised access/accidental activation of the devices.

3.4.12 No persons other than an Authorised Person (LV) or Competent Person (LV) may enter a switchroom unless they are accompanied by an AP (LV) or have receipt of a safety document issued to them by the AP (LV).

3.5 EXTERNAL STRUCTURE

Item		Y/N (Compliant)					Comments
		Sub LV - 1	Sub LV- 2	Sub LV - 5	Sub LV -E	Sub LV - 20	
3.5.1	Is there a safety sign (P1) displayed at the entrance?						
3.5.2	Is the sign legible?						
3.5.3	Is the name of the LV Switchroom exactly the same as the switchgear schedule?						
3.5.4	Is the sign securely fixed?						
3.5.5	Is the correct contact telephone number shown?						*Notices could be provided on the doors of the switchrooms / switch cupboards which provide contact names and telephone numbers (officers & switchboard).*
3.5.6	Is the door secure/sound?						
3.5.7	Is there an emergency escape door?						
3.5.8	If so, is it accessible and can it be opened from the inside?	N/A	N/A	N/A	N/A	N/A	
3.5.9	Is there a clear escape route outside the substation?						
3.5.10	If so, are the access arrangements correctly controlled?						
3.5.11	Are any rubbish or fire hazardous materials stored outside the substation?						

Commentary

3.5.12 The construction and design of electrical Switchrooms is detailed in WHTM06-01 chapter 8 which provides guidance on the location, construction, access and layout of them. It also details what fire precautions and environmental requirements should be taken into account during this process.

3.5.13 Signage on doors should be brought in line with HTMs.

3.5.14 Consideration should be given to install notices on the doors of Switchrooms / switch cupboards. These notices could include the contact names and telephone numbers of the

Authorised Persons (LV) for the site and of the switchboard. It may be prudent to include the text: “In the event of fire please raise the alarm”.

3.6 INTERNAL STRUCTURE

Item		Y/N (Compliant)					Comments
		Sub LV - 1	Sub LV - 2	Sub LV - 5	Sub LV - E	Sub LV - 20	
3.6.1	Is there a site logbook?						*Yes*
3.6.2	Is the Switchroom dry and clean?						*Yes*
3.6.3	Are heaters installed and operational?	N/A	N/A		N/A		Yes, where installed
3.6.4	Are duct covers fully in place?	N/A	N/A				Yes, where installed
3.6.5	Are rubber insulated mats installed in front of switchgear						Mat required in front of PFC units
3.6.6	Are there any signs of rain ingress?						*No*
3.6.7	Are there any visible defects in the structure?						*No*
3.6.8	Are there any signs of rodents in the substation?						*No*
3.6.9	Is the working space and lighting adequate?						*Lighting level not sufficient in Sub LV 1*
3.6.10	Is emergency lighting installed?						*Yes*
3.6.11	If so, is it included in the planned maintenance programme?						*Yes*
3.6.12	Is a poster for Electricity at work, displayed as required						*Notices need to be ordered and displayed*
3.6.13	Is a poster for CPR, displayed as required						*Notices need to be ordered and displayed*

3.6.14	Is an up to date schematic displayed						*Schematics are on display but cannot guarantee their accuracy.*
3.6.15	Is there a 24-hour telephone point inside?						*If AP uses mobile phone, AP to ensure signal is available in the vicinity of all major switch rooms*
3.6.16	Are any non-AP items stored in the substation?						*No*
3.6.17	Is a suitable fire extinguisher provided in the substation?						*Yes*
3.6.18	Has it been inspected?						*All extinguishers have been serviced by Hartson Fire Ltd.*

Commentary

3.6.19 The display of permanent posters and safety signs is an important aspect to warn of the hazards that may be present to unauthorised personal and are detailed in chapter 11 of HTM06-02.

3.6.20 Notices for both Electricity at Work Regulations 1989 and Treatment for Electric Shock need to be ordered and displayed within all main & secondary LV switchrooms accordingly.

3.6.21 Up-to-date schematics should be produced and fixed on the wall in all switchrooms.

3.6.22 Standard and emergency lighting should be provided to safely illuminate all electrical distribution equipment.

3.7 LV EQUIPMENT

Item		Y/N (Compliant)					Comments
		Sub LV - 1	Sub LV - 2	Sub LV - 5	Sub LV - E	Sub LV - 20	
3.7.1	Is each item of switchgear clearly labelled?						*Suitable permanent labels identifying the circuit need to be installed for some circuits to replace handwritten or dyno tape labels. Circuits may need to be checked for accuracy.*
3.7.2	Do the labels agree exactly with the switchgear schedule?						*Existing labels need to be checked for accuracy and updated if required*
3.7.3	Are labels displayed at the rear of the switchgear?		N/A				*Warning labels required for Sub LV - 5*
3.7.4	Is the switchgear operating mechanism locked?						*Switchgear located in shared plant rooms should be caged off or have working keys fitted to prevent unauthorised access/activation of devices. These keys will then need to be kept in a locked working cabinet.*
3.7.5	Does the switchgear condition agree with the maintenance record?						*Maintenance records not available for some devices*
3.7.6	Is there excessive noise or heat from the switchgear?						*No*
3.7.7	Are there any signs of leakage from visible compound-filled cable terminations?						*No*
3.7.8	Is the condition of the tripping battery installation satisfactory?		N/A	N/A	N/A	N/A	*There was a tripping batteries located within Sub LV1 checks need to be undertake to ensure it is being serviced and maintained.*
3.7.9	Are there any operational restrictions in place?						*No operational restrictions currently in place*
3.7.10	If so, are warning notices displayed?	N/A	N/A	N/A	N/A	N/A	

Commentary

3.7.11 Checks should be undertaken to confirm whether the tripping batteries located within Sub LV-1 is being serviced and maintained.

3.7.12 Suitable permanent labels identifying the circuit need to be installed for some circuits to replace handwritten or dyno tape labels. Circuits may need to be checked for accuracy.

3.7.13 Switchgear located in shared plant rooms should be caged off or have working keys fitted to prevent unauthorised access/activation of devices. These keys will then need to be kept in a locked working cabinet.

3.7.14 Maintenance records not available for all ACB's.

3.8 COMMENTARY ON RESILENCE

Item		Y/N (Compliant)					Comments
		Sub LV - 1	Sub LV - 2	Sub LV - 5	Sub LV - E	Sub LV - 20	
3.8.1	Does switchgear layout follow HTM layouts?						
3.8.2	Are transformers N+1 configuration?						
3.8.3	Are generators N+1 configuration?						
3.8.4	Are group 2 medical areas fitted with a UPS?	**TO BE CONFIRMED BY HEALTH BOARD**					
3.8.5	Are all group 2 areas fitted with medical IT systems (with interleaved circuits)?	**TO BE CONFIRMED BY HEALTH BOARD**					
3.8.6	Do all boards have mobile generator plug in point?						*No*
3.8.7	Are generators tested and maintained in line with WHTM06-01 (monthly – building load, annually full/ 110% load, black building test)?						*Yes*
3.8.8	Are UPSs maintained in line with WHTM06-01?	N/A	N/A	N/A	N/A		*Yes, Service carried out by Powercontrol 19.04.22 Many units were recommended to be replaced due to their age.*
3.8.9	Are IPSs maintained in line with WHTM06-01?	N/A	N/A	N/A	N/A		*Yes*

Commentary

3.8.9 The site HV infrastructure is organised with two incoming supplies from the district network operator WPD feeding a health board owned section of a switchboard connected via a bus section switch. The health board owned section of the HV board feeds two local transformers and either side of the HV ring.

In addition the new Hafan Y Coed development has its own dedicated substation off the WPD network. The health board is responsible for the HV cable and switch and transformer adjacent to the building.

3.8.10 The two incoming supplies and associated bus section switch represent the first single point failure. At the time of design this arrangement was a standard configuration which the DNO would provide to its clients and provided a clear demarcation between the DNO owned HV breakers and the health board HV breakers.

3.8.11 The ring and Hafan Y Coed substations have local LV generation. All substations do not have N+1 resilience and are only provided with one transformer and one generator. With the overall clinical risk of the site this may be acceptable but some areas of the site are clinical risk category A and as such makes generator and transformer maintenance more difficult.

3.8.12 With the reintroduction of the Electrical Safety Group (ESG) in the new WHTM06-01, the risk present in the electrical distribution system in terms of lack of resilience and aging equipment should be quantified and managed accordingly as part of the ESG process.

3.8.13 From each substation LV switchboards there are radial supplies to intermediate boards. Sub distribution boards are located throughout the hospital and have generally been renewed in the last ten years.

3.8.14 The main body of the hospital was built in 1933, with numerous extensions since. The main LV switchboards are of varying age raging from the 1980s' up to a few years old

3.8.15 Older switchgear is nearing the end of its design life having been in service over - 30years (CIBSE show an indicative life of 30 years for main supply switchgear) and consideration should be given to its replacement.

3.8.16 Numerous UPS units require replacing due to age, please refer to recent service report undertaken by Powercontrol on 19.04.2022

3.8.17 We would recommend the current APs' and CPs' have sufficient training to carry out interrogation of the systems and controlled switching of the IPS/UPS including any by-pass facilities to gain familiarisation with the systems installed.

4.0 Recommendations

The low voltage electrical system is generally managed in accordance with HTM06-02 there is plenty of evidence of safety documentation being used although not fully completed as shown in Table 2 of HTM 06-02 we would normally expect simple isolation and earthing diagrams to be completed on the DH approved sheets rather than extracts from AutoCAD / schematic drawings. In addition, the use of computer drafted safety programmes should be discussed with the AE.

The AP (LV) should note some site logbook entries are missing and should be completed and show every switching operation carried out on the system even if carried out via a safety programme. All APs' (LV) should ensure they complete the logbook in accordance with HTM 06-02.

The electrical systems vary in condition and age throughout the site and there are some single points failures present on the LV network.

Whilst the Health Board should note the full content of this report, it is recommended particular attention is given to addressing the following:

4.1 University Hospital Llandough currently has only two appointed APs' (LV). For a hospital of this size and complexity, we would recommend a minimum of three APs' be appointed. This would provide sufficient cover for annual leave and general absence. All APs' should meet the requirements laid down in HTM 06-02 before being nominated for appointment.

4.2 A number of Competent Persons (low voltage) (CP (LV)) appointments have expired, refresher training courses may be required before candidates can be reassessed.

4.3 The existing electrical distribution system does not fully comply with the design requirement laid down in WHTM 06-01 which deals with design and operational requirements. This shortcoming highlights the need for suitably qualified staff that are able to manage emergency situations.

4.4 There is an Operation Procedure Manual in place, this needs to be developed in accordance with HTM 06-02 requirements (details of what information should be contained within this manual can be found in Appendix 10).

4.5 Operating records are an important aspect of electrical safety management to enable APs' to safely manage their sites. HTM06-02 chapter 10 details the specific requirements for what documentation should be maintained on site.

4.6 Checks should be undertaken to confirm whether the tripping batteries located within Sub LV-1 is being serviced and maintained.

4.7 Up to date site schematics are essential for the safe operation of the electrical infrastructure. These should be produced in an electronic format so drawings can be constantly kept up to date.

4.8 The display of permanent posters and safety signs is an important aspect to warn of the hazards that may be present to unauthorised personal and are detailed in chapter 11 of HTM06-02. Notices for both Electricity at Work Regulations 1989 and Treatment for Electric Shock need to be ordered and displayed within all main LV Switchrooms accordingly.

4.9 Up-to-date schematics should be produced and fixed on the wall in all switchrooms.

4.10 Some LV switchgear is out of production due to is age, and spares and technical information may no longer be available. This would put the hospital at risk if failure of components were to occur. Consideration should be given for its replacement in the near future.

4.11 Signage on doors should be brought in line with HTMs.

4.12 Consideration should be given to install notices on the doors of switchrooms / switch cupboards. These notices could include the contact names and telephone numbers of the Authorised Persons (LV) for the site and of the switchboard. It may be prudent to include the text: “In the event of fire please raise the alarm”.

4.13 Suitable permanent labels identifying the circuit need to be installed for some circuits to replace handwritten or dyno tape labels. Circuits may need to be checked for accuracy.

4.14 The security of the electrical infrastructure is very important. All access doors to each switchroom should be kept securely locked when unattended. Switchgear located in shared plant rooms should be caged off or have working locks fitted to devices to prevent unauthorised access/accidental activation of the devices. These keys will then need to be kept in a locked working cabinet.

4.15 Standard and emergency lighting should be sufficient and maintained to safely illuminate all electrical distribution equipment. Consideration should be given to upgrade the lighting and emergency lighting within Sub LV1.

3.3.10 A service contract needs to be put in place to carry out the maintenance and servicing of ACBs’ there was little evidence of service sheets & labels on site and for those ACBs’ that was afforded a service label it was dated 2017.

3.3.11 The power factor correction unit installed within LV Sub 1 has been taken out of service. Further investigation may be required to see how viable it would be to bring the unit back into service.

4.16 There is a contract in place for fixed wiring testing. Certificate audited was UNSATISFACTORY. A strategy needs to be agreed going forward, we would recommend consideration be given to testing areas 100% in their entirety and undertaking remedials at the same time as the test to limit the number of UNSATISFACTORY certificates being returned. (It may be prudent to include a schedule of rates for the top twenty common repairs as part of the tender process).

4.17 We believe resilience could be increased if switchgear was modified to accommodate the connection of a temporary generator and consideration given to making some areas of the distribution system N+1 particularly in group 2 medial locations.

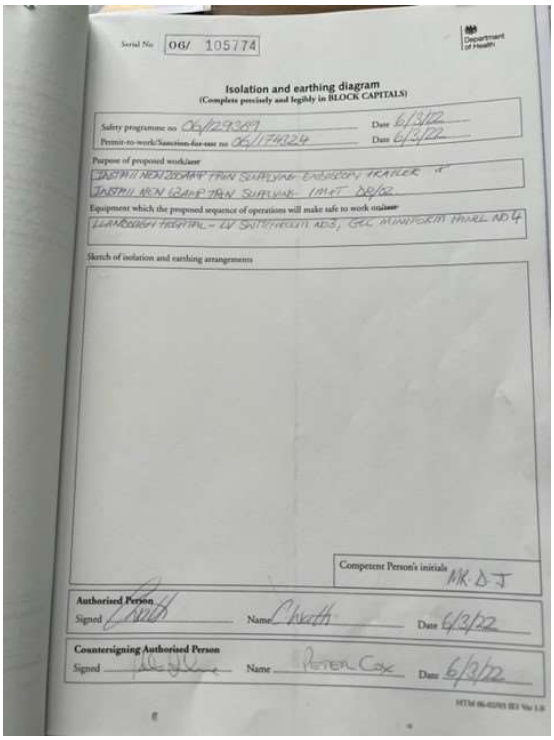
4.18 Emergency call out procedures should be clarified for both the in house and LV contractor during an outage. These should include the procedures for calling out the relevant staff (e.g. contact numbers etc.), retained within the operation and procedure manual for quick access and associated expected call out times clarified.

4.19 Contingency plans should also be drafted detailing the process/actions to be taken during various power supply failure scenarios e.g. long-term loss of mains from the DNO, catastrophic LV equipment failure, etc. These would assist and give confidence to the APs’ and health board to ensure adequate arrangements are in place during these events.

4.20 Numerous UPS units require replacing due to age, please refer to recent service report undertaken by Powercontrol on 19.04.2022

4.21 We would recommend the current APs’ and CPs’ have sufficient training to carry out interrogation of the systems and controlled switching of the IPS/UPS including any by-pass facilities to gain familiarisation with the systems installed.

Appendix A: Photographs



Serial No 06/ 105774

Department of Health

Isolation and earthing diagram
(Complete precisely and legibly in BLOCK CAPITALS)

Safety programme no 06/129369 Date 6/3/22
Permit-to-work/Sanction-for-test no 06/174324 Date 6/3/22

Purpose of proposed work/test
INSTALL NEW 200AMP TPN SUPPLYING ENDOSCOPY TRAILER &
INSTALL NEW 63AMP TPN SUPPLYING IMIT DB/02

Equipment which the proposed sequence of operations will make safe to work on/test
LLANDOUGH HOSPITAL - LV SWITCHROOM NO3, GEC MINIFORM PANEL NO 4

Sketch of isolation and earthing arrangements

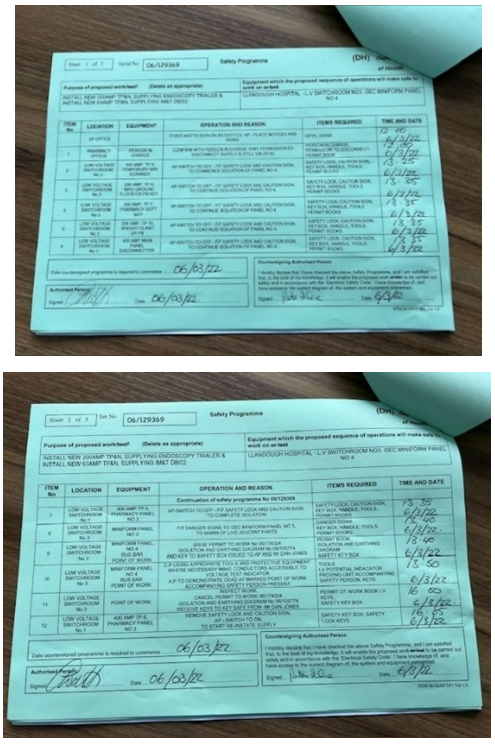
Competent Person's initials MK DJ

Authorised Person
Signed [signature] Name C Smith Date 6/3/22

Countersigning Authorised Person
Signed [signature] Name Peter Cox Date 6/3/22

HTM 06-02/03 (E) Ver 1.0

Figure 1: Isolation & Earthing Diagrams being issued not fully completed as shown in Table 2 of HTM 06-02



Safety Programme

Purpose of proposed work/test: INSTALL NEW 200AMP TPN, SUPPLYING ENDOSCOPY TRAILER & INSTALL NEW 63AMP TPN, SUPPLYING IMIT DB/02

Equipment which the proposed sequence of operations will make safe to work on or test: LLANDOUGH HOSPITAL - LV SWITCHROOM NO3, GEC MINIFORM PANEL NO 4

ITEM No	LOCATION	EQUIPMENT	OPERATION AND REASON	ITEMS REQUIRED	TIME AND DATE
1	PHARMACY OFFICE		CLOSE MAITE SIGN ON AUTO LV AP - PLACE NOTICES AND SIGNS	KEYS, SIGNS	13 25 6/3/22
2	LOW VOLTAGE SWITCHROOM No 1	100 AMP TP S, TEMPORARY MFD BOARD	AP-SWITCH TO OFF - FIT SAFETY LOCK AND CAUTION SIGN, TO COMMENCE ISOLATION OF PANEL NO 4	SAFETY LOCK, CAUTION SIGN, KEY BOX, HANDLE, TOOLS, PERMIT BOOKS	6/3/22 13 35
3	LOW VOLTAGE SWITCHROOM No 2	250 AMP, TP S, MAIN GROUND FLOOR DISTRIBUTION PO	AP-SWITCH TO OFF - FIT SAFETY LOCK AND CAUTION SIGN, TO CONTINUE ISOLATION OF PANEL NO 4	SAFETY LOCK, CAUTION SIGN, KEY BOX, HANDLE, TOOLS, PERMIT BOOKS	6/3/22 13 35
4	LOW VOLTAGE SWITCHROOM No 2	250 AMP, TP S, PHARMACY DEPT	AP-SWITCH TO OFF - FIT SAFETY LOCK AND CAUTION SIGN, TO CONTINUE ISOLATION OF PANEL NO 4	SAFETY LOCK, CAUTION SIGN, KEY BOX, HANDLE, TOOLS, PERMIT BOOKS	6/3/22 13 35
5	LOW VOLTAGE SWITCHROOM No 2	250 AMP TP S, BREAST CLINIC DP PB	AP-SWITCH TO OFF - FIT SAFETY LOCK AND CAUTION SIGN, TO CONTINUE ISOLATION OF PANEL NO 4	SAFETY LOCK, CAUTION SIGN, KEY BOX, HANDLE, TOOLS, PERMIT BOOKS	6/3/22 13 35
6	LOW VOLTAGE SWITCHROOM No 1	400 AMP MAIN PANEL DISCONNECTOR	AP-SWITCH TO OFF - FIT SAFETY LOCK AND CAUTION SIGN, TO CONTINUE ISOLATION OF PANEL NO 4	SAFETY LOCK, CAUTION SIGN, KEY BOX, HANDLE, TOOLS, PERMIT BOOKS	6/3/22 13 35

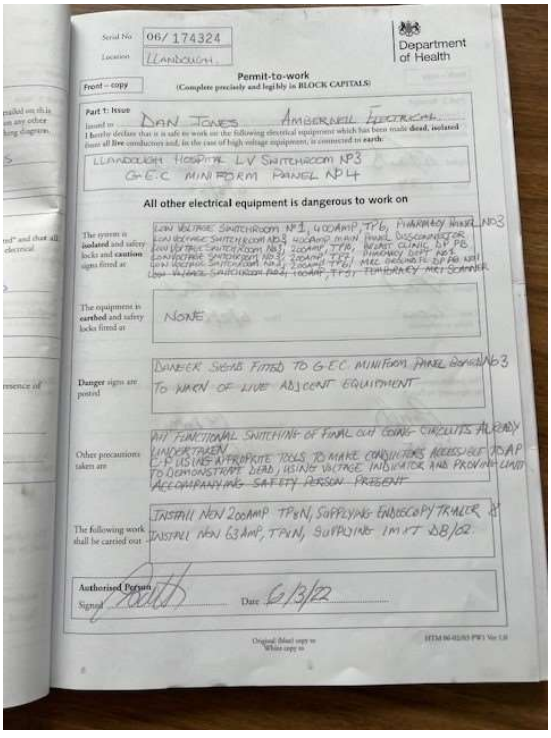
Date countersigned programme is required to commence 06/03/22

Countersigning Authorised Person

Authorised Person Signed [signature] Date 06/03/22

Signed [signature] Date 6/3/22

Figure 2: Safety Programmes being used



Serial No 06/ 174324
Location LLANDOUGH

Department of Health

Permit-to-work
Front – copy
(Complete precisely and legibly in BLOCK CAPITALS)

Part 1: Issue
Issued to DAN JONES AMBERNELL ELECTRICAL
I hereby declare that it is safe to work on the following electrical equipment which has been made dead, isolated from all live conductors and, in the case of high voltage equipment, is connected to earth:
LLANDOUGH HOSPITAL LV SWITCHROOM NO3
G.E.C MINIFORM PANEL NO 4

All other electrical equipment is dangerous to work on

The system is isolated and safety locks and caution signs fitted at: LOW VOLTAGE SWITCHROOM NO1, 400AMP, TP&N, PHARMACY PANEL NO3; LOW VOLTAGE SWITCHROOM NO3, 400AMP MAIN PANEL DISCONNECTOR; LOW VOLTAGE SWITCHROOM NO3, 250AMP TP&N, BREAST CLINIC DP PB; LOW VOLTAGE SWITCHROOM NO3, 250AMP TP&N, PHARMACY DEPT NO3; LOW VOLTAGE SWITCHROOM NO3, 250AMP TP&N, MRI GROUND FLOOR DP PB; LOW VOLTAGE SWITCHROOM NO3, 100AMP TP&N, PHARMACY MRI SCANNER

The equipment is earthed and safety locks fitted at: NONE

Danger signs are posted: DANGER SIGNS FITTED TO G.E.C MINIFORM PANEL BOARD NO3 TO WARN OF LIVE ADJACENT EQUIPMENT

Other precautions taken are: ALL FUNCTIONAL SWITCHING OF FINAL OUT GOING CIRCUITS ALREADY UNDERTAKEN C.R.U USING APPROPRIATE TOOLS TO MAKE CONDUCTORS ACCESSIBLE TO AP TO DEMONSTRATE DEAD, USING VOLTAGE INDICATOR AND PROVING UNIT ACCOMPANYING SAFETY PERSON PRESENT

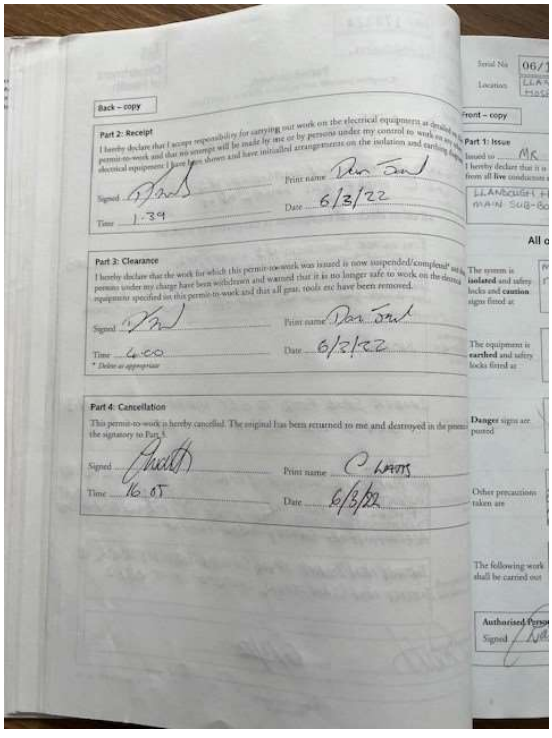
The following work shall be carried out: INSTALL NEW 200AMP TP&N, SUPPLYING ENDOSCOPY TRAILER & INSTALL NEW 63AMP, TP&N, SUPPLYING IMIT DB/02.

Authorised Person Signed [signature] Date 6/3/22

Original (blue) copy to
White copy to

HTM 06-02/03 PW1 Ver 1.0

Figure 3: Permit to Work being issued



Back – copy

Part 2: Receipt
I hereby declare that I accept responsibility for carrying out work on the electrical equipment as detailed on the permit-to-work and that no unsafe will be made by me or by persons under my control to work on any of the electrical equipment I have been shown and have initialled arrangements on the isolation and earthing.
Signed [signature] Print name Dan Jones
Date 6/3/22
Time 1.39

Part 3: Clearance
I hereby declare that the work for which this permit-to-work was issued is now suspended/completed* and all persons under my charge have been withdrawn and warned that it is no longer safe to work on the electrical equipment specified on this permit-to-work and that all gear, tools etc have been removed.
Signed [signature] Print name Dan Jones
Date 6/3/22
Time 4.00
* Delete as appropriate

Part 4: Cancellation
This permit-to-work is hereby cancelled. The original has been returned to me and destroyed in the presence of the signatory to Part 3.
Signed [signature] Print name C Smith
Time 16.05
Date 6/3/22

Figure 4: Permit to Work being correctly cancelled

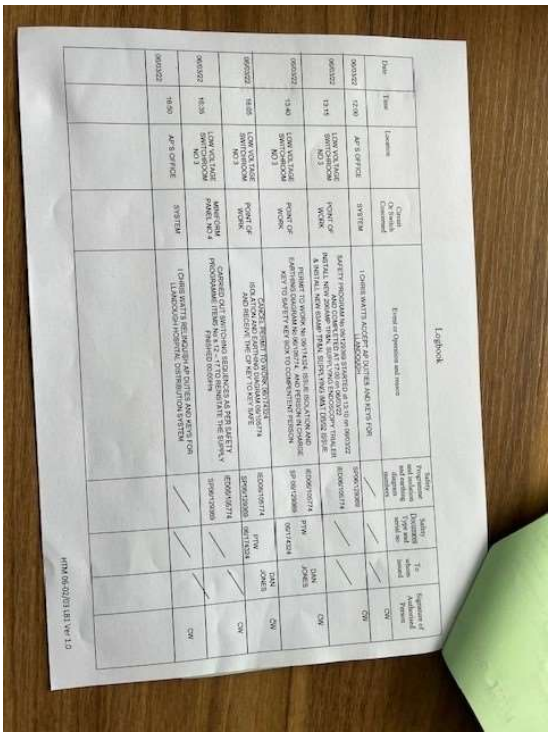


Figure 5: Logbook entries not in full accordance with HTM 06-02.

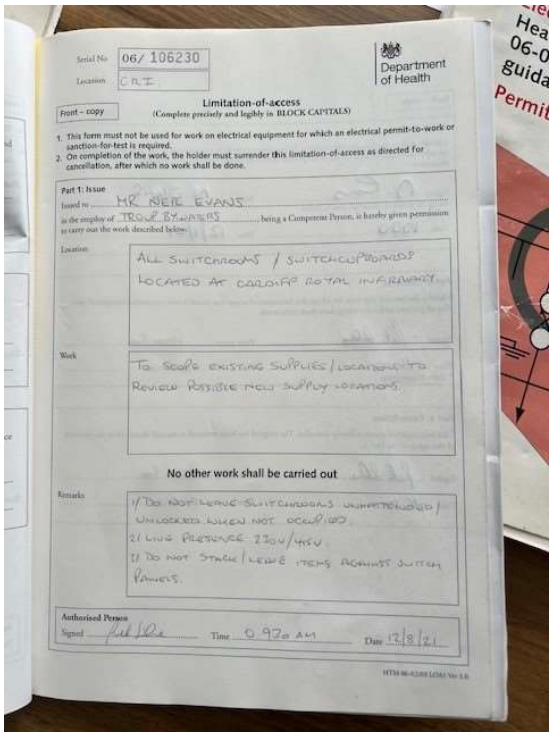


Figure 6: Evidence of Limitation of Access forms being used.

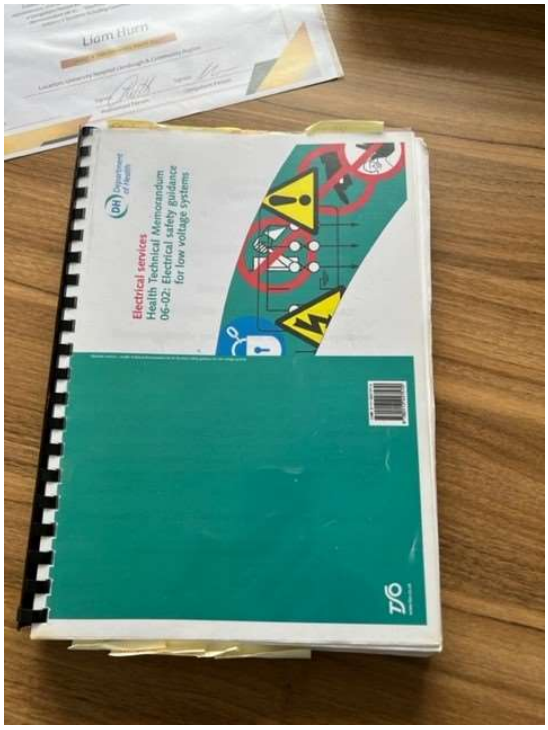


Figure 7: Hard copies of HTM-06-02

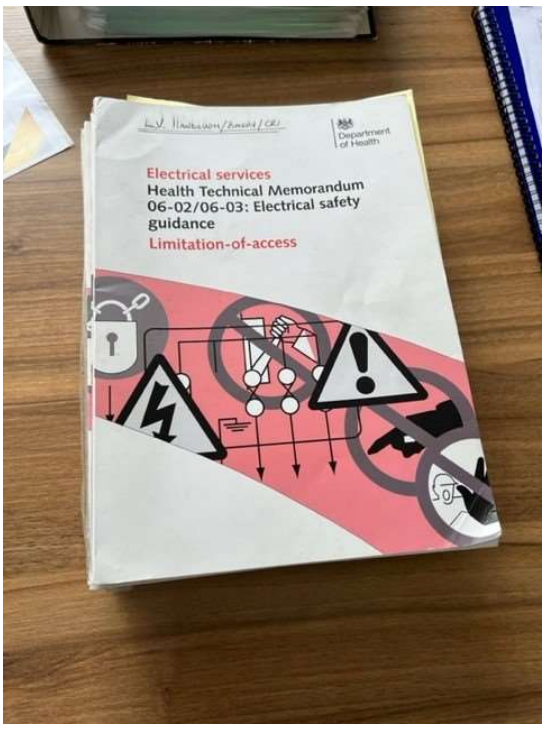


Figure 8: Safety documentation books

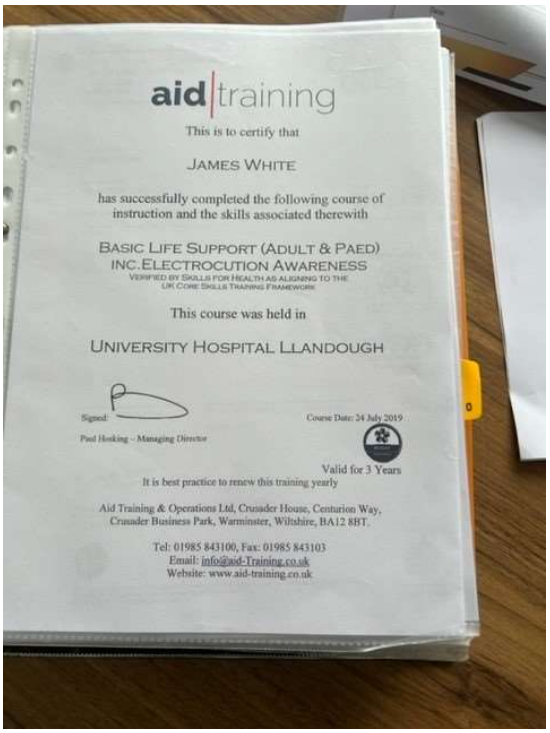


Figure 9: CP 1st Aid Certificate expires July 2022

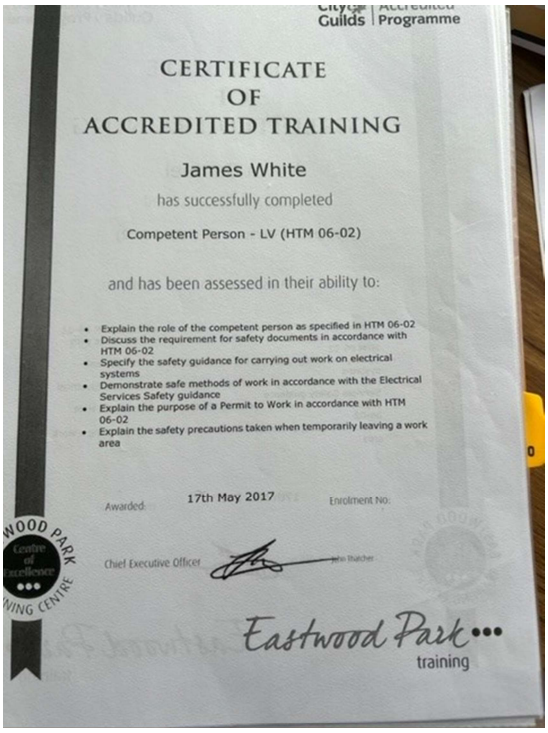


Figure 10: CP (LV) Certificate expired May 2020

Figure 11: Designated AP Office

Figure 12: Lock off station

Figure 13: Safety signage

Figure 14: Safety key boxes

Figure 15: PPE

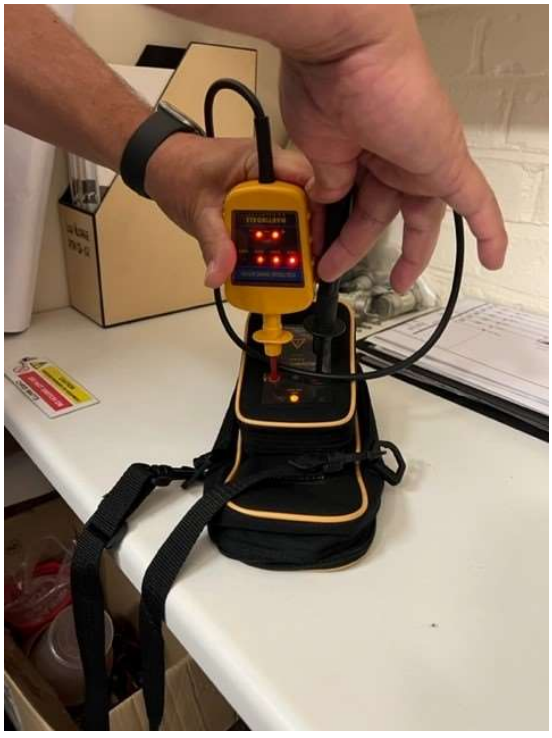


Figure 16: GS38 tester & proving unit

Figure 17: Archived electrical installation condition reports.


Electrical Installation Condition Report

EICR:

1. Details of the client

Address of Installation

2. Details of the installation

2. Extent of the installation and limitations of the inspection & testing

Extent of Installation Covered By Report

Agreed Limitations if any on the inspection & testing

NUMBER OF DEFECTS PER CATEGORY

Code C1 Observations:

Code C2 Observations:

Code C3 Observations:

Further Investigation:

No. C1 - Danger present risk of injury - immediate remedial action required, C2 - Potentially Dangerous
C3 - Improvement recommended, FI – further investigation without delay is recommended

5. Summary of the condition of the installation

General condition of the installation (in terms of electrical safety)

THE INSTALLATION IS UNSATISFACTORY DUE TO C2 OBSERVATIONS REQUIRING ATTENTION AND ALSO ITEMS REQUIRING FURTHER INVESTIGATION. C3 OBSERVATIONS WILL ALSO REQUIRE ATTENTION ACROSS THE INSTALLATION. C2 OBSERVATIONS REQUIRE ATTENTION ON THIS SURVEY

As reasonably foreseeable, and on completion of all Code 1 & 2 defects, the electrical installation can remain in service until the date of the next inspection.

Overall assessment of the installation in terms of its suitability for continued use.

UNSATISFACTORY

*An unsatisfactory assessment indicates that dangerous and/or potentially dangerous conditions have been identified

6. Declaration

I/We, being the person(s) responsible for the inspection and testing of the electrical installation (as indicated by my/our signatures below), particulars of which are described above, having exercised reasonable skill and care when carrying out the inspection and testing, hereby declare that the information in this report, including the observations and the attached schedules, provides an accurate assessment of the condition of the electrical installation taking into account the stated extent and limitations in section 3 of this report.

Inspected and tested by:

Position:

Date:

Report authorised for issue by:

Position:

Date:

Figure 18: Electrical installation condition report (unsatisfactory)

Figure 19: Entrance signage not fully HTM compliant

Figure 20: LV 1 Switchboard, not fully WHTM06-01 compliant

Figure 21: Warning labels installed rear of switchboard

Figure 22: ACB service label dated 2017

Figure 23: Handwritten labelling

Figure 24: Handwritten labelling

Figure 25: Earth Bar in good condition conductors unlabelled

Figure 26: Power Factor Correction Unit switched off

Figure 27: Tripping Battery, no service label attached

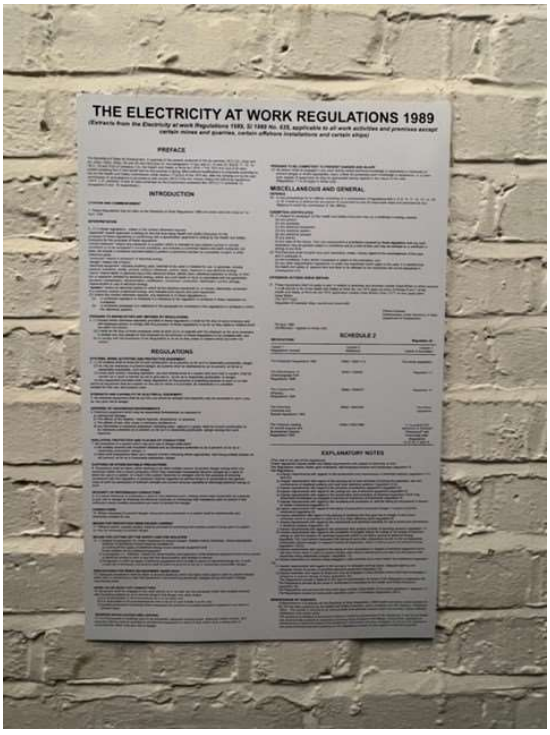


Figure 28: Electricity at Work Regulations poster on display

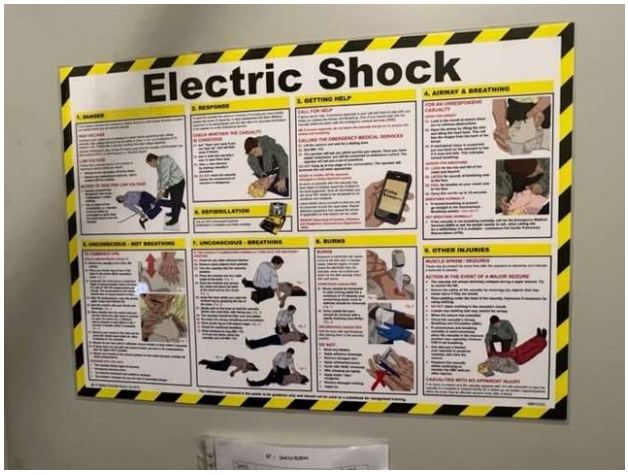


Figure 29: Electric Shock treatment notice on display

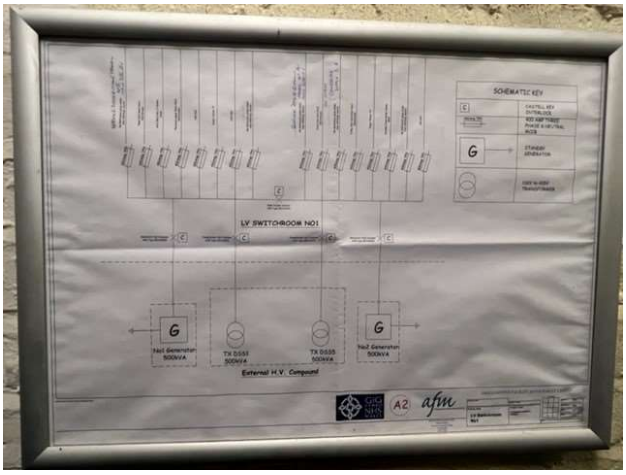


Figure 30: Schematic on display

Figure 31: Co2 Fire Extinguisher date of last service May 2022

Figure 32: Entrance signage not fully HTM compliant

Figure 33: LV 2 Switchboard, now obsolete & not WHTM06-01 compliant

Figure 34: ACB no service label attached to identify if unit has been serviced.

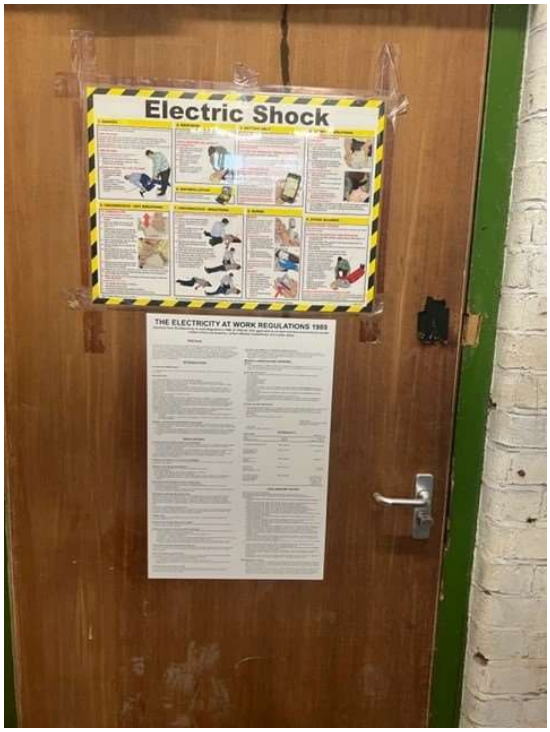


Figure 35: Electricity at Work Regulations & Electric Shock treatment notices on display

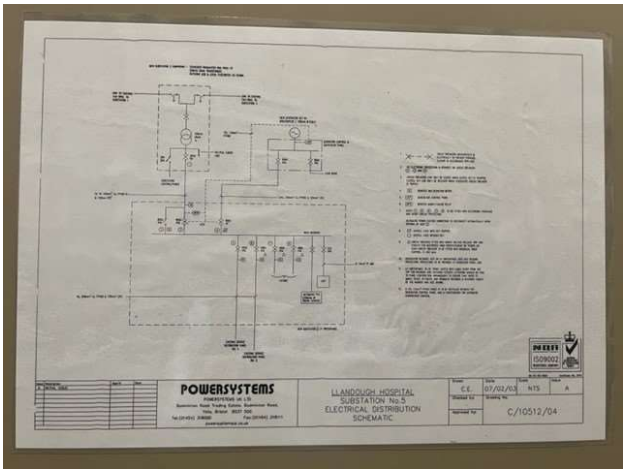


Figure 36: Schematic on display

Figure 37: Co2 Fire Extinguisher date of last service February 2022

Figure 38: Entrance signage HTM compliant

Figure 39: Entrance signage HTM compliant

Figure 40: LV 5 Switchboard, not fully WHTM06-01 compliant

Figure 41: No rubber insulated mat installed in front of PFC Unit

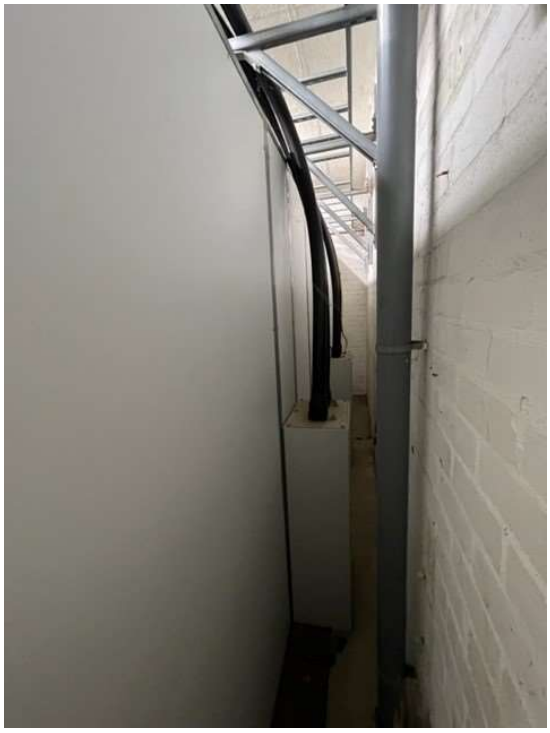


Figure 42: No warning labels installed rear of switchboard

Figure 43: ACB no service label attached to identify if unit has been serviced.

Figure 44: Earth Bar in fair condition not all conductors labelled

Figure 45: Powerfactor Correction Unit, service label dated 29/10/2021

Figure 46: Electric heater (thermostatically controlled), signs of scorching

Figure 47: Electric shock treatment notice on display. No Electricity at Work Regulations poster on display.

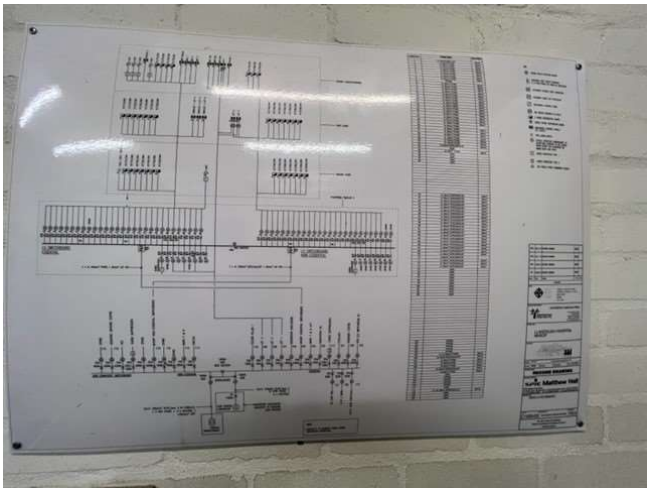


Figure 48: Schematic on display

Figure 49: Co2 Fire Extinguisher date of last service May 2022

Figure 50: Entrance signage HTM compliant

Figure 51: LV E Switchboard, not fully WHTM06-01 compliant.

Figure 52: Warning labels installed rear of switchboard.

Figure 53: Surge Protection installed & healthy

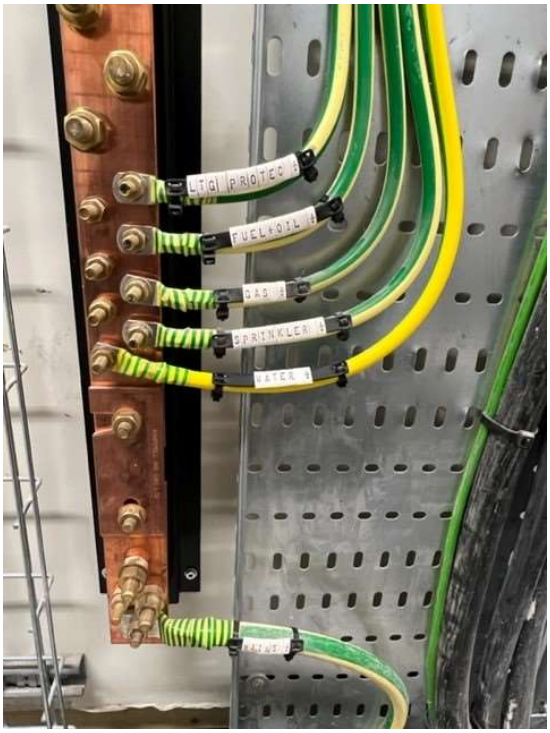


Figure 54: Earth Bar in excellent condition & all conductors labelled

Figure 55: Electricity at Work Regulations poster on display but no Treatment for Electric Shock notice on display

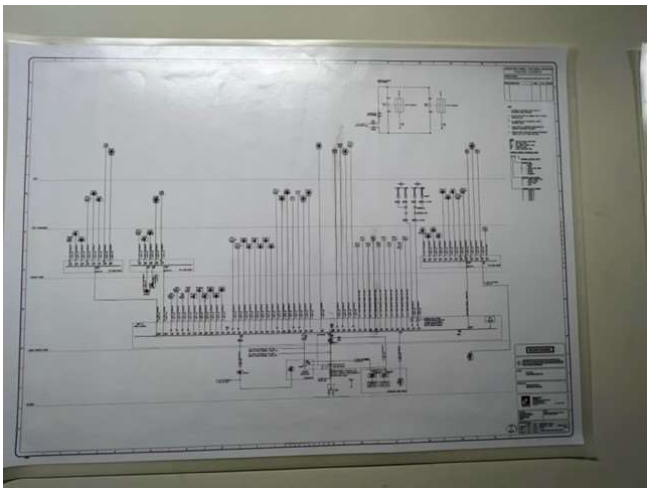


Figure 56: Schematic on display

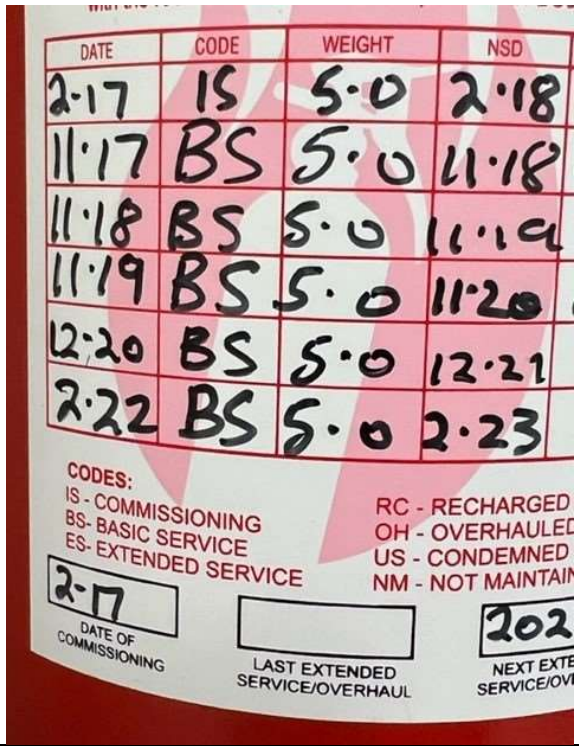


Figure 57: Co2 Fire Extinguisher, date of last service February 2022

Figure 58: Entrance signage not fully HTM compliant

Figure 59: LV 20 Switchboard, now obsolete & not WHTM06-01 compliant

Figure 60: Warning labels installed rear of switchboard.

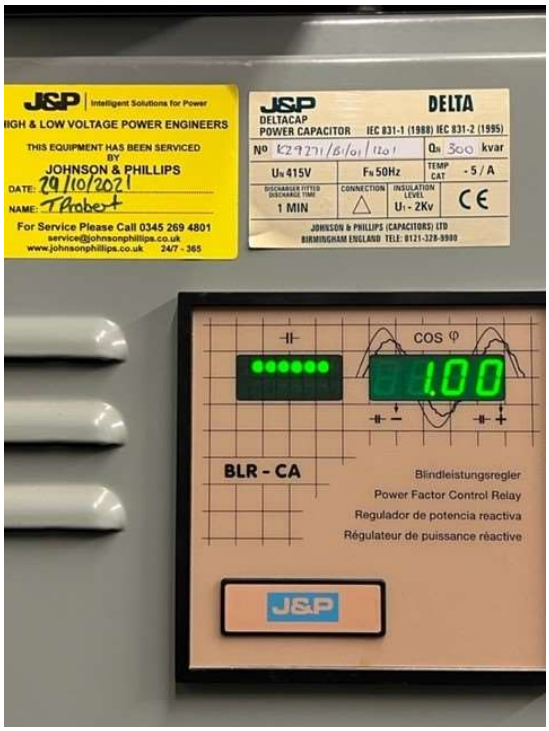


Figure 61: Powerfactor Correction Unit, service label dated 29/10/2021

Figure 62: Electric Heater Installed & distribution Schematic on display

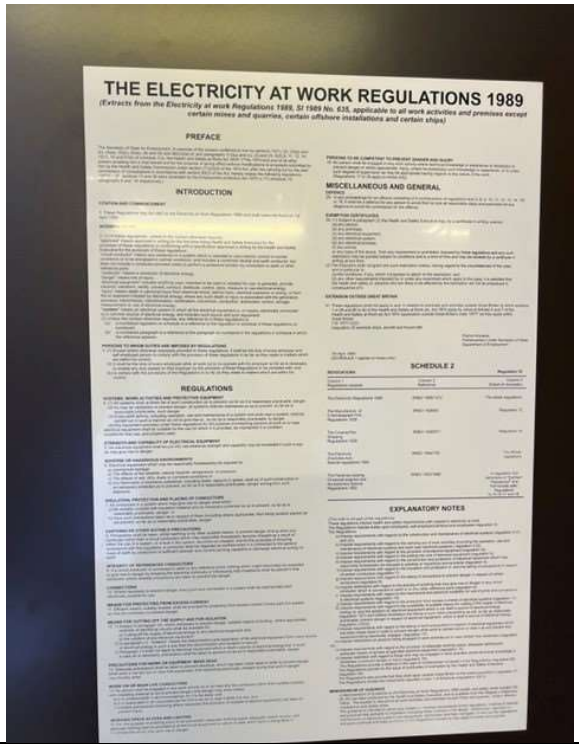
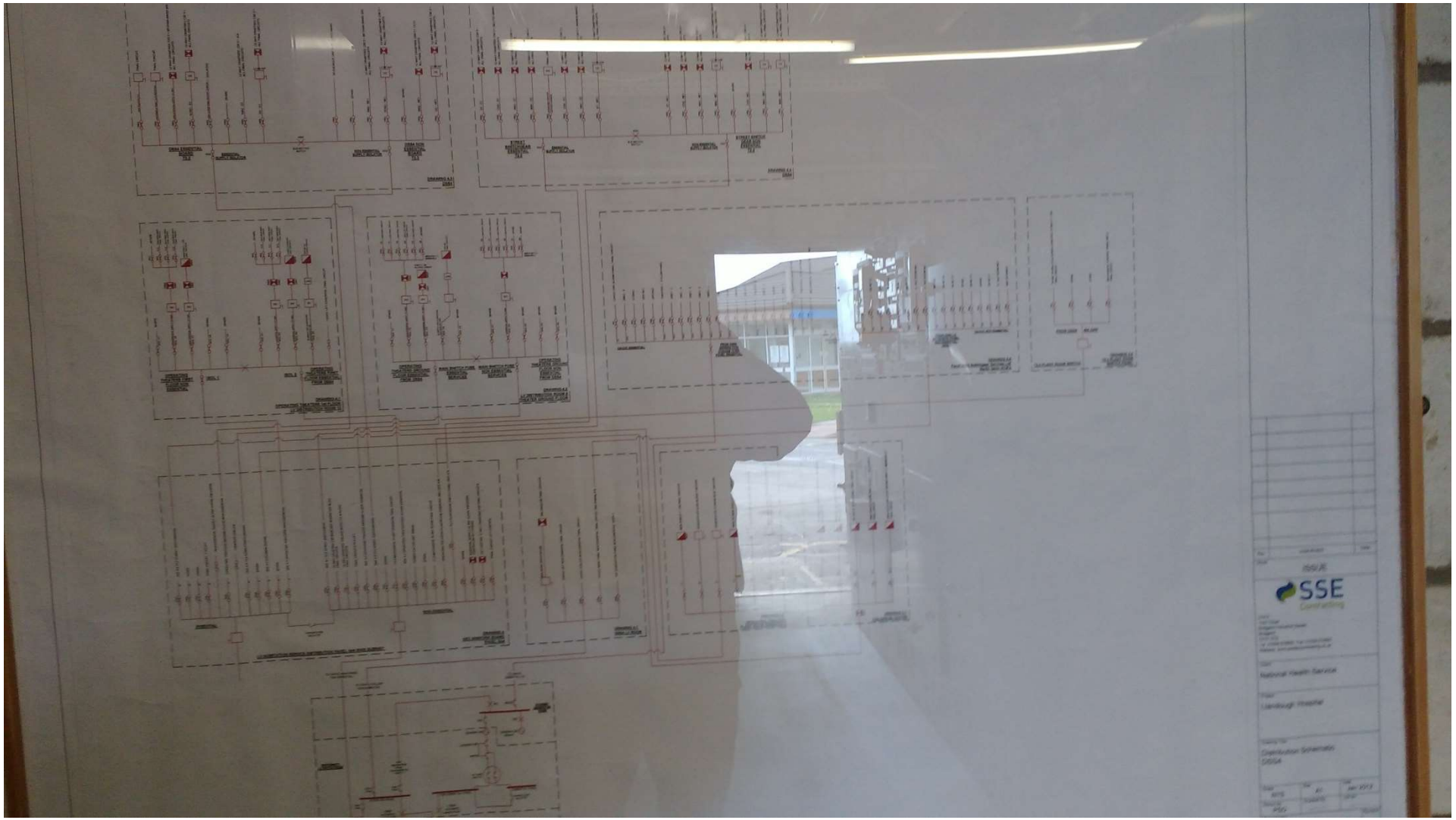


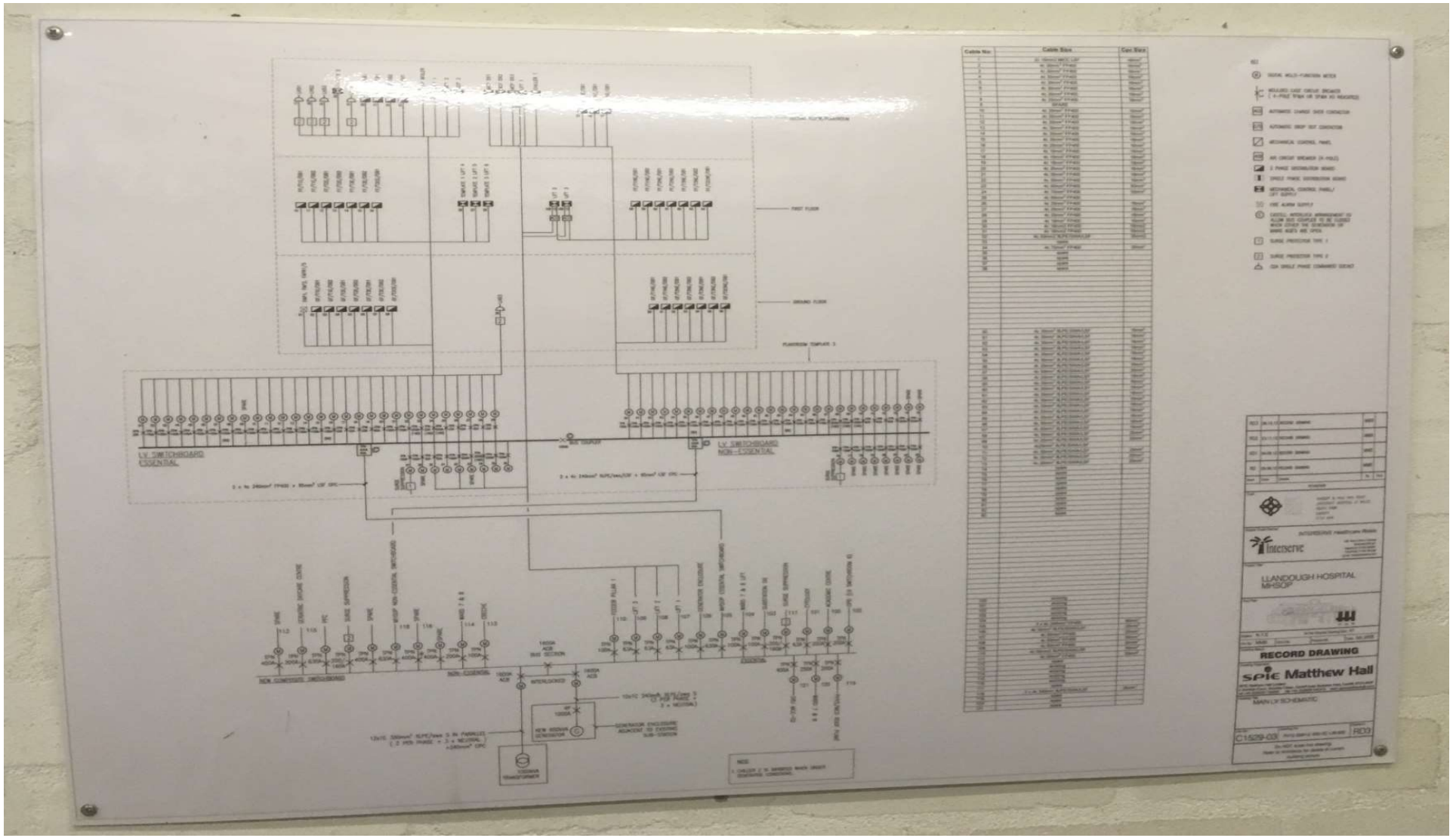
Figure 63: Electricity at Work Regulations poster on display but no Treatment for Electric Shock notice on display

Figure 64: Co2 Fire Extinguisher date of last service May 2022

Site Schematics


BREAST CLINIC DB PB
(ROOF PLANT ROOM)
FED FROM PHARMACY PANEL No4
(No3 LV SWITCHROOM
DRAWING 3.4
BREAST CLINIC
FED FROM LV SWITCHGEAR No3
PHARMACY PANEL
WEST FOOT SWITCHROOM
LINK TO PANEL No3
[7.5S]


SSE


LV SWITCHBOARD ESSENTIAL
LV SWITCHBOARD NON-ESSENTIAL
Interserve
LLANDOUGH HOSPITAL MHSDF
RECORD DRAWING
spie Matthew Hall
MAIN LV SCHEMATIC
C15259-03