



# Electrical Safety Rules and Procedures

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# Contents

<b>Section 1 Introduction.....</b>	<b>4</b>
1.1 Background.....	5
1.2 Scope .....	6
1.3 Purpose.....	6
1.4 Application .....	6
1.5 Compliance with safety rules and procedures.....	7
1.6 Objections .....	7
1.7 Roles and responsibilities.....	8
1.8 Issue of the rules and procedures .....	8
1.9 Customer rules .....	8
1.10 Safety equipment .....	9
1.11 Reporting .....	9
1.12 Portable electrical equipment.....	10
<b>Section 2 Process overview .....</b>	<b>11</b>
2. Process overview .....	12
<b>Section 3 Definitions .....</b>	<b>13</b>
3. Definitions.....	14
<b>Section 4 Roles and Responsibilities of Nominated Persons .....</b>	<b>18</b>
4.1 Mace roles and responsibilities .....	19
4.2 Contractors roles and responsibilities.....	25
<b>Section 5 Assessment of Competence .....</b>	<b>28</b>
5.1 Training and assessment .....	29
5.2 Mace approved electrical contractors .....	29
5. Assessment of competence .....	30
5.3 Approved contractors.....	30
<b>Section 6 Electrical Safety Rules .....</b>	<b>31</b>
6.1 General.....	32
6.2 Safe working (Isolated).....	34
6.3 PIPIC explanation .....	35
6.4 Electrical permit process .....	38
6.5 Specific requirements to be provided by electrical contractors.....	42
6.6 Procedures prior to energisations on construction sites .....	45
6.7 Live working .....	46
6.8 Live working examples .....	46
6.9 Closed End Policy .....	47
6.10 Mace process for access into live apartments and live spaces.....	47
6.11 Live testing and arc flash assessment.....	48
6. Electrical safety rules .....	48
6.12 Interface with the Mace Excavation / Services Coordinator .....	49
6.13 Electrical isolations for demolition activities .....	49
6.14 – Christmas and other holiday shutdowns. ....	49

# Contents

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**Section 7 Notice of Transfer of Operational Control.....50**

7.1 Items of Temporary Generating Plant .....51

7.2 Operation of HV/LV Switch-gear .....52

7.3 Trade Contractor’s issue of their own Transfer of Operational Control (ToC) letter.52

7.4 Handover of system to Client.....52

**Section 8 Interface with Distribution Network Operations .....53**

8.1 DNO/IDNO RAMS approval procedure and operatives works on site.....54

8.2 Handover of space to the DNO/IDNO procedure .....55

8.3 Following energisation .....55

**Section 9 Emergency Situations .....56**

9.1 Treatment for electric shock.....57

9.2 Electrical incident – first response .....57

9.3 Post incident – restoration of supplies .....57

9.4 Electrical First Alerts .....57

9.5 Electrical switchrooms .....57

**Appendices .....58**

Appendix A Guidance note on arc flash protection .....59

Appendix B Notice to trade Contractors who decline to sign a transfer of Operational Control .....60

# **Section 1**

## Introduction

# 1. Introduction

## 1.1 Background

These Electrical Safety Rules and Procedures are part of a suite of electrical documents and should be read, and applied in conjunction with the following:

1. [Electrical Safety Plan](#) – mandatory document. Must be completed and implemented before any electrical works start on the project. It is a requirement that this document be updated on a monthly basis through the duration of the project, or when significant change occurs e.g. a major revision to the programme or scope of the works.
2. Site Temporary Building Services Process. A mandatory process that must be adopted on all projects.
3. [Access into Live Apartments](#) document.
4. [Mace Process for Access and Working in Live Spaces](#).

The core standards are underpinned by regular competence assessments of the Mace management staff and contractors responsible for the management, installation and commissioning for all electrical works and systems on each Mace site - section 4 of this document refers.

For clarity the following voltage ranges are taken from the 18th Edition IET Wiring Regulations.

- Extra-low (ELV). Not exceeding 50V a.c. or 120V ripple free d.c. whether between conductors or to earth.
- Reduced Low Voltage (RLV) – is defined in regulation 411.8.1.2. as ‘the nominal voltage of the reduced low voltage circuits shall not exceed 110 V AC rms between lines (three-phase 63.5 V to earthed neutral, single-phase 55 V to earthed midpoint)’.
- Low (LV). Exceeding extra-low voltage but not exceeding 1000V a.c. or 1500V d.c. between conductors, or 600V a.c. or 900V d.c. between conductors and earth.
- High (HV). Normally exceeding low voltage.

Medium Voltage (MV) is not a recognised voltage term in the UK in either BS7671, or the Electricity, Safety, Quality and Continuity Regulations 2002. However it is a recognised terminology in mainland Europe / Worldwide and therefore this can be used, if required, in Electrical Safety Plans for projects carried out in mainland Europe / Worldwide, but it must be specified what the exact voltage and frequency is.

The Joint Industry Board’s (JIB) 2020 handbook defines MV as Above 1,000V but below 33,000V, however Mace do not recognise that definition and where MV is recorded as a voltage in the project’s Electrical Safety Plan the exact voltage must be defined as per the above note.

**NOTE** – all HV control measures documented in these procedures will apply to this voltage range

The Electrical Safety Rules and Procedures have been issued in order to:

1. Document standard safe systems of work on or near electrical systems in order to confirm that legislation is complied with, in particular the Health and Safety at Work etc. Act 1974, the Management of Health and Safety at Work Regulations 1999 and the Electricity at Work Regulations 1989.
2. Provide guidance and information to Mace staff and their contractors in order for them all to work safely and reduce the risk of serious injury.

# 1. Introduction

## Associated Regulations and Documents

This document is based on electrical industry best practice and, where applicable, on the Acts, Regulations and documents as detailed below:

- The Health and Safety at Work Act 1974.
- The Management of the Health and Safety at Work Regulations 1999 and subsequent amendments
- The Electricity at Work Regulations 1989.
- The Electricity Safety, Quality and Continuity Regulations 2002.
- IET Wiring Regulations, Eighteenth Edition. Requirements for Electrical Installations, as amended.
- HSE Guidance note HSG85 – Electricity at Work, including ‘Safety Electrical Testing at Work’.
- HSE Guidance HSG230, 2nd edition – Keeping Electrical Switchgear Safe.
- Electrical Safety First’s Best Practice Guide No 2 - Guidance on the management of electrical safety and safe isolation procedures for low voltage installations.
- Electrical Safety First’s Best Practice Guide No. 7 - Test instruments for electrical installations: Accuracy and Consistency.
- IET Code of Practice for In-Service Inspection and Testing of Electrical Equipment, as amended.
- IET Code of Practice for Electric Vehicle Charging Equipment Installation.
- IET Code of Practice for Electrical Energy Storage Systems.

When working outside of the UK then other Regulations and Codes may be applicable. The relevant Regulations and Codes must be clearly stated in the ESP, and the Project Appointed EE must review these to determine if these are of a lesser standard.

These Regulations and Codes can only be used on Mace projects if they are determined to exceed UK requirements.

## 1.2 Scope

This document applies to all electrical systems managed and maintained by Mace approved contractors. It includes systems owned by Mace directly or systems for which Mace are responsible for e.g. client systems.

The electrical systems for the purpose of this document comprise of:

- The high and low voltage distribution installations energised from a Distribution Network Operator (DNO) and owned by or operated and maintained by a client of Mace or the landlord as appropriate.
- Generation at high or low voltage from in-house client based systems that feed into the distribution systems operated and maintained by Mace.
- Temporary electrical installations as applicable to construction sites.

*Throughout this document there are numerous hyperlinks to Mace documents that are not accessible to non-Mace operatives. These can be provided, upon request, from The Chief Electrical Engineer’s Office.*

## 1.3 Purpose

The purpose of this document is to detail the process for planning, conducting and monitoring electrical work at Mace projects. This includes conducting risk assessments, identifying roles and responsibilities, developing the [Electrical Safety Plan](#) and associated SSoW, and monitoring the application of these requirements by contractors.

## 1.4 Application

If Mace take responsibility for the operation and maintenance of the electrical system at client sites only, there may be occasions where the client owns a set of their own approved electrical safety rules and procedures and requires Mace to comply with them. An assessment of these rules and procedures will be made and a decision taken by the project appointed Electrical Engineer for Mace, in consultation with the Chief Electrical Engineer’s Office, as to which single set of rules and procedures will apply. Please refer to section 1.9 - Customer rules, for further information.

Any approved non-Mace rules and procedures will be communicated to all staff and any required training carried out before issue and implementation.

Should the client’s set of rules and procedures be considered to be of a lesser standard than the Mace rules and procedures, the Mace requirements will be applied.

# 1. Introduction

## 1.5 Compliance with safety rules and procedures

All safety rules and procedures will be followed.

If exceptional circumstances arise where the safety rules and procedures cannot be applied in full, work will only proceed after a full assessment of the risks, the production of detailed method statements and the application of suitable and sufficient control measures. This requires approval from the Chief Electrical Engineers Office.

### 1.5.1 Isolation of a Project's Electrical System

Failure to comply with the Mace Electrical Safety Rules and Procedures shall result in the respective contractor's Transfer of Operational Control letter being withdrawn. The electrical system(s) controlled by the Contractor, or part thereof, shall be immediately isolated, and the Contractors Team stood down until the corrective measures are agreed, with the EE and/ or EA, and implemented accordingly.

Examples of non-compliances include but are not limited to:

- No approved Mace Electrical Safety Plan for the project.
- No signed and accepted Transfer of Operational Control Letter (ToC) in place.
- No accepted Tier 1 Contractors Project Specific Electrical Safety Plan.
- Evidence of a lack of Operational Control to either the access controlled permit areas or the circuits controlled by the Contractor.
- If the installation has an inadequate detail or clarity of information supporting the ToC letter
- A Post Energisation audit that scores below 50%
- No evidence of Electrical Test and Inspection on energised circuits.
- If there are non compliant test results or any unaccepted Limitations on Temporary Building Services Electrical Installation Condition Report (EICR).
- Main Earthing not in place / no evidence it has been tested and inspected.
- No completed [Generator checklist](#), for circuits / appliances fed from a Temporary Generator.
- Any works being undertaken in an unsafe nature.
- Where it has been established that the Project Team have deliberately or inadvertently deviated from the Mace Electrical Safety Rules and Procedures.

If in any doubt the EE/EA should contact the CEE's Office for any advice/ ruling.

## 1.6 Objections

No person is expected to work in an unsafe manner. If any person receives an instruction which they consider poses a health, safety or environmental risk to them or any associated persons, they will first refer the matter to his/her immediate supervisor before starting work.

If the supervisor is unable to find an acceptable safe solution, the relevant Mace Project Appointed Electrical Engineer will investigate the objection and confirm that suitable control measures are identified and put into place.

If the relevant Mace Project Appointed Electrical Engineer is unable to resolve the situation they will refer the matter to the relevant Electrical Engineer (or in their absence, the Chief Electrical Engineer's Office).

# 1. Introduction

## 1.7 Roles and responsibilities

All Mace employees and Mace contractors have a duty to comply with:

- United Kingdom, European and worldwide legislation, as appropriate.
- Company (and as appropriate the customers) safety requirements, including the requirements of this document.
- All applicable Regulations, Codes of Practice, Guidance Notes and IEC Standards.

If through intentional action, carelessness or neglect, a person fails to comply with the safety rules and procedures and thereby causes danger to themselves or others, that person will be subject to a disciplinary process.

All persons issued with these safety rules and procedures within the employment of Mace have the mandatory duty to understand the rules and their individual roles and responsibilities.

Mandatory training, supervision and resources will be provided by Mace to enable all Mace personnel to comply with the rules and procedures. All Mace contractors shall have a similar obligation with regard to the training and competence of their staff.

All works on electrical systems shall be planned and controlled by the application of suitable and sufficient control measures through method statements and risk assessments provided by the competent contractor.

## 1.8 Issue of the rules and procedures

The electrical safety rules and procedures will be available to all persons who have a responsibility to manage the electrical installation at any site where Mace have a responsibility for management, operation and/or maintenance of the electrical systems.

A copy of the rules and procedures will be issued, under a controlled document process, to all employees and contractors nominated by:

- Mace Business Unit Directors.
- Mace Business Unit Technical Directors.
- Chief Electrical Engineer's Office.
- Electrical Engineers.
- Electrical Assessors.
- Mace MEP Managers.

The issue of the rules alone gives no authority for work.

## 1.9 Customer rules

In instances where Mace take responsibility for the operation, alteration, isolation and inspection and testing for refurbishments within the Customer's premises the Customer, or their Facilities Management (FM) company will operate their own Electrical Safety Rules and Procedures.

It is the responsibility of the owner or occupier to check all apparatus is clearly and correctly identified and labelled. The client may delegate authority for this to Mace under the contract for which Mace will transfer the operational control to competent companies. If there is any doubt or confusion regarding the identification of circuits or equipment, work must stop and the matter referred to the Mace manager who will, if necessary escalate the matter to the Project Appointed Mace Electrical Engineer/ Chief Electrical Engineer's Office, who will either resolve or refer to the client and agree a resolution such that work can resume.

These Customer Safety Rules and Procedures must be communicated to the Mace MEP team by the Customer's representative and a copy of these rules obtained and saved in the Central Electrical Log. The details of these rules, and the Customer's Electrical Manager's details must be recorded in sections 2 and 5 of the Project Electrical Safety Plan.

For clarity:

- Where the Customer retains Operational Control of Electrical Circuits and Areas, then any isolations and issuing of the respective Electrical Permits must be issued by the Customer or their representatives under their Electrical Safety Rules and Procedures.

# 1. Introduction

- Where Mace and their Trade Contractors retain a clearly defined, operational control of electrical installations and areas then the Trade Contractor's Electrical Rules and Procedures, including isolations and the issue of Electrical Permits shall be operated.
- When Mace are carrying out electrical works where they may require either a Permit to Work, or Limitation of Access Permit to be issued, the Mace Team are to formally request that the responsible FM Company issue their Electrical Rules and Procedures document, and give the Mace Team and their respective Contractor's a full briefing on these Procedures. The date and content of this briefing should be recorded, together with a signed attendance record.
- The Mace team must also formally request that the Customer's FM team issue all relevant electrical test results and maintenance documents on all circuits/ switchgear that the Mace team will be working on. If this is not made available, then the Mace team are to contact the Chief Electrical Engineer's Office for further guidance to progress. Mace cannot accept the handover of any circuits or switchgear where this information has not been provided.
- Where there are shared access and egress to any Switchrooms, risers etc. between the Mace Contractors and the Customer's FM operatives, there must be a clear, written procedure for access to these areas that clearly defines the process and procedures. This signed off procedure must be contained within the project's Electrical Safety Plan.

## 1.9.1 Airport, rail and London underground electrical rules

Airport, Rail and Underground management organisation's electrical rules differ from the usual Trade Contractor and FM electrical rules, both from an Operational Control of the electrical installation, but also access into Live Spaces under an access permit.

Where these or other organisation's electrical rules differ from the usual trade contractor and FM electrical rules, then the specific access and isolation arrangements must be agreed with all parties, Mace, Trade Contractor, Client, and clearly defined in the Project's Electrical Safety Plan before works commence.

If there is any doubt on these arrangements, please contact the CEE's Office for further guidance.

## 1.10 Safety equipment

All contractors engaged by Mace must supply and maintain equipment to work safely e.g. tools, safety equipment and PPE.

It is the responsibility of all persons at work to understand the need for and to use, take reasonable care of, and not abuse, this equipment.

All contractors must ensure that their electrical teams have free and easy access to their own Safety Locks and Caution Signs so they can apply them as a secondary control measure to any isolation completed under a Permit to Work. See section 6.4.10 for further details on this process.

## 1.11 Reporting

All accidents, incidents, near misses and dangerous occurrences will be reported in accordance with Mace reporting procedures. Any investigation will determine the root cause(s) and any learning from the investigation will be used to communicate to the appropriate staff.

If electrical system defects, abnormal conditions or unsafe works are observed, the Transfer of Operational Control letter shall be removed from the respective Contractor, work will be suspended and reported immediately to the project appointed Electrical Engineer or Electrical Assessor and escalated to the Business Unit Leaders and Health, Safety and Wellbeing Department and the Chief Electrical Engineer's Office.

Within seven days of an incident, a meeting shall be convened at 155 Moorgate for the defaulting contractor(s) Managing Director(s) and HSW Lead(s) to present their findings and confirm their improvement plan for use on Mace projects.

The following Mace Leadership team shall also be in attendance

- At least one Group Board Director
- Representative from the CEE's Office
- HSW Construction Lead
- Respective Business Unit Managing Director
- Respective Business Unit HSW Lead

# 1. Introduction

## 1.12 Portable electrical equipment

When working on or near portable electrical equipment, as defined in the IET Code of Practice for In-Service Inspection and Testing of Electrical Equipment, the following requirements must be implemented:

- No persons may remove any covers, of any form, that will expose live electrical parts. This includes all office equipment, portable tools, plug tops (even for changing of fuses), etc.
- All persons should immediately withdraw from service and report to their Site Manager any leads, plugs or equipment that is seen to be damaged or in need of repair. The Site Manager will arrange disposal as appropriate.
- No persons will use any portable equipment, unless it is labelled that it has been inspected, is safe to use and shows the date of the next test, normally within three months for site equipment and 12 months for office based equipment.
- New equipment does not require a portable appliance test prior to use, on the proviso it has a CE mark and has been visually inspected prior to confirm that there are no obvious defects. It must have a label fitted detailing when it was put into service and be added to the project's appliance master schedule.

Where a Mace operative is working from home, they shall note the following requirements with regard to Mace issued electrical equipment:

- They shall note the date of any electrical equipment they receive for home use and when it was put into service.
- We recommend that the power supply to the Mace electrical appliances has 30mA RCD protection either by using an RCD plug adaptor OR an RCD socket outlet OR an RCD on the circuit breaker to the socket outlet
- Mace operatives are to undertake the following inspections:
  - User Checks every three months.
  - Formal Visual Inspections every twelve months
  - Return the electrical equipment to Mace every three (3) years for the Combined Inspection and Test.

For further guidance on this please contact the CEE's Office.

All PAT on Mace projects shall be carried out in accordance with the IET Code of Practice for In-Service Inspection and Testing of Electrical Equipment, as amended.

# **Section 2**

## Process overview

## 2. Process overview

The flowchart below provides a simple graphic representation of the procedure to be adopted in the application of the Mace Electrical Safety Rules and Procedures.

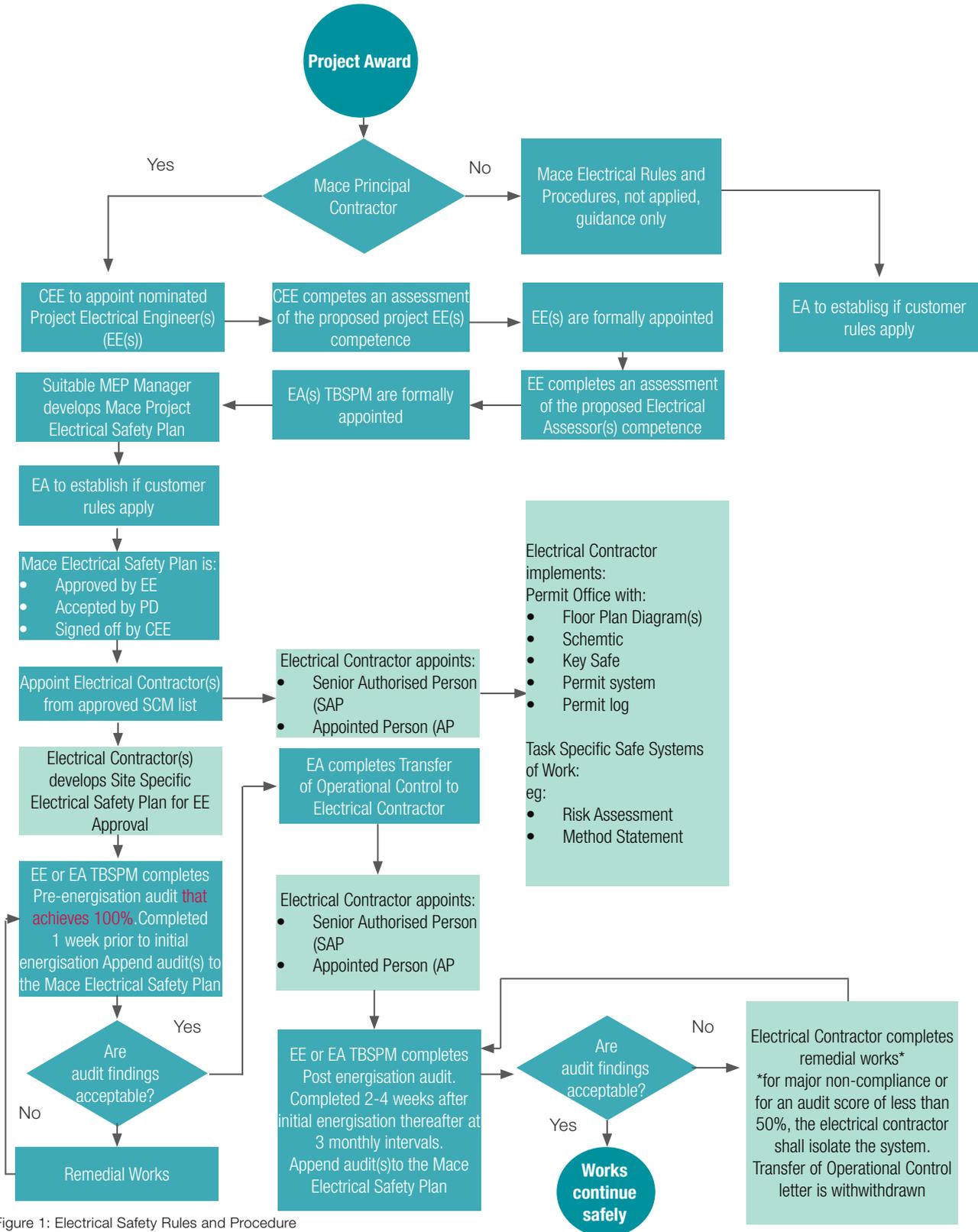


Figure 1: Electrical Safety Rules and Procedure

# Section 3

## Definitions

## 3. Definitions

### **Accompanying Safety Person**

**(ASP)** – A competent person to assist in the avoidance of danger to a person carrying out specified activities.

**Additional Earth** – An earth of approved type applied after the issue of a safety document (for example to identify the point of work or drain induced voltage).

**Apparatus** – Any item of electrical machinery or equipment in which conductors are used.

**Approved** – Sanctioned in writing to satisfy, in a specified manner, the requirements of any or all of these safety rules. Each approval will be uniquely identified.

**Authorised Person (AP)** – A competent person provided by a contractor with written authority issued by the contractor's relevant manager and endorsed by Mace to carry out specified duties. The normal duties may include routine switching operations. They may appoint persons in charge and competent persons for both high and low voltage systems.

**Authorising Engineer (AE)** – The person within a contracting company who is responsible for the contracting companies' electrical safety policy, assessment and appointment of Senior authorised persons and authorised persons within their contracting company.

**Basic Isolation/Self Isolation** – An isolation of a circuit from a single electrical supply that requires only one point of isolation.

**Business Unit (BU)** – A defined operating centre within one of the business divisions of Mace.

**Business Unit Authorising Engineer (BU AE)** – A person appointed by the Mace CEE's Office responsible for the operation and management of Mace Electrical Safety Rules and Procedures policy within their Business Unit.

**Caution Sign** – A durable, approved notice warning against interference with a point of isolation, wording CAUTION Persons Working on Equipment Do Not Switch On or Operate, manufactured from a robust material.

**Chief Electrical Engineer (CEE)** – The person appointed by the Chief Technical Officer with responsibility for the implementation, application and auditing of these electrical rules, guidelines and procedures and for appointing Mace Electrical Engineers throughout the business as well as overseeing all appointments of contractors who have responsibility for the operational control of the electrical systems on projects.

**Chief Technical Officer (CTO)** – The person appointed by Mace with responsibility for the implementation, application and auditing of technical Rules and Procedures and for appointing the Mace Chief Electrical Engineer. An employee.

**Competent Person (CP)** – A person recognized as having suitable qualifications, training, sufficient knowledge, relevant practical skills and experience for the nature of the electrical work to be undertaken and is able at all times to prevent danger and injury to himself/herself and others. Provided by the contractor.

**Complex Isolation** – An isolation from at least two potential electrical supplies that will require at least two points of isolation. This will also require a safety programme/switching log that is derived from an isolation and earthing diagram.

**Conductor** – An electrical conductor arranged to be electrically connected to a system.

**Confirm Dead** – Demonstrate with the use of test equipment, or an approved cable spiking procedure that no electrical potential exists that is liable to cause danger or injury.

**Contractor** – Any person not directly employed by Mace but contracted to provide goods or services.

**Danger** – The risk to the health and safety of, or bodily injury to any person.

**Danger Signs** – A durable, approved notice warning of the inherent danger of the system, wording DANGER Live Electrical Equipment Do Not Touch. These danger signs are additional warning notices placed on adjacent live enclosures to the Point of Work, manufactured from a robust material.

**Dead** – At or about zero voltage and disconnected from any live system.

**Dead Testing** - Implementation of measures to assess an electrical installation, with all sources of electricity removed and/or isolated, to establish its compliance with BS7671 before live testing can take place. This includes ascertaining values by means of appropriate measuring instruments.

**Disconnected** – Equipment or part of an electrical system that is not connected to any source of electrical energy.

**DNO** – Distribution Network Operator.

**Double Locking** – This is a process where the person completing the works OR the Person in Charge of the works shall then apply their own Safety Lock and Caution Sign to the Point of Isolation where an electrical permit to Work has been issued. This is a control measure to assist in the premature re-energisation of the isolated circuit.

**Duty Holder** – As defined in the Electricity at Work Regulations 1989, Duty Holders or more specifically 'persons on whom duties are imposed' have responsibilities identified in Regulation 3 for Employers/Self Employed and Employees.

**Electrical Assessor (EA)** – A person appointed by the Electrical Engineer to assess risk assessments and method statements.

## 3. Definitions

**Earth** – The conductive mass of the earth, whose electric potential at any point is conventionally taken as zero.

**Earthed** – Connected to earth via approved earthing devices.

**Electrical Energy Storage Systems (EESS)** – EESS provide storage of electrical energy so that it can be used later. These systems include, but are not limited to, Uninterruptable Power Systems (UPS) both static and rotary types, Static Inverters, Central Battery Emergency Lighting Systems, Multi-cell DC systems, Wind, Solar PV, Thermal Energy Storage, etc.

This definition is taken from the IET Code of Practice for Electrical Energy Storage Systems, 2nd Edition.

**Electrical Engineer (EE)** – A trained Technical Manager acts as a focal point for all electrical works on nominated projects.

**Electrical Equipment** – Anything used, intended to be used or installed for use to generate, provide, transmit, transform, rectify, convert, conduct, distribute, control, store, measure or use electrical energy.

**Electrical Safety Plan (ESP)** – A project Safety Plan allocating responsibility for all electrical works on the project.

**Employer** – for the scope of these. Rules, employer means Mace.

**Electrical Safe System of Work (ESSoW)** – An Electrical operational Safe System of Work which includes but is not limited to Risk Assessment/ Method Statements, Permits, Safety Programme/Switching Log, Electrical Safety Plan.

**Fixed Installation** - an installation which cannot be moved from place to place without major dismantling or modification, whether or not it has its own motive power. This is not to be confused with Fixed Equipment as defined in BS7671.

### Health Safety and Wellbeing

**Director** – The person appointed by Mace to be responsible for Health, Safety and Wellbeing issues. An employee.

**IDNO** – Independent Distribution Network Operator. These also include BNO (Building Network Operator's) and ENO (Exempt Network Operators).

**Immediate Supervision** – Supervision by a person with adequate technical knowledge, experience and competence who is continuously available at the point of work, and who attends the point of work as is necessary for the safe performance of the work by a contractor.

**Instructed Person (Electrically)** – A person adequately advised or supervised by a skilled person (as defined) to enable that person to perceive risks and to avoid hazards which electricity can create. Definition taken from the IET Wiring Regulations, 18th Edition

**Isolated** – Disconnected and secured from the system by an approved isolating device, or by adequate physical separation having a sufficient gap of approved separation.

**Isolation Certificate** – A safety document issued by an authorised person defining the details of the isolation and issued to another person in accordance with isolation rules.

**Isolation and Earthing Diagram** – A Safety Document that is first drawn up to allow the Safety Programme and Switching Schedule to be written. The Isolation and Earthing diagram should accurately show the diagram of the circuit that is to be worked on, it should clearly indicate the point(s) of isolation, the Point of Work and for HV installations where the circuit is earthed.

**Lead Electrical Engineer (LEE)** – A Mace appointed Electrical Engineer

who is Senior, with regard to the Management of the Mace ESSoW, to the other Electrical Engineers on a Business Unit / Project basis, as applicable

**Limitation of Access (LoA) Permit** – A safety document to allow access into an area under permit control to undertake defined works. These can be for both non-electrical and electrical installation works. These are usually confined to the area where the Electrical Contractor is controlling access to.

**Live** – Connected to a source of electricity and at a voltage between conductors or between conductors and earth.

**Live Testing** - An operation of working on parts of the electrical system under a specific ESSoW while the part to be worked upon is still live. This is usually limited to the live tests as set out in the 18th Edition, IET Wiring Regulations, but can also include proving a circuit is dead with a voltage indicator, or fault finding diagnostics.

**Live working** – Work on or near live conductors.

**Lock Out Tag Out (LOTO)** – An element of a safe system of working for the isolation of equipment/systems by a competent person which requires 'securing' and 'tagging' a point or points of isolation.

**Mobile Equipment** - Equipment that is moved while in operation or which can easily be moved from one place to another while connected to the supply.

**National Electricity Registration Scheme (NERS)**. Scheme that allows approved contractors to carry out contestable connection work.

**Non-Standard Cabling** – Specifically CY, SY and YY type of flexible cabling, that is not permitted for use on Mace projects for Low Voltage applications and above.

## 3. Definitions

**Operation, Isolation and Earthing Certificate (OIEC)** – A DNO Safety Document to co-ordinate operational safety across an interface, such as between Mace, the Contractor and a DNO.

**Ordinary Person** – A person who is neither a skilled person nor an instructed person. Taken from 18th Edition BS7671.

**Portable Appliance Testing (PAT)**  
- This is the examination of electrical appliances and equipment to confirm they are safe to use. Most electrical safety defects can be found by visual examination but some types of defect can only be found by testing.

**Permit to Work (PTW)** – A safety document to allow work(s) to be undertaken on a part of the HV or LV electrical system(s) that is currently or has been live and requires isolation from all sources of energy for the works to proceed. The permit will provide details of where the electrical supply has been securely isolated from all sources of energy and that it has been either proved or confirmed dead. These are not necessarily confined to the area which the Electrical Contractor is controlling access to.

**Personal Supervision** – Supervision by a person having adequate technical knowledge, experience and competence who is, at all times during the course of the work, in the presence of the person or persons being supervised.

**Person in Charge (PIC)** – A competent person whose duties may include receipt and clearance of specified safety documents. They control the activities of the working party and provides supervision as required. Provided by the contractor.

**Point of Isolation** – The points at which a section of system or item of apparatus is isolated from all possible sources of energy.

**Point of Work** – The point at which the works to the isolated section of a system, or item of apparatus is to be carried out.

**Proving Unit** – A portable, battery-powered device that serves as an electronic voltage source to safely verify the operation of an electrical Voltage Indicator. The Proving Unit must be suitable for use with the selected Voltage Indicator.

**Safety Key Box** – An approved device for the secure retention of keys for locks used at points of isolation. For high voltage installations, this shall either incorporate two locks to allow access with unique keys marked authorised person and competent person or allow the fitting of two safety locks whose keys will be: one retained by the authorised person and one issued to the competent person after securing the box.

**Safety Locks** – a unique lock, indelibly coloured red, with one key only for each lock, used to secure a Point of Isolation. These are to have a unique reference number, preferably engraved.

**Safety Programme/Switching Log** – A document consisting of a written plan and Isolation and Earthing diagram (indicating the condition of the installation before, during and after the switching operations) , that will accompany the issue of a permit to work, sanction to test, and certification of Isolation and earthing, including the reinstatement process for the electrical system on completion of the work and/or test. It is to include: the purpose of the proposed work or test, the intended sequence of safety operations to be performed and details of the safety documents issued.

**Sanction to Test** – A safety document which specifies the high or low voltage apparatus which has been made safe and details the conditions under which testing will be carried out. For high voltage, it details which circuit main earths can be temporarily removed.

**Schematic** – A simplified line-drawing generally used by engineers and technicians to describe and understand how a system works at an abstract level. Schematic drawings often require the use of industry standard line-art symbols so they may be understood within industries.

**Senior Authorised Person (SAP)** – An Authorised Person provided by a Contractor who provides additional competence to an Authorised Person for complicated installations. They may appoint Authorised Persons and carry out the duties of an Authorised Person.

**Skilled Person (Electrically)** – Person who possesses, as appropriate to the nature of the electrical work to be undertaken, adequate education, training and practical skills, and who is able to perceive risks and avoid hazards which electricity can create. Definition taken from the IET Wiring Regulations, 18th Edition

**Specific Written Instruction (SWI)**  
– Abbreviation within this document for Specific Written Instruction for particular switching operations in respect of specific items of high and low voltage equipment and phasing tests. A written instruction by the Authorising Engineer to a skilled person to carry out defined operations of switchgear and phasing tests, immediately and without any intentional delay.

**Spiking** – In the absence of clear and certain identification, the cable is to be spiked at the Point of the Work and thereafter identified by an appropriate procedure only after written approval from the Electrical Engineer.

**Standing Instruction (SI)** – Abbreviation within this document for standing instruction for electrical equipment. Written authority, applicable for up to three years and reviewed annually, issued by an Authorising Engineer to a skilled person to undertake defined tasks.

## 3. Definitions

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**Switching** – The operation of circuit breakers, interrupters, disconnectors, fuses or other methods of making or breaking an electrical circuit and the application and removal of circuit main earths.

**System** – All electrical equipment which is or may be connected to a common source of energy, including the source.

**Technical Director (TD)** – A Mace Appointment where the TD is to oversee, coordinate and take accountability for all Technical Services related issues (planning, design, engineering, MEP, digital, facades, sustainability, lean) corresponding to the Business Unit / Sector, to include procurement strategy, bidding, design, planning, construction methodology, quality control and delivery of projects, both on site and during the pre-qualification and tender process, to confirm the business meets its objectives of delivering quality projects, on time and profitably to agreed project and business targets.

**Temporary Building Services Package Manager (TBSPM)** – A Mace MEP Manager, preferably with an electrical bias, to be appointed on each project to manage the Temporary Site Building Services required during the construction of a new project.

**Voltage Indicator** – A handheld piece of electrical test equipment, manufactured in accordance with BS(EN) 61243-3 that is used to prove electrical equipment, or electrical circuit/cabling, is electrically live or dead. All Voltage Indicators used on Mace projects must be a minimum of Category IV.

**Work** – Any activity on the electrical system excluding switching, operating or controlling.

**Working lock** – The normal lock applied to the operating mechanism of the switchgear. Its purpose is to prohibit operation without authority.

# **Section 4**

## Roles and Responsibilities of Nominated Persons

## 4. Roles and responsibilities of nominated persons

### 4.1 Mace roles and responsibilities

The table below details Mace's roles and responsibilities

Role	Duties
<b>Group Health, Safety and Wellbeing Director</b>	<ul style="list-style-type: none"> <li>Approval and communication of the HSW management system.</li> <li>Analyse and escalate trends and findings from incidents, near misses and investigations.</li> <li>Monitor and review requirements of the HSW management system.</li> </ul>
<b>Chief Technical Officer (CTO)</b>	<ul style="list-style-type: none"> <li>Approve all Mechanical and Electrical Procedures within the business.</li> <li>Implement an auditing process and review mechanisms of M&amp;E rules and procedures as required.</li> <li>Approve and agree with the Group Board Director the appointment of the Chief Electrical Engineer for the business and any subsequent role and responsibility positions for the Chief Electrical Engineer.</li> <li>Approve all mandatory training with reference to these Rules and guidelines.</li> </ul>
<b>Chief Electrical Engineer (CEE)</b>	<ul style="list-style-type: none"> <li>Report directly to the Chief Technical Officer.</li> <li>Assess the competency and approve the appointment of Business Division and/or Business Unit Authorising Engineer and Electrical Engineers</li> <li>Approve contractors to operate their electrical systems on Mace sites.</li> <li>Investigate and report electrical accidents, incidents and near misses.</li> <li>Communicate learning points from audits, accident and incident reports to operational standards.</li> <li>Recommend all mandatory training for the approval of the Chief Technical Officer and implement.</li> </ul>

Table 1: Mace roles and responsibilities

## 4. Roles and responsibilities of nominated persons

Role	Duties
<p><b>Lead Electrical Engineer (LEE) / Electrical Engineer (EE)</b></p> <p><b>(this is performed by an electrically biased MEP Manager)</b></p>	<ul style="list-style-type: none"> <li>• Liaise with the CEE Office on electrical safety matters within their nominated sector.</li> <li>• Confirm that the information within the Electrical Control Log is regularly updated, reviewed and that the tracker document is accurately updated so that the Electrical Compliance Dashboard can be accurately communicated.</li> <li>• Request appointment of Contractors to operate and maintain electrical systems on behalf of Mace on allocated projects.</li> <li>• Audit Mace and the Contractor’s personnel to confirm compliance with the Rules and Procedures at sites where Mace have management responsibility.</li> <li>• Audit Contractors to confirm compliance with their respective electrical safe systems of work (ESSoW).</li> <li>• Provide technical assistance at sites where Mace have management responsibility.</li> <li>• Confirm that the monthly Electrical Site Inspection on Yellow Jacket is completed on all projects and upload the Inspection to the respective project folders on the Central Electrical Control Log.</li> <li>• Request the provision of mandatory electrical training for Electrical Engineers, Electrical Assessors and TBSPMs.</li> <li>• Appoint Electrical Assessors and TBSPMs within their nominated Business Unit following authorisation from the CEE’s Office.</li> <li>• Assist in the review and acceptance of any Contractor’s Excavation and Breaking Ground SSoW/RAMS, and provide technical assistance of the review for existing services drawings.</li> </ul> <p><b>Note</b> - all project appointments are to be made via the Appointed Coordinator section on the Project Data Page on Infomace’</p>

Table 1: Mace roles and responsibilities

## 4. Roles and responsibilities of nominated persons

Role	Duties
<p><b>Electrical Assessor (EA)*</b></p> <p><b>(this is performed by an electrically biased MEP Manager)</b></p>	<ul style="list-style-type: none"> <li>• Responsible for the review and acceptance of low voltage Risk Assessments/Method Statements on Mace sites within their nominated projects including maintenance works and ensure compliance with the Contractor's safe systems of work.</li> <li>• Carry out LV Pre and Post energisation audits, when required, on Mace Projects.</li> </ul> <p>For instances where there are numerous EAs, then the CEE's Office at its discretion may appoint a Lead Electrical Assessor (LEA). Where a LEA has been appointed then they will have the additional roles and responsibilities to:</p> <ul style="list-style-type: none"> <li>• Liaise with the CEE's Office on electrical safety matters within their nominated sector.</li> <li>• Confirm that the information within the Electrical Control Log has been regularly updated, reviewed and that the tracker document has been accurately updated so that the Electrical Compliance Dashboard can be accurately produced by the CEE's Office.</li> <li>• Audit Mace and the Contractor's personnel to confirm compliance with the Safety Rules and Procedures at sites where Mace have a management responsibility. Note: this is for LV only.</li> <li>• Complete the monthly Electrical Site Inspection on Yellow Jacket for their respective project and upload the Inspection to the respective project folder on the Central Electrical Control Log.</li> <li>• Appoint Electrical Assessors within their nominated Business Unit following authorisation from the CEE's Office.</li> <li>• Assist in the review and acceptance of any Contractor's Excavation and Breaking Ground SSoW/RAMS, and provide technical assistance of the review for existing services drawings.</li> </ul>

Table 1: Mace roles and responsibilities

## 4. Roles and responsibilities of nominated persons

Role	Duties
<p><b>Temporary Building Services Package Manager (TBSPM)</b></p> <p><b>(this is performed by a MEP Manager)</b></p>	<ul style="list-style-type: none"> <li>• Design and Procurement of the complete Temporary Building Services in line with the Mace Temporary Building Services Process document.</li> <li>• Produce, or ensure the timely production of the project Electrical Safety Plan prior to any works commencing on site</li> <li>• Review and accept the Temporary Building Services Contractor(s) Safe Systems of Work for the Electrical installation</li> <li>• Ensure the compliance of Temporary Building Services to the Mace Environmental Policy including the upload of information, where applicable, to Optimise.</li> <li>• To engage Mace Utilities in a timely manner to ensure any temporary Utility Services are procured, managed and installed as per the Mace Utilities Policy.</li> <li>• Assist and review/accept the specialist trade contractors risk assessments (where applicable) and design drawings for all Temporary Building Services Elements, including Temporary Building Services for commissioning purposes.</li> <li>• Support projects on proposed methodology of the temporary building services</li> <li>• Ensure all elements of the Electrical Installation are being tested and inspected, both new installations and Periodic Condition Reports' in accordance with the latest edition of BS7671, IET Wiring regulations.</li> <li>• Complete the monthly Electrical Site Inspection on Yellow Jacket for their respective project and upload the Inspection to the respective project folder on the Central Electrical Control Log.</li> <li>• Assist in the review and acceptance of any Contractor's Excavation and Breaking Ground SSoW/RAMS, and provide technical assistance for the review of existing services drawings.</li> <li>• Monitor, review and audit the implementation of both Mace and the Temporary Building Services Contractor(s) Safe Systems of Work (SSoW) through periodic audits being recorded in yellow jacket. These audits include:                         <ul style="list-style-type: none"> <li>o Electrical Pre-Energisation Audit</li> <li>o Electrical Post Energisation Audit</li> <li>o Site Accommodation Audits</li> </ul> </li> </ul>

## 4. Roles and responsibilities of nominated persons

On smaller projects, the roles of the EE, EA and TBSPM can be undertaken by one Mace Manager, this is at the discretion of the BU EE. Where a Mace ESP is written by a Manager that has combined roles, the ESP must undergo a peer review by an EE/EA from another project.

There can also be numerous EE's, EA's and TBSPM's allocated to a single, larger project. Where this is necessary there must be a Lead Electrical Engineer appointed on this project.

The CEE's Office reserves the right to review the EE/EA/TBSPM allocation on any project and instruct additional resource where they feel it is necessary.

All Mace EE's and EAs shall preferably be ECS registered and hold a valid and in date ECS card. Where this is not possible then the CEE's Office shall accept a suitable CSCS card.

\* The MACE appointed Electrical Engineers and Electrical Assessors must produce and advise of all of their electrical qualifications and competencies upon any reasonable request from the Chief Electrical Engineers office. Failure or refusal to do so will result in the removal from the position of EE or EA.

The following matrix (Figure 2) shows the grading for those Mace Electrical Managers who are approved to review, comment, accept and/or reject Trade Contractors RAMS according to the nature of the works to be undertaken. This matrix is not exhaustive. Should the environmental conditions or methods of conduction (direct or adjacent) introduce an additional hazard, seek further guidance from the project appointed Electrical Engineer or the Chief Electrical Engineer's Office.

## 4. Roles and responsibilities of nominated persons

Electrical RAMS	LV Dead	LV testing	LV Energised	HV equipment or cabling that has not been energised	All HV cabling or equipment that is connected and with the potential to be energised
<p><b>Authority Matrix</b></p> <p>Not previously energised</p> <p>Includes:</p> <p><b>Low Voltage (LV)</b></p> <ul style="list-style-type: none"> <li>Installing electrical conductors</li> </ul> <p><b>High Voltage (HV)</b></p> <p>Installation of electrical switchgear and containment/ bus-bar etc.</p>	<p>Not previously energised</p> <p>Includes:</p> <ul style="list-style-type: none"> <li>Installing electrical conductors</li> </ul> <p>Installation of electrical switchgear and containment/ bus-bar etc.</p>	<p>On or near electrical conductors which are in the process of being energised or which are energised or have been energised previously</p> <p>Includes:</p> <ul style="list-style-type: none"> <li>RCD test</li> <li>Earth loop impedance tests</li> <li>Phase rotation testing</li> <li>Commissioning</li> <li>Spiking to confirm dead</li> <li>Isolations</li> <li>Crane, Hoists, Lifts and Escalator RAMS</li> </ul> <p>Dead testing, including Insulation resistance testing &lt; 1000v</p>	<p>On or near electrical conductors which are energised or have been energised previously</p> <p>Includes:</p> <ul style="list-style-type: none"> <li>Fault finding</li> </ul> <p>Complex systems including, Electrical Energy Storage Systems, Photo Voltaic Systems, Generator and associated controls systems, SCADA systems, ATS'</p>	<p>Not previously energised</p> <p>Limited to:</p> <ul style="list-style-type: none"> <li>Pulling cables</li> <li>Cleating</li> <li>Dressing cables</li> </ul>	<p>On or near electrical conductors which are in the process of being energised or which are energised or have been energised previously</p> <p>Includes:</p> <ul style="list-style-type: none"> <li>Spiking</li> <li>Proving dead</li> <li>Isolations</li> <li>Works inside previously energised distribution systems</li> <li>Live terminations</li> <li>Testing (dead and live), pressure test</li> </ul>
<b>Project / Construction/Health and Safety Manager</b>	<p>✓</p> <p>RAMS second acceptance signatory</p>	<p>✗</p>	<p>✗</p>	<p>✗</p>	<p>✗</p>
<b>MEP Construction Manager</b>	<p>✓</p> <p>RAMS either lead or second signatory</p>	<p>✓</p> <p>RAMS second signatory</p>	<p>✗</p>	<p>✗</p>	<p>✗</p>
<b>LV Electrical Assessor / Temporary Building Services Package Manager</b>	<p>✓</p> <p>RAMS either lead or second signatory</p>	<p>✓</p> <p>RAMS lead signatory</p>	<p>✓</p> <p>RAMS lead signatory</p>	<p>✓</p> <p>RAMS second signatory</p>	<p>✗</p>
<b>Electrical Engineer</b>	<p>May deputise for LV Assessor</p>	<p>May deputise for LV Assessor</p>	<p>✓</p> <p>RAMS second acceptance signatory</p>	<p>✓</p> <p>RAMS lead signatory</p>	<p>✓</p> <p>RAMS lead acceptance signatory</p>
<b>Mace Chief Electrical Engineer's Office</b>	<p>Not required</p>	<p>May deputise for LV Assessor</p>	<p>May deputise for LV Assessor</p>	<p>May deputise for Electrical Engineer</p>	<p>✓</p> <p>RAMS second acceptance signatory</p>

Figure 2 : Electrical Risk Assessment Method Statement (RAMS) Authority Matrix detailing the lines of authority and control for the electrical works on Mace sites as prescribed within these Electrical Safety Rules and Procedures

## 4. Roles and responsibilities of nominated persons

### 4.2 Contractors roles and responsibilities

The table below details the roles and responsibilities for Contractors.

Role	Duties
<b>Contractor's Authorising Engineer (AE)</b>	<ul style="list-style-type: none"> <li>• Responsible for the operation and management of the Contractor's electrical safety policy.</li> <li>• Assess and appoint Senior Authorised and Authorised Persons within their Contractor's organisation.</li> <li>• Responsible for confirming compliance with the Contractor's ESSoW.</li> <li>• Responsible for the assessment of the Contractor's competent people.</li> <li>• Responsible for the training of all electrical persons within their organisation.</li> </ul>
<b>Contractor's Senior Authorised Person (SAP) where necessary **</b>	<ul style="list-style-type: none"> <li>• Liaise with client and/or Mace regarding operational safety, procedures and outages.</li> <li>• Providing technical support to site Authorised Persons for non- routine operations.</li> <li>• Provide technical support in the production of switching schedules, method statements and risk assessments.</li> <li>• Determine the level of supervision required after assessing the level of risk and staff competence.</li> <li>• Audit to confirm compliance with Rules and Procedures at sites where Mace have management responsibility.</li> <li>• Authorise safety programmes and switching schedules.</li> <li>• Assess and appoint Authorised Persons for the site(s) for which <b>they are</b> responsible.</li> <li>• To carry out a familiarisation briefing to all Contractor's APs, CPs and other relevant Operatives.</li> <li>• Access and appoint Persons in Charge, Accompanying Safety Persons and Competent Persons.</li> </ul> <p>They will be responsible for the work or test to be attended, and is to confirm that:</p> <ul style="list-style-type: none"> <li>• The Safety Person understands their intended role.</li> <li>• Fully understands how to disconnect from all sources of supply the Equipment being worked on or tested.</li> <li>• How to switch off any test equipment or disconnect it from its source of supply.</li> </ul>

Table 2: Contractor roles and responsibilities

## 4. Roles and responsibilities of nominated persons

Role	Duties
<b>Contractor's Authorised Person (site specific) **</b>	<ul style="list-style-type: none"> <li>• Produce 'safety programmes' and switching schedules for works requiring a permit to work.</li> <li>• Agreeing outages with client in conjunction with the EE or EA.</li> <li>• Plan maintenance of electrical assets.</li> <li>• Agree level of supervision of the work.</li> <li>• Control work in areas of risk, higher than routine.</li> <li>• Provide supervision and guidance as required.</li> <li>• Issue and cancellation of electrical permits to work, electrical Sanctions to Test, Operation, Isolation and Earthing Certificates and Limitation of Access Certificate documents and maintain a formal log of documents listed.</li> <li>• Control operations and work at sites where Mace have management responsibility.</li> <li>• Insist on receipt of task specific RAMS prior to issue of any Permit</li> <li>• Identify the point of work and issue all permits at the Point of Work.</li> <li>• Identify and agree the process for the release of stored energy.</li> <li>• Confirm the quality of completed work prior to energising.</li> <li>• Complete all operational documentation and records required by the client.</li> <li>• Operate switchgear according to level of authorisation.</li> <li>• Assess and approve RAMS associated with live LV working for commissioning and fault diagnosis</li> <li>• Achieve safe custody of safety keys.</li> <li>• Access and appoint Persons in Charge, Accompanying Safety Persons and Competent Persons.</li> <li>• Advise the client and Mace of relevant bulletins and switchgear operational restrictions and implications for site safety.</li> <li>• Be familiar with the electrical equipment they will be operating.</li> <li>• Please refer to the AP requirements as stated in section 6 of this document.</li> </ul>

Table 2: Contractor roles and responsibilities

\*\* No Mace personnel will act as an Authorised Person or Senior Authorised Person. It is set that on each Mace project the transfer of operational control for the electrical services is transferred to an operating contractor who will have competent persons that will comply with these rules and procedures and comply with statutory obligations. These Contractors must have their own Electrical Safety Policy which sets out their Electrical Safety Rules and Procedures and their assessment of competence for Senior Authorised Persons, Authorised Persons and other individuals who carry out electrical works, in accordance with the contractor's specified electrical safe systems of work.

## 4. Roles and responsibilities of nominated persons

Role	Duties
<b>Contractor's Person in Charge</b>	<ul style="list-style-type: none"> <li>• Comply with Safety Rules and Procedures.</li> <li>• Receive specified safety documents e.g. Permit to Work or Limitation of Access' from the Contractor's Authorised Person, and sign off same on completion of the specified works.</li> <li>• Audit quality of electrical work.</li> <li>• Provide supervision and guidance as required to all members of working party.</li> <li>• Work on dead HV and dead LV systems when instructed</li> <li>• Provide a job record and reports of work carried out on completion of work.</li> </ul>
<b>Contractor's Competent Person (working in a high voltage/low voltage area)</b>	<ul style="list-style-type: none"> <li>• Comply with Safety Rules and Procedures.</li> <li>• Receive, from the Contractor's Authorised Person, Limitation of Access documents, understand nature and extent of work to be carried out in proximity to live systems and follow instructions.</li> <li>• Supervise working party.</li> </ul>
<b>Contractor's Safety Person/ Accompanying Safety Person</b>	<p>The Safety Person is a person not directly involved in the work or test, who:</p> <ul style="list-style-type: none"> <li>• Has adequate knowledge, experience and ability to avoid danger.</li> <li>• Keep watch.</li> <li>• Be able to carry out a controlled isolation if found to be necessary.</li> <li>• Prevent unauthorised interruption of the work or test.</li> <li>• Be able to apply first aid.</li> <li>• Summon help.</li> <li>• To accompany Authorised Persons or Persons in Charge in situations of increased risk.</li> <li>• To significantly contribute to safe working.</li> </ul> <p>The Safety Person is to be in attendance when the Senior Authorised Person considers it necessary and in the following circumstances:</p> <ul style="list-style-type: none"> <li>• Whilst equipment is being proved or confirmed dead.</li> <li>• Whilst equipment is being earthed, other than by means of a switch.</li> <li>• Whilst the Senior Authorised Person is spiking a cable.</li> <li>• Whilst testing is being undertaken at high voltage.</li> <li>• Whilst a high voltage potential indicator is in use.</li> <li>• Whilst voltage and phasing tests are being undertaken at high voltage</li> <li>• Whilst any person is opening or working in a high voltage enclosure.</li> <li>• To be in attendance whilst any operative is breaking ground/excavating around any energised electrical cabling.</li> </ul> <p>The Safety Person will have received training in emergency first aid in accordance with this document.</p>

Table 2: Contractor roles and responsibilities

# **Section 5**

## Assessment of Competence

## 5. Assessment of competence

The Chief Electrical Engineers Office has the responsibility for the provision of training for all persons, including but not limited to; EEs, EAs.

No person shall be expected to work outside their level of competence.

Training will be provided before any additional responsibilities are given.

### 5.1 Training and assessment

- The Chief Electrical Engineer's Office will assess competence of Mace staff who will be reviewed annually, or shorter if the performance of an individual falls below the accepted standard.
- Authorisation will be revoked for violation of this document.
- In addition to the usual EE, EA, TBSPM training, all members of the Mace electrical team are required to complete the following Mace specific training sessions every two years:
  - Electrical Safety on Construction Sites – for electrically biased managers.
  - Mace Electrical Pre and Post Energisation Audit procedures.
  - Safe Isolation.
- On achieving the required standard of safety and experience, the candidate will receive an authorised job description detailing the duties in full and signed by both parties to confirm these duties, and whoever carried out the technical assessment.

- The CEE's Office will provide confirmation of the required electrical qualifications, skills, knowledge and experience and appropriate skill cards required to fulfil electrical roles for Mace staff.
- Where a Mace or Contractor's operative has non-UK training and qualifications, details are to be submitted to the CEE's Office for verification and acceptance for appointment on Mace projects. The operative shall not be allowed to undertake any works relating to their proposed role until the qualifications have been verified.

### 5.2 Mace approved electrical contractors

- As part of its supply chain authorisation process, the Mace Chief Electrical Engineer's Office will first be required to review and accept the Corporate Electrical Core Policy and Procedures document of each of its Tier 1 Electrical Contractors. The CEE's Office shall confirm acceptance of the Electrical Contractor's ESSoW via a Standing Instruction letter.
- Tier 2 Electrical Contractors shall be approved by the CEE's Office on a project by project basis.

## 5. Assessment of competence

### 5.3 Approved contractors

- Before being permitted to work on site, the Contractor and their site specific electrical safety procedures will have been assessed by the LEE / EE
- This will contain details of qualifications, skills, knowledge and experience along with any formal training received, as well as appropriate skill cards or equivalent international authorising cards
- Upon approval by the Chief Electrical Engineer's Office for the role of operating electrical systems on any individual project, the Electrical Engineer will assess the Contractor's site specific roles and training assessments for the individuals nominated by the Contractor.
- The EE must see the original copies of certificates or electronic copies certified by the issuing authority. Method statements will contain certified copies of training and competence records.
- EEs and EAs will be expected to monitor and audit both the quality and safety of the Contractor's site work. Contractor's certification will, via the CEE's Office, be revoked for violation of the Mace Electrical Safety Rules and Procedures.
- Contractors are required to issue all training certification for key individuals e.g SAPs/APs who will work on or operate electrical equipment to the Mace Project Appointed Electrical Engineer.
- All Contractors undertaking electrical works on Mace projects are to ensure that their electrical staff are ECS registered, with a grade suitable for the works that they will be undertaking.
- The Contractor's management team for the project must maintain updated the ECS tracker for the project.
- All Cranes and Hoist operatives that undertake electrical works on Mace projects must be ECS registered with a grade suitable for the works that they will be undertaking, with at least one operative registered as an ECS Gold Card Approved Electrician.
- It is the responsibility of the Project Appointed Electrical Team, EE, EA and TBSPM, to confirm that all electrical staff/operatives employed by non-electrical contractors, for example fit-out, landscaping etc., are identified prior to them commencing their installation. They shall be identified in the Mace Project Specific Electrical Safety Plan and the procedures with regard to the Transfer of Operational Control in sections 6.5.1 and shall be followed.

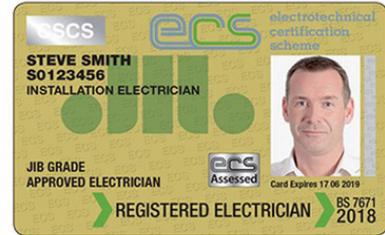


Figure 3: Example of ECS Gold card

# **Section 6**

## Electrical Safety Rules

## 6. Electrical safety rules

### 6.1 General

Safety rules specific to managing the risks on or around electrical systems are detailed below.

- Each project must have a transfer of operational control letter/ agreement in place between Mace and the contractor who will be in operational control of the electrical systems. See section 7.
- The transfer letter must clearly detail the extent of the electrical services that the Contractor is in operational control of, supported by clearly defined schematics and floor plans clearly identifying the permit-controlled areas that they are in control of.
- Contractors appointed to control electrical systems must have in place a Project Specific Electrical Safety Plan and the Mace Electrical Safety Rules and Procedures must be complied with, in addition to their own electrical safety rules and procedures. For further guidance on the Project Specific Electrical Safety Plan and Project Specific ESSoW please refer to section 6.5.
- Tasks, such as substation cleaning, electrical and mechanical system checks and dc unit maintenance may have to be undertaken in proximity to live electrical apparatus. Access to substations containing live electrical apparatus will only be made available to personnel who are recognised as competent by the contractor. All work to be undertaken as per safety documentation and specific electrical safe system of work (ESSoW)
- Work will only take place with all inherent dangers, where practicable, removed from the system.
- Trained personnel are defined as those who have received training to carry out all or specific tasks relating to working with electricity and have received authorisation from the contractor in writing as being competent to carry out those tasks safely. They must meet the following requirements when conducting their works:
  - All persons authorised by the contractor to work on any electrical equipment will have received adequate familiarisation training.
  - Authorised Persons will have received training in safe emergency isolation and the first aid procedures to follow in the event of electric shock and burns. Such training will be refreshed at appropriate intervals.
- All Voltage Indicators and Electrical Test instrument test leads shall be a minimum of Category IV (CAT IV) to 600V regardless as to where they will be applied on the installation. For UPS and other stored energy systems, these shall be CAT IV to 1000V.
- All electrical circuits will be proved dead before starting work by the use of an approved test instrument that has been proved to operate correctly, both immediately before testing the circuit supply and immediately after the test, known as Prove Test Prove (PTP). A proving unit must be used to facilitate the proving of the voltage tester. **A known live source is not accepted on Mace projects as a means for proving a voltage indicator.**
- When isolating a circuit by removing a fuse or removable circuit breaker from a distribution board, the fuse carrier or circuit breaker will be removed where possible. An approved caution sign will be fixed at the isolation position for the duration of the work and a safety lock will be applied with the key stored in the key control box where this is possible and in accordance with the Electrical Contractor's accepted lock out – tag out (LOTO) procedure.
- Mace reserves the right to release relevant Electrical Safety Alerts and Technical Notes across all of its projects for each Mace project team and Trade Contractors to brief to their teams via Toolbox Talks (TBTs). Copies of the Briefing Scripts and attendance registers must be retained for audit purposes. Currently the following TBTs must be completed on every project.
  - Compliance with the Closed End Policy.
  - Double Locking isolations completed under a Permit to Work.

## 6. Electrical safety rules

### 6.1.1 All LV Distribution Equipment on Mace Projects.

Each Distribution Board that forms part of the Distribution Equipment and that has been energised and put into service, shall contain a clear and up to date, Distribution Board Schedule.

All terminations, 100A and above to and within the LV Distribution Equipment shall be torqued to the manufacturer's recommendations. Records of this operation, including the torque wrench calibration certificates shall be retained on site for the duration of the project.

Calibration of the Torque Wrench, and any ongoing accuracy checks, shall be in strict accordance with the manufacturer's recommendations. Evidence of these items shall be retained on site for inspection by Mace

The selection of the compression lugs and bolts used for the connection to the LV Distribution Equipment shall be appropriate to the hole configuration of the connection point. For example, if the connection point has an M14 hole, both the compression lug and bolt shall also be M14.

Where the connection point has the facility for a four-hole compression lug, also known as a transformer lug (figure 4), this shall be the preferred selection of lug.



Figure 4: Four hole compression lug

### 6.1.2 Distribution cabling

For all distribution cabling, the practice of reduced, or half sized neutrals, on the TBS Electrical installation is not permitted. Where this practice is to be installed on any part of the PBS Electrical installation, then the respective contractor shall provide a detailed Technical Submittal confirming how the neutral conductor shall be monitored in accordance with BS7671.

### 6.1.3 Electrical Energy Storage Systems (EESS)

Works to any part of the EESS's equipment and any associated ancillary items shall only be undertaken by the Equipment's Specialist Contractor. This includes but is not limited to:

- Installations, adaptations and alterations to the battery interconnection links, support racks etc.
- Any form of battery string isolations and associated Permit to Works on the system.

**Note** – this does not include the termination of SWA cabling that feed a sub circuit which is fed from this EESS.

Once the EESS' storage batteries are interconnected, there shall be an exclusion zone around the EESS battery storage that shall be a minimum of two metres. Access within this zone shall be controlled under a Limitation of Access permit issued by an Authorised Person from the respective Contractor that is responsible for this service.

Before any works are to be undertaken to either the batteries or their support racks, each string of batteries shall be isolated from the UPS and each battery string shall be broken down into smaller strings which do not exceed 120VDC.

All and any works to be carried out on the EESS system, and / or its corresponding battery strings, shall be the subject of a task specific Risk Assessment. This Risk Assessment shall consider and comply with the Manufacturer's recommendations in every respect.

The Proving of a Voltage Indicator using the EESS' batteries is not permitted. Proving of the Voltage Indicator must be completed using a compatible Proving Unit.

All works to and around EESS' shall be completed in accordance with section 7 of the IET ACOP Code of Practice for Electrical Energy Storage Systems. Table 7.3, Hazard Inventory, of the aforementioned document, should be consulted by Specialist Contractors, with regard to the Design, Installation, Operation and Maintenance of all EESS systems.

### 6.1.4 Use of non-standard cabling

The use of SY, YY and CY cabling is not permitted for any part of the LV installation, either for any temporary fixed installations, temporary portable equipment and extension leads or any part of the PBS installation, across Mace projects due to their inability to fully comply with any British or Harmonised standards.

## 6. Electrical safety rules

### 6.2 Safe working (Isolated)

No works are to commence until the required parts of the system have been prepared and released for work e.g.

- All sources of energy must be disconnected completely.
  - The item or section disconnected must be secured against restoration of energy by the application of a safety lock and a caution sign. This process forms a Point of Isolation. Only when all disconnection points have been made points of isolation has the item of apparatus or the section of system been isolated.
  - For HV circuits, conductors of the isolated section will be short circuited and earthed, where applicable, using approved means. For LV circuits the earthing of isolated circuits is strictly prohibited and shall only be allowed after written confirmation is received from the Chief Electrical Engineer's Office.
  - Any adjacent live conductors or equipment will be identified by visible means from the zone of work and conductors segregated by insulated barriers or other approved means and all marked with approved danger signs.
  - All remaining system hazards will be removed. System hazards may be any or all of the following:
    - Electrical Energy Storage Systems - see section 6.1.3 for further details.
    - Generators and uninterruptible power supplies.
    - Auxiliary electrical supplies.
    - Charged springs.
    - Compressed gases.
  - The point of work will be positively identified and proved dead by the contractors authorised person to the person in charge of the work.
  - An appropriate safety document will be issued by the contractor prior to the commencement of any work. All Permit to Work and Limitation of Access Permits shall be issued by the contractors SAP/ AP at the 'Point of Work'.
  - Where an Electrical Contractor operates a single point, Basic/Self-Isolation as their control measure, then their Electrical Safety Plan must clearly detail their Safe Isolation Procedure, presented in the form of a process flow chart. The ESP should also include a copy of the signed register relative to each of the operatives on the Mace project that have received a corresponding briefing. An example of an approved flow chart can be found in section 6.3.1.
- NOTE** – this procedure is not permitted for a Complex Isolation or where an operative isolates an electrical circuit for another operative.
- If the isolated circuit could not be proved dead, or if there is any doubt of identifying the cabling that is to be worked on then this must be 'Spiked' and certified by the AP before the works can proceed. Where a cable has been spiked to confirm dead, then a Permit to Work must be issued
  - Where there is a live HV cable/ busbar energised throughout any part of a Mace project, there will be an exclusion zone, relative to the voltage of the system, operated along the entire length – this shall be a minimum of two metres. Access within this zone shall be controlled under a Limitation of Access permit issued by an Authorised Person from the respective Contractor responsible for this service.
  - Where there are excavation and breaking ground operations around any live electrical services the two metre exclusion zone rules apply. Where these are DNO/ IDNO services, and there is written confirmation that these cannot be de-energised, then the contractor undertaking the excavation works must deploy an Accompanying Safety Person to oversee the excavation works and ensure their accepted SSoW are strictly adhered to.
  - Concealed electrical services – where electrical services are concealed and/or are covered by other services, for example ductwork, then there must be clear, permanent signage fitted to the service that is obscuring the electrical service. This must also be clearly communicated to the Client Team at handover, and all adaptations made during the construction phase **must** be done so under LoA permit issued by the contractor in operational control of the service.

## 6. Electrical safety rules

### 6.3 PIPIC explanation

When conducting basic and complex Low Voltage isolations, the PIPIC criteria can be utilised. An equivalent process can be utilised.

1	P	<b>Plan (Safety Programme/ Switching Schedule etc)</b>	Review the planned work including any risk assessments and method statements and prepare (or review) the safety programme, switching schedule and temporary earthing requirement (if applicable).
2	I	<b>Isolate</b>	Isolate from all sources of supply. Where practicable, prevent unauthorised connection or unauthorised operation by fixing Safety Locks at all the points of isolation, and visibly fix Caution Signs at all points of isolation.
3	P	<b>Prove Dead</b>	Equipment to be worked on is the equipment that has been isolated. Where practicable prove dead with a voltage test Indicator at all the points of isolation and at the point(s) of the work. At the points of isolation fix safety locks and caution labels. Identify cables with certainty at the point of the work.
4	I	<b>Issue Paperwork (Permit to work etc)</b>	At this stage and at the point of work and point of isolation the authorised person is to issue the necessary permit to work/safety programme to the person in charge of the work.  <b>Note:</b> Where a complex isolation is to be carried out, and prior to the issue of any permit to work, a safety programme is to be prepared. This shall detail the intended sequence of operations to be performed to make the equipment safe for the execution of the work or test together with its restoration into service, if applicable. The purpose of the proposed work or test and details of all associated safety documents shall also be issued.
5	C	<b>Confirm Dead</b>	Where it is not practicable in step 3 to prove that the cable to be worked on is dead, the cabling to be worked on is to be spiked at all point(s) of work by the SAP/AP. Cable spiking equipment is available in two forms of operation; hydraulically or by explosive cartridge – please note hydraulic cable spiking equipment is not permitted on Mace projects. This will also require the attendance of an Accompanying Safety Person.

## 6. Electrical safety rules

### 6.3.1 Isolation Procedures for Safe Working on Electrical Systems and Equipment

All Trade Contractors undertaking any form of Isolation on Mace projects must have an approved, Safe Isolation process flow chart contained within both their Core Safety Rules and their Project Specific Electrical Safety Plan.

Isolation means the disconnection of the electrical supply or supplies, if more than one, to an electrical installation for safety reasons. This is carried out by operating devices that have been provided within the electrical installation for the purpose of isolation to make the electrical system, or part of it, DEAD.

Once the electrical supply has been isolated, the means of isolation must then be secured so that the system / equipment cannot be inadvertently made live.

It is important that all sources of electrical supply are isolated, and that the system / equipment is proved to be DEAD before work is carried out.

The Electricity at Work Regulations requires the isolation of electrical equipment and systems to prevent danger. All electrical systems or equipment must be DEAD before installation or maintenance is carried out. A system is any part of an electrical installation from the source of supply to the equipment installed.

The Regulations also state that no person shall take part in any work activity unless they are competent and possess the necessary technical knowledge and experience in order to prevent danger or is under suitable supervision.

Once the system / equipment is proved DEAD, work can begin.

\*An approved voltage indicator must comply with the Health and Safety Executive's guidance note GS38, in particular BS(EN) 61243-3, and must be CAT IV (600V) for general electrical works and CAT IV (1000V) for works on or around UPS and stored energy systems. The approved voltage indicator must be "proved" using a proving unit of corresponding manufacture before and after use to show it is working correctly.

**NOTE:** Both the Electricity at Work Regulations and Health and Safety Executive's guidance note GS38 and BS(EN) 61243-3 should be referred to with this guidance.

## 6. Electrical safety rules

The following flow chart illustrates the safe isolation procedure to be applied when working on electrical systems and equipment.

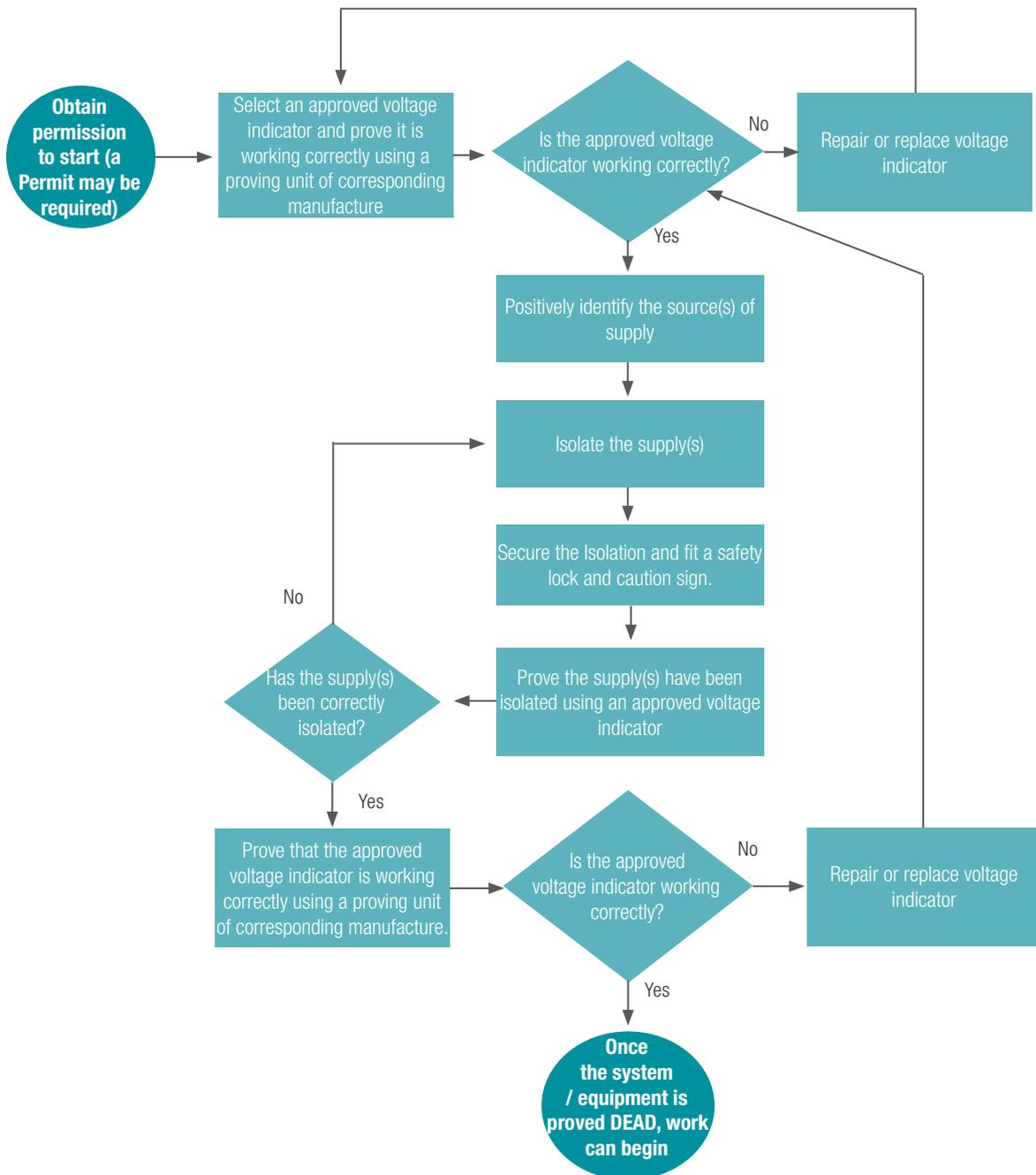


Figure 5: Safe isolation procedure

## 6. Electrical safety rules

### 6.4 Electrical permit process

Where a Contractor selects the Permit Process as their control measure the following are the minimum standards on a Mace project with regard to Safe Isolation and correct permit issue.

#### 6.4.1 Agreement on the Permit Areas.

At the pre-construction phase it is essential that the areas that the Electrical Contractor(s) is to control access to under their Electrical Permit System is recorded and agreed. This should cover, but is not limited to:

- Switch-rooms
- Any Electrical Room, Space, Riser Etc. that contains Electrical Distribution Equipment
- Generator Enclosures

A plan drawing showing the final layout should be marked up to clearly show and define the area(s) and / or room(s) where the Electrical Contractor will control the access. This drawing, together with a corresponding marked up schematic defining the scope of the electrical system, need to be referenced and appended to the Transfer of Operational Control letter and updated when necessary.

Before energisation, the entrance doors/hatches etc. to the areas the Contractor is to display durable signage that clearly states:

- An electrical hazard warning label from Schedule 1 and Section 1 (c) of the Electricity Safety, Quality and Continuity Regulations 2002.
- To enter this area you will need a Permit
- Name of the Contractor managing the space
- Contact details for the SAP / AP / manager of the Contractor

- Emergency and out of hours contact details
- The highest voltage contained in the space.
- Details of where the site defibrillator is held.

This signage must remain in place for the duration of the project up to Practical Completion, and shall not be removed prior to this milestone date.

There shall also be a secure method of locking the entrance door / hatch to these area(s), with the key issued to the Electrical Contractor managing the access to this space.

The Electrical Contractor will provide the following in each switchroom immediately prior to first energisation and maintained thereafter or adjacent to electrical equipment whilst it is being worked on;

- Electrical Shock Poster.
- Emergency Contact Details.
- Method of isolating supply.
- Suitable fire protection.

#### 6.4.2 - Agreement on Permit System

The Electrical Contractor is to issue their own, Project Specific Electrical Safety Plan that should cover the application and management of their Permit System.

This needs to include their management structure and the names, contact details and qualifications of the Senior Authorised Person(s) (SAP) / Authorised Person(s) (AP).

This is to be reviewed and accepted by the Mace Project Appointed Electrical Engineer (EE) and/or Electrical Assessor (EA).

Prior to the Permit System coming into effect on site the Electrical Contractor is to carry out a presentation to the Mace site management team and other Contractor's managers and supervisors

to clearly communicate their processes and requirements for operatives wishing to gain access to the areas they control.

The permit process should be implemented, as a minimum, at least 48 hours prior to the respective energisation.

**Note** – where individual circuits can be securely isolated and prevent unauthorised access, this should be managed under a Permit to Work system as opposed to handing the whole room to the contractor to operate a Limitation of Access permit system.

#### 6.4.3 - Correct Permit Type for the Works to be undertaken

The following are the different types of Electrical Permits currently used on Mace projects

**Permit to Work** – purpose, to allow work(s) to be undertaken on a part of the electrical system that is currently or has been live and requires isolation from all sources of energy for the works to proceed. The permit will provide details of where the electrical supply has been securely isolated from all sources of energy and that it has been either proved or confirmed dead.

These are not necessarily confined to the area which the Electrical Contractor is controlling access to.

Issued at the Point of Work by – Either the Electrical Contractor's Senior Authorised Person (SAP) or Authorised Person (AP) for the project

**Limitation of Access** – purpose, to allow access into an area under permit control to undertake defined works. These can be for both non-electrical and electrical installation works.

Issued at the Point of Work by – either the Electrical Contractor's SAP or AP for the project.

## 6. Electrical safety rules

These permits cover two different types of work activity so the SAP must check the correct permit type is issued for the works to be undertaken. They are not interchangeable and their use is clearly defined and not at the discretion of the SAP/AP.

A Permit to Work must not be issued for any operatives to gain access to an area.

A Limitation of Access Permit must not be used where an isolation has taken place.

**Sanction for Test** – purpose, to allow a temporary earth to be removed to allow testing prior to the energisation of the circuit.

This is usually a High Voltage document/requirement and is not applicable for LV applications. However, some Electrical Contractors are using this document for LV and other applications. Where this is the case the Project Appointed EE must review the Contractor's ESSoW and establish that it is appropriate to use under the particular circumstances.

### 6.4.4 - Permits issued at the Point of Work

All types of permits must be issued at the Point of Work and not from the APs Office or desk. This is so that the AP clearly communicates the hazards to the operatives, and the do's and do not's within the area in question and that all operatives fully understand the potential hazards and associated limitations.

Additional APs may be required to check that the system is being operated correctly.

For PTWs they must also prove or demonstrate that the circuit to be worked on is 'dead' and show the Operative the Point(s) of Isolation and where Caution and Danger signage is placed.

The issue of any form of electrical permit via a photo of the permit sent to WhatsApp, text message or any other electronic form shall not be accepted. Once the AP has completed their briefing at the Point of Work, they shall issue a signed and accepted paper copy of the permit to the Person in Charge (PiC), or other Competent Person responsible for completing the works.

It is the PiC's responsibility to fully brief their working party at the Point of Work referring to the task specific RAMS and to the relevant electrical permit. An electronic issue of a photo of the permit is not accepted. Where this has been discovered, the working party will be immediately stood down, and the working party briefed on the contents of the electrical permit.

### 6.4.5 - Clearly defined description of works and limitations

Both electrical permit types must have clear written descriptions which outline what works are to be undertaken under the permit.

The SAP/AP must then confirm that the key safety information, and agreed limitations and/or restrictions are clearly defined and detailed on the permit.

When the permit is issued at the Point of Work the SAP/AP can then reinforce these limitations and restrictions when issuing the permits.

### 6.4.6 - Task Specific ESSoW

Commonly a non-electrical Contractor applying for a Limitation of Access permit will issue their Task Specific SSoW for the works that they are undertaking on a construction site. These will not contain a Risk Assessment for the voltages and electrical equipment their operatives will be working under a LoA permit.

The Electrical Contractor's SAP/APs must identify the hazards and control measures in these areas and confirm

that the Non-electrical Contractors management produce a Task Specific Risk Assessment for these areas.

This ESSoW must be clearly communicated by the Non-electrical Contractors management to their operatives prior to them undertaking any works in these areas, and a copy of this Risk Assessment is to be presented to and signed off by the operatives at the time of them applying for the permit.

### 6.4.7 - Complex Isolations to have Accompanying Safety Programme derived from Isolation and Earthing Diagram.

A complex isolation is an isolation from at least two potential electrical supplies that will require at least two points of isolation. To undertake these works safely and correctly, the SAP/AP will need to complete a Safety Programme that has been derived from an Isolation and Earthing Diagram.

This is to confirm all potential electrical supplies are identified and isolated and that the associated caution and danger signs are placed in the correct location.

This needs to be completed by the SAP/AP prior to this isolation taking place, and not written out ad hoc whilst the isolation is taking place.

These Safety Programmes should be checked, approved and counter signed by a second SAP/AP. They shall also be taken out and used by the AP when undertaking the switching activities. The switching activities shall not be completed from memory.

Where a mistake on the Safety Programme is observed during the switching activities, the AP shall return the installation to a safe status, stand down the planned works, and then re-write the Safety Programme for review and acceptance by another SAP/AP.

# 6. Electrical safety rules

## 6.4.8 - Cancellation of Permits

All types of permit are to be cancelled by the SAP/AP at the Point of Work once they are satisfied that the works have been completed, where applicable re-tested and, in the case of the LoA permit, the area has been offered back in a satisfactory condition.

All Contractors are to keep an up to date list of all permit types on site for inspection by Mace

With regard to the PTW, the circuit that has been isolated can only be re-energised once the permit has been cancelled by the SAP/AP.

## 6.4.9 - Correct placement of Caution/Danger signage and correct type of Safety Lock

There are two types of signage that is applied to single point and complex isolations, these need to be correctly placed at the Point of Work. The following definitions apply:

**Caution Sign** – A durable, approved notice warning against interference with a point of isolation, wording CAUTION Persons Working on Equipment Do Not Switch On/Operate, manufactured from a robust material.

**Danger Signs** – A durable, approved notice warning of the inherent danger of the system, wording DANGER Live Electrical Equipment Do Not Touch. These danger signs are additional warning notices placed on adjacent live enclosures adjacent to the Point of Work, manufactured from a robust material.

**Safety Locks** – a unique lock, indelibly coloured red, with one key only for each lock, used to secure a Point of Isolation. These are to have a unique reference number, preferably engraved on the lock – see following photo of model lock.

Safety key box / key cabinet – refer to section 6.5.5, Locks and Keys.



Figure 6: Example of safety lock



Figure 7: Example of accepted signage



Figure 8: Example of accepted signage



Figure 9: Example of accepted signage



Figure 10: Example of accepted signage



Figure 11: Example of accepted signage

**Note:** these Caution Signs will be accepted on Mace projects until 31st December 2023

## 6. Electrical safety rules

### 6.4.10 - Double safety lock application for Permit to Work isolations

In order to prevent any accidental re-energisation following an isolation completed under the Permit to Work process, the following control measure shall be implemented:

- The AP completing the isolation shall apply a 'multi-hasps' LOTO attachment to the Point of Isolation (see figure 12).
- They shall then apply their Safety Lock and Caution Sign.
- The person completing the works OR Person in Charge of the works shall then apply their own Safety Lock and Caution Sign.
- Each party shall retain the key to their respective Safety Lock.
- Once this has taken place the AP can continue to prove or confirm dead as applicable.
- This 'double locking' arrangement must be noted on the Permit by the AP.
- All trade Contractors must complete a Toolbox Talk (TBT) on the requirement of the Double Locking procedure and retain the TBT script and signed attendance register on site for audit by the Mace electrical team.



Figure 12: Multi hasp LOTO attachment

- Prior to re-energisation both parties shall need to be in agreement that the circuit is safe to re-energise and then they shall each remove their own Safety Locks and Caution Signs, allowing the AP to re-energise accordingly.

#### Notes:

If the person completing the works or Person in Charge of the works does not have their own Safety Lock and Caution Sign, **the AP must** make one available to them so that the double-locking can be applied.

#### Where:

- the Point of Isolation does not allow for a multi hasp to be applied OR
- the two points of isolation prevent a lockable access cover,

Then the next upstream/preceding isolation point in the circuit shall be isolated, double-locked and Caution Signs applied.

For example: on a consumer's unit if a double-lock applied prevents the lockable cover from being closed then the unit's Main Switch shall be isolated, double-locked and Caution Signs applied.

Where it is not practicable to apply a multi-hasps to allow Double-Locking and only one Safety Lock and Caution Sign can be applied, an accepted measure for 'Double-Locking' is the use of Lock Boxes – see figure 13 and 14.

In this situation there is one Safety Lock and Caution Sign to the Point of Isolation, and the key for the Safety Lock is placed in the Lock Box.

For the type 1 Lock Box (figure 13), the AP would retain one key to the Lock Box and person completing the works OR Person in Charge (PinC) would retain the second.

For the type 2 Lock Box (figure 14), the AP and person completing the works OR PinC would apply their own Safety Locks and retain their own keys.

Please note, whilst this is an accepted procedure, Double-Locking the Point of Isolation is still the preferred method.



Figure 13: Type 1 Lock Box



Figure 14: Type 2 Lock Box

## 6. Electrical safety rules

### 6.4.11 - Basic/Self Isolation

Where an Electrical Trade Contractor's ESSoW allows their Competent Person(s) can carry out a basic isolation to allow a circuit to be isolated so the circuit can be worked on, this will be allowed with the following provisos:

- This is allowed for occasional, local isolations only and shall not replace the Permit to Work system as defined earlier in this document.
- The Trade Contractor must have a clearly defined and agreed Safe Isolation procedure for these works and include this in their Project Specific Electrical Safety Plan. This must also include a Project Specific Risk Assessment for this type of isolation
- There must be evidence of a briefing and training by the Trade Contractor's AE/SAP/AP to the Competent Person(s) who will be carrying out these isolations.
- The isolation(s) carried out by the Competent Person shall be for the works that they will be carrying out. They shall not perform an isolation for another person.
- They shall have the appropriate LOTO equipment and voltage tester / proving unit as defined earlier in this document.
- There must be an up to date Basic Isolation schedule detailing all basic Isolations carried out on the project and maintained by the Contractor.
- There must be a photographic record/evidence of every Basic Isolation undertaken for Mace Inspection.
- All isolations shall be logged, recorded and records made available for inspection and audit by Mace Electrical Engineers and Assessors.

### 6.4.12 - Record Keeping

A copy of each issued, completed and signed off permit must be retained on site for the duration of the project.

These must be sequentially numbered and logically filed in the AP's Office/space on site and have a corresponding schedule for inspection and audit by Mace management.

Where paper copies of the permits are used by the Contractor all permit types shall come with a unique serial number and on and be of the type that a carbon copy can be made when writing out the permit.

**Printed copies where the Contractor inserts their own serial number are not permitted.**

### 6.5 Specific requirements to be provided by electrical contractors

Production and submission of the Contractor's core Electrical Rules and Procedures document (ESSoW).

All Mace Electrical Contractors that carry out electrical installation works on Mace projects are to submit their core Electrical Rules and Procedures and associated ESSoW to the Mace Chief Electrical Engineer's Office for review, comment and acceptance prior to any electrical works commencing on any Mace project.

The CEE's Office shall confirm acceptance of the Electrical Contractor's ESSoW via a Standing Instruction letter.

This must include, as a minimum:

- Details of the Mace Supply Chain Contractors Roles and Responsibilities for all electrical operatives and required training and competencies of the following:
  - Authorising Engineer (AE)
  - NICEIC Qualifying Manager (QM)
  - Electrical Project Director (PD)
  - Electrical Project Managers
  - Senior Authorised Person (SAP)
  - Authorised Person (AP)
  - Electrical Test Engineers
  - Electrical Site Supervisors
- Management of the following for all voltage bands:
  - energisation and isolation procedures
  - inspection and testing procedures
  - permit procedures
  - record keeping
- auditing procedure
- ESSoW for all works undertaken by the contractor in support of their core business.
- Any exclusion zones, areas enforced by the contractor.

Once submitted the Electrical Contractor will then be required to present their Rules and Procedures to the Mace CEE's Office before final acceptance is confirmed.

## 6. Electrical safety rules

### 6.5.1 Production and submission of the Contractor's Electrical Safety Plan

All Contractors that carry out electrical installation works on Mace projects shall submit their Project Specific Electrical Safety Plan to the Project Appointed Electrical Engineer preferably prior to any electrical works commencing on site, but this must be in place and accepted before any energisations can take place.

The Electrical Safety Plan is not to be confused with the Contractors core Electrical Safety Rules and Procedures Policy.

The Electrical Safety Plan shall be cross referenced as appropriate to the Contractors Project Specific ESSoW and shall include as a minimum:

- Details of the Mace Supply Chain Contractors Roles and Responsibilities for all electrical operatives and required training and competencies of the following:
  - Project Director
  - Project Manager
  - Company AE\* and / or NICEIC QM
  - Project's LV SAP\* (if applicable)
  - Project's HV SAP\* (if applicable)
  - Project's LV AP\*(s)
  - Project's HV SAP\* (if applicable)

Plus appointment letters of those indicated\*.

- Safe Isolation and LOTO procedure in the form of a process flow chart.
- Marked up plan drawings showing the areas the Electrical Contractor will take control of and limit access to via the use of an access permit.
- Details of their PTW and LoA procedures.
- Emergency procedures to include as a minimum
  - Emergency access procedure to the Contractors permit controlled areas.
  - Emergency isolation points within these areas.
  - Emergency contact details of the Contractor's managers, SAPs, APs etc.
  - Additional training / briefings required to Mace personnel for the above procedure.
- Energisation strategy including proposed dates.
- Electrical Inspection and Test Plan, including their methodology Earth Fault Loop Impedance Testing (Calculation or Direct Measurement).
- Whether the Contractor Transfers Operational Control to their Electrical Sub Contractor.

Once the Contractor submits their Project Specific ESP, the projects EE, EA or TBSPM must complete the Contractors Electrical Safety Plan checklist to confirm all required information is in place before the contractor can commence their works.

It is essential that the Electrical Contractor's APs have sufficient resource to check that they effectively control the operation and energisations of the electrical systems on the project.

This document specifies the minimum expectations and standards for the Contractors SAPs, APs etc. on Mace projects.

For clarity, please see the following notes on the application of the Mace ESR+P for Contractors.

- Lift Contractors – electrical operations are not exempt from the Mace ESR+P's and they must comply with the requirements of this document and be issued with a Transfer of Operational Control letter as defined in Section 7. Where there is a Lift Motor Room on the project, access into this space is to be controlled via the Lift Contractor's permit system and this arrangement should be clearly detailed in the Transfer of Operational Control Letter.
- Crane, Hoist and Slip/Jump Form Contractors – where their Electrical Contractor extends a fixed installation from a TBS connection point, all relevant items within the Mace ESR+P's are applicable. They are to submit their Project Specific ESP for approval, and they shall be subject to both Pre and Post Energisation audits.

**Note** - Due to the nature and limited extent of the works involved with each of the above Contractor's, they will not be required to keep an updated schematic in a lockable frame or require office space for their AP.

Where **any** of the above Contractors decline to submit their core ESSoW, and Project Specific ESP or fail to comply with the Mace ESR+P's then they are not to be issued with a Transfer of Control Letter, and they are not allowed to undertake any form of isolation or live testing works. All works must be carried out under a Permit to Work system with isolations undertaken and permits issued by the Electrical Contractor in control of the circuit supplying the installation, usually the Temporary Building Services Contractor.

## 6. Electrical safety rules

The respective contractor shall then be formally notified, in writing using the approved text in Appendix B, of this arrangement by the EE, EA, TBSPM. Evidence of this notification shall then be uploaded to the respective folder on the Central Electrical Control Log.

If a Contractor who is not in operational control of their installation is observed undertaking energisations, isolations or live testing, this shall be listed as a First Alert and the escalation process in section 9.4 put into force.

### 6.5.2 Office Space

The SAP / APs must be given adequate office space to operate, record and manage their energisation, testing, isolation and permit procedures as per their Electrical Safe Systems of Work (ESSoW).

The size of office space required will depend on the size of the project, but there must be sufficient wall and desk space to accommodate the project:

- All folders containing the Contractors
  - Project Specific ESSoW
  - Permits,
  - Permit and Key Schedules,
  - Electrical Safety Plan
  - Core Electrical Safety Rules and Procedures
- All HV and LV Schematics for the Project – minimum A1 size in lockable frames
- Safety lock and working lock key safes

- Up to date list of test instruments that have been used on the project and:

- In date calibration certificate for each item of test equipment – even if they have been removed from the project

- Evidence of between calibration checks

### 6.5.3 SAP / AP Appointment

Where there is minimum of two APs on the project one must be appointed as the Lead AP / SAP for the project.

There must also be a clearly defined, written Management Structure for the SAPs / APs

Each Contractor shall have their SAP and APs Project Specific Appointment letters available at their office / space for review by Mace managers.

### 6.5.4 Electrical Permits and other Safety Documents

The HV / LV electrical permit system and its requirements are set out in section 6.4 of the Mace Electrical Safety Rules and Procedures document.

Paper copies of the aforementioned schedules and permits shall be retained on site for inspection by Mace managers for the duration of the project.

All of the above schedules shall be updated as the permits are issued and for larger projects these shall be no longer than 48hours without being updated.

Electronic systems will be considered for use but they need to be submitted to the CEE's Office for prior approval.

### 6.5.5 Locks and Keys

Both safety and working locks are defined in the Mace Electrical Rules and Procedures document – Definitions and section 6.4.9. The keys for these locks are to be retained and locked in a key cabinet(s) where:

- There will be separate key safes for working and safety locks.
- The keys for these key cabinets will remain under the control of the SAP / APs
- The key cabinets shall not have a combination lock
- There is no set location for the safety and working lock key safe(s), but the Mace preference is the SAP / APs Office. They will be securely fixed to a wall in either the SAP / APs Office or a Switch-room where access to this room is controlled by the SAP / AP

They will have a corresponding key schedule.

All key schedules shall be updated progressively as the safety / working locks are applied / altered.

The Contractor shall switch to off and apply working locks to all outgoing ways on all switchgear, bus-bar tap-offs, etc., once installed in their permanent position on the project.

A corresponding and up to date working lock schedule shall be maintained by the Contractor and kept for inspection by Mace.

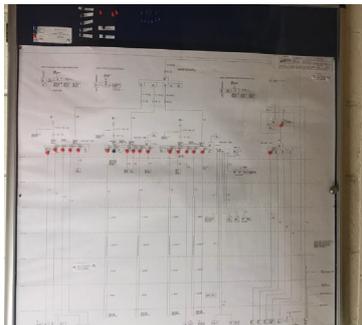
# 6. Electrical safety rules

## 6.5.6 Schematics

It is essential that the SAPs/APs maintain updated HV/LV Schematic(s) in their office that show:

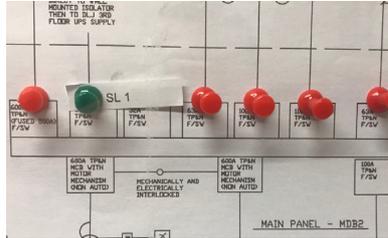
- The circuits that have been dead tested
- The circuits that are energised
- Any applied isolations, either under PTW or to prevent accidental energisations
- The safety lock numbers for these isolations.

The schematic must be enclosed in a lockable frame, preferably A1 in size, but for small projects and installations, this can be reduced to A3 on the proviso that the schematic is legible.



To indicate the status of the individual circuits the following pin colours shall be utilised.

- Red - Energised
- Green – Isolated
- Blue – Dead Tested



Where the project has multiple schematics that make the use of a lockable frame unworkable, and the control can be restricted to the Trade Contractor's Permit Office to SAP, APs only, the requirements for a lockable frame can be negated under the following provisos:

This is only applicable where there are over four schematics.

The Permit Office's access is strictly limited to the Trade Contractor's Authorising Engineer, SAP and APs only. All other operatives and managers will not be allowed into this area.

The schematics will not need to be in a lockable frame, however all other requirements of this section are to be adhered to.

The Trade Contractor must obtain written acceptance from the CEE's Office to allow the above exception to be made on their project.

For isolations carried out with an associated PTW the above schematics shall be updated directly after the permit is issued/cancelled. For all other activities the schematic shall go no longer than 48hours without being updated.

The Mace Project Appointed EE shall seek acceptance from the CEE's Office where their Electrical Contractor proposes to use a PC/BIM based solution for recording information on a schematic. The Contractor shall then present their solution to the CEE's Office for comment/acceptance.

## 6.6 Procedures prior to energisations on construction sites

Prior to any Contractor energising circuits, LV and above, the following items shall be carried out with written evidence that they have been completed:

- Presentation from the Electrical Contractor to the Mace project team and other Contractor 'Black Hat' supervisors covering:
  - The area(s)/circuits that are being energised – including marked up plan drawing(s).
  - A pre-energisation safety notice to be affixed prior to energisation, in particular identifying the proposed time and date of the energisation and contact details of the Contractor's AP.
  - The emergency procedures and contact details of SAP / APs
  - The areas the Electrical Contractor is controlling access to under a LoA process – including a marked up plan drawing(s).
  - An overview of their control measures including their PTW / LoA / Request for Power procedure
- A site wide Toolbox Talk (TBT) given by all Contractor's managers/supervisors to their respective workforce for 'Power On'
- A minimum of seven days prior to the energisation:
  - A Pre Energisation audit carried out with the report issued on Yellow Jacket and a copy saved to the Central Electrical Control Log.
  - Transfer of Operational Control issued to the respective Electrical Contractor.

## 6. Electrical safety rules

### 6.7 Live working

- Work must not be carried out on or near any live conductor (other than one suitably covered with insulating material so as to prevent danger). In extremely exceptional circumstances having established that it is absolutely necessary to work on any item of electrical equipment whilst it is energised, the Project Appointed Electrical Engineer will submit full justification to the CEE's Office for approval prior to any works being undertaken. The submission will be accompanied by a full set of RAMS and arc flash study/calculations supporting the category of flame retardant garments and PPE selected. Please refer to appendix A for further guidance.
- Live fault-finding is only permitted on live low voltage equipment provided all reasonable and practical attempts have first been carried out to find the fault with the equipment dead: that is the equipment has been isolated from all sources of energy.

**Please note:** Where specific activities are defined as Live Testing, these will only be carried out by a nominated Contractor under conditions detailed in their approved safety documentation and specific electrical safe system of work (ESSoW). A 'standing instruction' will be required to be issued by the CEE's Office to the contractor carrying out these works under their approved safe system of works.

### 6.8 Live working examples

For clarity the following are examples of live working:

- Removal of any cover or lid that exposes a live single insulated cable, for example the glanding chamber of a switch-panel, and removal of trunking lid(s)
- Removal of any accessory, or cover that exposes a live electrical terminal or live part(s) – note, this does not include for direct measurement for electrical testing
- Installation of any 'tap off' or similar device into a bus-bar or live system that is switched to on and therefore has the potential to draw an arc.
- Drilling into an enclosure that contains live electrical cabling / live parts.
- Removal of any cover or lid to allow a laptop or PC to be plugged into for commissioning purposes that exposes any live terminal, live part or single insulated cable for any electrical voltage that exceeds ELV.
- Live fault-finding is only permitted on live low voltage equipment provided all reasonable and practical attempts have first been carried out to find the fault with the equipment dead: that is the equipment has been isolated from all sources of energy.

**Please note** this is not an exhaustive list and where there are queries on a specific activity that is not covered this is to be referred to the CEE's Office for further guidance.

## 6. Electrical safety rules

### 6.9 Closed End Policy

Where cabling:

1. has previously been connected and energised (from either a temporary or permanent power supply or circuit) and then isolated but with the potential to become energised for the future connection of an accessory or luminaire,

or

2. is connected to any source of electrical supply that has the capacity to become energised, even if this supply is isolated and locked off.

or

3. has been temporarily connected together to allow an electrical dead test to be performed, including proving and tracing of circuits by 'tone-tracer' or similar devices,

it shall be suitably connected and enclosed in an enclosure providing at least the degree of protection of IP2X or IPXXB and shall have the appropriate voltage warning labelling affixed.

This is to ensure that all cabling is contained should the circuit inadvertently become energised as part of the test and inspection procedure, thus exposing live conductors.

For example where the ends of a ring final circuit have been joined together to allow an insulation resistance dead test after a Dry-liner has completed their first fix, then the cables shall be connected and enclosed as described above.

The corresponding test sheets shall clearly identify those circuits to which this 'Closed End Policy' has been applied.'



Figure 15: what good looks like - closed end policy

### 6.10 Mace process for access into live apartments and live spaces

#### 6.10.1 Access into live apartments

Various Business Units/Sectors within Mace are often appointed to deliver accommodation facilities ranging from single dwellings such as caretaker premises, student accommodation and apartments. Additionally there may be a requirement to access other live spaces for the purpose of implementing client change, fault finding, etc. Although the quality standards may vary and whatever the reason is for accessing live spaces, there is an absolute statutory obligation for Mace and its employees to ensure that a safe system of works is adopted at all times throughout the construction delivery process.

The CEE's Office has set out the mandatory Mace process for Access into Live Apartments. Whilst the process defines the minimum standard required for Mace to meet its statutory obligations, it is also designed to ensure standardisation of the construction delivery process for similar activities/projects across the Mace business.

This process can be found at the following hyperlink - [Mace Process for Access into Live Apartments.](#)

## 6. Electrical safety rules

### 6.10.2 Access into live spaces

Once the project is energised it is usual for the ceilings, walls, floor voids and similar spaces, to have live electrical services in all areas of Mace construction projects. These pose a serious safety challenge that requires robust control measures.

The CEE's Office has published the mandatory Access into Live Spaces document that sets the minimum standard required and the necessary control measures that are to be implemented across Mace projects where we have any live, and energised spaces. This includes but is not limited to:

- Floor voids
- Ceiling voids
- Drylined walls and ceilings.
- Risers
- Internal and external cable ducts or trenches.

[Mace Process for Access and Working in Live Spaces.](#)

### 6.11 Live testing and arc flash assessment

Live Testing is defined in Section 3, Definitions, of this document.

Please note, this does not include 'Commissioning' where a cover is to be removed and a laptop plugged into a data socket where live terminals are exposed for the duration of the commissioning activity. This example of 'Live Working' is included in section 6.8 of this document.

It is the Electrical Trade Contractor's responsibility to carry out a specific Risk Assessment to ascertain the control measures and degree of PPE their operatives will require in order to carry out their electrical testing works safely. The Mace ESR+P states the minimum acceptable standard required on a Mace project and should not be used as a definitive guide or an assessment of what is 'Live Working' or 'Live Testing'.

Where the Trade Contractor deems it necessary, under their ESSoW, to carry out an Arc Flash Protection Study to undertake their works safely, this should be communicated to Mace and included in their PPE assessment when they issue their Project Specific ESSoW for Mace acceptance.

Arc Flash Protection Studies are not necessarily confined to the Live Working examples as defined in section 6.8 of this document. Consideration should also be given to the following examples of hazardous operations that may need an Arc Flash Study to be undertaken:

- High Voltage Switching Operations.
- High Voltage proving dead for isolation purposes.
- Excavation of electrical cabling, e.g. hand digging.

- Switching and testing work to existing Low Voltage Switchgear where there is no evidence of regular maintenance.
- Connection and disconnection of batteries associated with Electrical Energy Storage Systems.

**Note** – the above list is not to be considered exhaustive.

## 6. Electrical safety rules

### 6.12 Interface with the Mace Excavation / Services Coordinator

Where a non-electrical contractor's scope of works is to either excavate or expose electrical services by any form of excavation or demolition activities, the Mace project appointed EE, EA or TBSPM, as applicable, shall be required to:

- Review and provide technical support to the Mace Excavation / Services Coordinator, with regard to existing services drawings and establishing any discrepancies with the available information.
- Review, comment and accept the Contractors proposed cable identification methodology/RAMS/ Safe System of Work (SSoW).

#### 6.12.1 Works on or around existing, buried cabling

Before commencing excavating or breaking ground where known live electrical services are located, a member of the Project Appointed Electrical team, in conjunction with Mace Utilities, shall contact the owner of the electrical cabling and formally request an isolation of these services in writing.

Where a request for this isolation is not accepted or acknowledged, the project shall then proceed with the excavation in accordance with the requirements of this section and the Mace Excavation and Breaking Ground Procedure.

Where there are excavation and breaking ground operations around any live electrical services the two metre exclusion zone rules apply. Where these are DNO/IDNO services, and there is written confirmation that these cannot be de-energised, then the contractor undertaking the excavation works must deploy an Accompanying Safety Person to oversee the excavation works and ensure their accepted SSoW are strictly adhered to.

### 6.13 Electrical isolations for demolition activities

To prevent any existing live electrical services from being struck during the demolition process, the following step-by-step process must be adopted:

- A thorough review of any as-built information, test results, etc. provided by the Client / the Client's FM team by the Mace team and the demolition / services contractors.
- An initial site survey by the demolition / services contractors to establish and agree if there are any boxings, ceilings, etc., that need to be removed to enable the services contractor to commence a thorough review and to undertake any necessary isolations.
- The demolition contractor to carefully remove boxings, ceiling tiles, etc., with the services contractor in attendance.
- The services contractor to start the isolations and:
  - spray all isolated services in green spray along their entire length to establish that they can be removed.
  - identify any live services that must remain, if applicable. These services shall be clearly labelled, and additional boxing built around them, if required.
- Any remaining live services drawings shall be briefed to all Black Hats for cascade and a plan drawing of these shall be included in the Mace Induction and put on the project bulletin board.
- Once the service isolations are complete, the services contractor shall mark up a drawing and issue an isolation certificate.

- They will then walk the areas with Mace and the demolition contractor's managers to identify the isolated areas and prove that the services are isolated.
- The isolation certificate and corresponding drawing shall then be handed to the demolition contractor to commence their works.

Where a service is not clearly marked or is discovered during demolition works, they must cease works in the area and seek confirmation by the services contractor that this is isolated and can be removed.

Where the above process cannot be adhered to, the project appointed EE, EA or TBSPM shall contact the CEE's Office prior to works commencing so that an alternate plan for isolation(s) can be determined.

### 6.14 – Christmas and other holiday shutdowns

Where a project is due to be shut down for Christmas or other holiday periods exceeding 4 days, the Project Appointed electrical team are to populate a concise list of emergency and out of hours contact details for the TBS, all PBS and Lift/Escalator contractors and upload this to the Project file in the Electrical Control Log.

# **Section 7**

## Notice of Transfer of Operational Control

## 7. Notice of transfer of operational control

Each Mace site shall transfer the operational control of the electrical system to the Contractor for the element of the electrical system that they are managing. This is to include each contractor for all Electrical Systems, e.g. lifts, escalators, BMS etc.

The EE, EA or TBSPM, as appropriate, must outline the electrical energisation and audit schedule for the project in the project Electrical Safety Plan and identify who has been appointed for the operational control of the electrical works, for all temporary and permanent power systems.

The energisation and audit schedule section of the Mace ESP must clearly identify the proposed energisation dates for the temporary and all elements of the permanent electrical installations, together with dates for the corresponding pre and post energisation audits.

Prior to energisation, a Notice of Transfer of Operational Control letter will be issued by the EE, EA or TBSPM, and signed by the Contractor with a date and time.

The transfer letter should be issued at least one week prior to energisation and have clearly defined electrical schematic and plan drawings showing the extent of the areas / systems that the Contractor is accepting control of. This letter, schematic and plan drawing is to be signed and dated by all relevant parties prior to energisation. The completed documents are to be bound as one PDF and uploaded to the Central Control Log.

No system is to remain energised without the respective Transfer of Operational Control letter being properly completed and in place.

The transfer letter should be unique to each Contractor and should not be a combined letter detailing numerous contractors.

If through the timeline of a project the Transfer of Operational Control changes, then the Electrical Engineer must, prior to any change, re-issue the Operational Control appointment and the revised Electrical Contractor must sign and accept responsibility and accountability.

Where a non-electrical Tier 1 Contractor is employing any Electrical Contractor as part of their works, for example a Ductwork company employing a Smoke Extract Installer, the transfer letter shall be issued to the Tier 1 Contractor. On receipt of the Mace TOC letter, it shall be incumbent upon the Tier 1 Contractor to immediately issue a corresponding Transfer of Operational Control letter to his Tier 2 Electrical Contractor(s).

### 7.1 Items of Temporary Generating Plant

The use of items of Generating Plant to provide lighting and/or small power shall be discouraged. This includes generators for site and accommodation as well as ad hoc generators supplied and applied on site to support local power and lighting.

Where the use of a generator cannot be avoided then the [Generator Checklist](#) shall be completed.

Once this has been satisfactorily completed and signed off by the TBSPM the generator shall be given a unique reference number for the project. This [Generator Checklist](#) includes details on the required spill kits, fuel and storage, bunds, earthing arrangement, lifting loads etc.

Where a Contractor is utilising the generator to supply a piece of fixed equipment or installation, they shall be issued with a Transfer of Operational Control letter prior to energisation.

Where a Contractor is utilising a generator to supply items of plant, or if it is a standalone lighting tower, they will not be required to be issued with a transfer letter.

The Contractor shall ensure that there is adequate and compliant electrical protection and that any additional earthing requirements are clearly detailed and recorded on the Generator Checklist, and that the transfer letter is in place before the Generator is put into service. All generators that are used on site shall be utilised, re-fuelled, stored and lifted in strict compliance with the Manufacturer's instructions and recommendations.

All completed [generator checklists](#) shall then form part of the project's Electrical Safety Plan and be stored as an Appendix in the online control log.

If the above is not adhered to then the generator(s) shall be isolated and removed from site until the [checklist](#) is completed.

Where any of the above Contractors decline to submit their core ESSoW, and Project Specific ESP or fail to comply with the Mace ESR+P's then they are not to be issued with a Transfer of Control Letter, and they are not allowed to undertake any form of isolation or live testing works. All works must be carried out under a Permit to Work system with isolations undertaken and permits issued by the Electrical Contractor in control of the circuit supplying the installation, usually the Temporary Building Services Contractor.

The respective contractor shall then be formally notified, in writing using the approved text in Appendix B, of this arrangement by the EE, EA, TBSPM. Evidence of this notification shall then be uploaded to the respective folder on the Central Electrical Control Log.

If a Contractor who is not in operational control of their installation is observed undertaking energisations, isolations or live testing, this shall be listed as a First Alert and the escalation process in section 9.4 put into force.

## 7. Notice of transfer of operational control

### 7.2 Operation of HV/LV Switch-gear

It is essential for the Contractors who have operational control of the HV and/or LV Switchgear that their operatives are fully briefed on the correct operation of the switchgear.

For newly installed switchgear this briefing is to be carried out by the switchgear manufacturers on site to the Contractors SAP, AP(s) and should include as a minimum:

- Operation of all switching or protective devices.
- Correct Point(s) of isolation.
- Interface with any SCADA, or other systems, that can remotely switch any component of the switchgear.
- Any maintenance that needs to be carried out.

Where a Contractor is taking operational control or management of existing switchgear, then the person(s) who were managing this switchgear shall arrange for the manufacturer to give the above briefing.

They shall also issue any/all Maintenance and Electrical Condition Reports / Inspection records for the above switchgear. If no records exist it is strongly recommended that the Project Appointed Electrical Engineer for the project instructs the Contractor taking operational control of the switchgear to undertake a full Electrical Condition Report and Dilapidation Study on the equipment prior to the equipment being handed over.

Upon completion of the briefings there is to be a written register of attendees, and the course briefing contents sheet that is to be retained by the Contractor.

### Cancellation or Withdrawal of Transfer of Operational Control letter

Failure to comply with the Mace Electrical Safety Rules and Procedures shall result in the respective Contractor's Transfer of Operational Control letter being withdrawn. The non-compliant electrical circuit(s) or system(s) controlled by the Contractor shall be immediately isolated, and the respective Contractor's team stood down until the corrective measures are agreed, with the EE and/or EA, and implemented accordingly.

### 7.3 Trade Contractor's issue of their own Transfer of Operational Control (ToC) letter

Where Trade Contractor's issue their own ToC letter to any of their Sub-Contractors this shall be discouraged, and only allowed in exceptional circumstances. Where they propose to Transfer Control to their Sub-Contractors, this will need the written approval from the CEE's Office, and the following will need to be provided by the respective Trade Contractor's AE:

- Why their sub-contractor cannot work to their ESSoW.
- The extent of their Sub-Contractors installation, inspection and testing etc. within their contract works.
- Confirmation that the AE has reviewed and approved the sub-contractors ESSoW.
- Confirmation that the AE has interviewed the proposed sub-contractor's key electrical appointments and their corresponding qualifications and is happy with these appointments.
- How the AE will audit and monitor performance of their Sub-Contractor against their ESSoW.

### 7.4 Handover of system to Client

Where any part of the electrical system, including energised spaces, risers, switch-rooms etc. has been handed over to the Client or their FM team, then the project's electrical team shall notify them in writing clearly defining what has been handed to them for their operational control. A copy of this shall be uploaded to the relevant folder on the Central Log.

The electrical team shall then update the Mace Project Specific ESP, and all relevant and affected ToC letters to the relevant contractors.

For the latest transfer of operational control letter template, click [here](#).

# Section 8

## Interface with Distribution Network Operations

## 8. Interface with distribution network operators

Client sites where Mace has responsibility for the operation and maintenance of the electrical network will be supplied by a Distribution Network Operator (DNO) at either low or high voltage.

On behalf of the client, Mace contractor's operational staff have access only to the client's equipment and have specified operational switching authorisations.

### 8.1 DNO/IDNO RAMS approval procedure and operatives works on site

MACE recognise that DNOs do not always cooperate with requests for risk assessments and method statements in advance of work being done and will not agree to Mace safe systems of work. However, IDNOs tend to be more cooperative and amenable to fitting in with Mace safe systems of work.

Where DNO/ IDNO works fall outside of the site boundary, Mace would not have liability under Health and Safety at Work Legislation or Regulations to the employees or self-employed contractors of other organisations outside of their own site that are not under its instruction or supervision and for which it has no control over the method of work or safe systems of work.

For DNO/IDNO works on or within the site boundary where individuals from other organisations are on a site on which Mace is undertaking any of the roles under CDM 2015 (or any other Health and Safety Regulations) then the responsibilities of Mace extends as far as appropriate to the role Mace is undertaking. In this situation we must review, comment and accept the DNO/ IDNO RAMS and their corresponding Safe Systems of Work. In this respect, it is essential that Mace formally record their concerns in writing to the DNO/ IDNO.

In situations where meter installers are attending site it will be essential to provide the induction and assess the risks of them having access to the site for this work. If they do not have appropriate accreditation such as CSCS, or if they do have this but particular hazards on the site give rise to concern for their safety then it may be that man marking is necessary.

Should the DNO/IDNO or any contractor operating on their behalf be observed undertaking any unsafe work methods then preventative action should be taken immediately and then formally reported back to the DNO/ IDNO, as appropriate, in writing.

All visitors to site, relative to these works, must receive an induction and this is a strict requirement. No individuals should be allowed on site unless they have had an induction and this is recorded.

## 8. Interface with distribution network operators

### 8.2 Handover of space to the DNO/IDNO procedure

Prior to the construction of a space for the DNO/IDNO for them to occupy, install their equipment and take ownership there must be a schedule of specific requirements from the DNO/IDNO.

When handing over an area on the project for the DNO/IDNO there needs to be a joint inspection of the space with the Project Appointed Electrical Engineer and the DNO/IDNO's SAP/AP. Once this has been satisfactorily carried out there needs to be written acceptance by the DNO/IDNO's SAP/AP that they have formally accepted the space.

The inspection process should typically include, but not necessarily be limited to the following items as a minimum:

1. The built form, weather-tight, door construction, door security.
2. Incoming ducts.
3. Earthing provision (where applicable).
4. Ancillary services, lighting, small power, supplies for tripping batteries etc.
5. Cleanliness, and absence of water.
6. Safe access and egress provision to the space.
7. Availability of 24 hour 365 day unimpeded access to the space.

Where a barrier or enclosure is erected around HV Switchgear and / or Transformer the requirements in this regard are given in The Electricity Safety, Quality and Continuity Regulations 2002, part 3, section 11(b) which states:

(b) enclose any part of the substation, which is open to the air and contains live equipment which is not encased, with a fence or wall not less than 2.4 metres in height to prevent, so far as is reasonably practicable, danger or unauthorised access;

Signage shall also be in accordance with the ESQCR, section 11 (c) and Schedule 1

**Note:** where the site is not in a position to accept a live service then Mace should arrange for the DNO/IDNO to isolate the service until the site is in a position to accept the energisation.

### 8.3 Following energisation

All work involving working across the interface boundary must be planned in advance and subject to a formal procedure for operation, isolation and earthing. The DNO is responsible for issuing an Isolation and Earthing Certificate in accordance with their rules with the Mace contractor responsible for operational control of electrical systems switching on the client's equipment.

No Mace personnel may operate or instruct operations on the DNO equipment owned by the DNO's at any interface substation. In emergency conditions, to remove danger and preserve life, an emergency power off button may be used to disconnect DNO's supplies.

Any work or fault conditions involving the incoming supplies at any site must be notified to the relevant DNO control centre by a Mace manager. All operational activities on the remainder of the distribution system within the site are the responsibility of Mace staff.

# Section 9

## Emergency Situations

## 9. Emergency situations

As part of the Project Delivery Plan (PDP), each project is required to develop an Emergency Management Plan.

This shall be contained in the Contractors Project Specific Electrical Safety Plan and shall include a written, emergency procedure that shall, as a minimum, cover the following items:

- Emergency access procedure to the Contractors Permit Controlled Areas
- Emergency isolation points within these areas.
- Emergency contact details of the Contractor's managers, SAPs, APs etc.
- Additional training/briefings required to Mace personnel for the above procedure.
- Briefing scripts and attendance registers shall be retained by the respective contractor for audit purposes by the Mace electrical team.

### 9.1 Treatment for electric shock

All Mace Electrical Engineers and Electrical Assessors assessing risk on high and low voltage systems will be trained in, and conversant with, resuscitation and emergency first aid.

This training will be refreshed every three years.

Contractors will supply the equivalent training for their staff and provide the necessary certification. Qualifications must be provided for all individuals whom the Electrical Contractor has authorised to carry out or operate any electrical equipment on Mace projects.

### 9.2 Electrical incident – first response

- Remove electricity supply with haste. Emergency operation of all switchgear is permitted, as long as it is safe to do so.
- Casualties may be removed from contact with live low voltage systems using insulated material.
- Nobody should approach a person in contact with high voltage systems.
- Once the system has been made dead, isolated and earthed, tests with approved instruments will be used before contact is made.
- Inform the Electrical Engineer as soon as reasonably practicable and as soon as the emergency situation allows.
- The normal rules of First Aid will apply.
- Where the person who receives the shock is conscious and seems well, the First Aider must continue to monitor their condition, as the effects of an electric shock may not be immediately obvious. It is strongly recommended that the person that has received the electric shock seeks hospital treatment and medical advice as soon as practicable following the incident

### 9.3 Post incident – restoration of supplies

- Restoration of supplies will follow the ending of the declared emergency situation but only after written approval from the Project appointed EE (or by the CEE's Office for a more serious emergency situation) and shall be by the Contractor's Authorised Person.

- The exact identity of any damaged apparatus must be established, by the AP, SAP or AE, in order that a programme of switching can be prepared such that it is not re-energised.
- The incident needs to be reported according to the Mace [Incident Reporting and Investigation procedure](#)

### 9.4 Electrical First Alerts

Within seven days of any electrical incident, a meeting shall be convened at 155 Moorgate for the defaulting contractor(s) Managing Director(s) and HSW Lead(s) to present their findings and confirm their improvement plan for use on Mace projects.

The following Mace Leadership team shall also be in attendance

- At least one Group Board Director.
- Representative(s) from the CEE's Office
- HSW Construction Lead
- Respective Business Unit Managing Director
- Respective Business Unit HSW Lead

### 9.5 Electrical switchrooms

The Electrical Contractor will provide the following in each switchroom immediately prior to first energisation and maintained thereafter or adjacent to electrical equipment whilst it is being worked on;

- Electrical Shock Poster.
- Emergency Contact Details.
- Method of isolating supply.
- Suitable fire protection.

# Appendices

# Appendix A Guidance note on arc flash protection

An arc flash, is usually caused by inadvertent contact between an energised conductor such as a bus bar or wire with another conductor or an earthed surface. When this occurs, the resulting short circuit current can melt the conductors and produce strong magnetic fields that blow the conducting objects apart. The resultant fault current ionises the air and creates a conducting plasma fireball with arc temperatures that can reach upwards of 35,000 degrees Fahrenheit. Severe injury and even death can not only occur to persons working on the electrical equipment but also to people located nearby.

Arc flash injury can include external burns to the skin, internal burns from inhaling hot gasses and vaporised metal, hearing damage, eye damage and blindness from the ultraviolet light of the flash as well as many other devastating injuries. Depending on the severity of the arc flash, an explosive force known as an arc blast may also occur which can result in a pressure of hundreds and even thousands of pounds of force, launching debris as shrapnel at hundreds of miles per hour.

The severity of the thermal effect of an arc flash is defined as incident energy and is measured in terms of calories/centimetre<sup>2</sup> (cal/cm<sup>2</sup>) that a victim could receive to the skin surface. An arc flash can range from nothing more than minor uneventful sparks to a massive and deadly electrical explosion.

## Protection from arc flash

As a frame of reference for incident energy, an exposure of 1.2 cal/cm<sup>2</sup> can produce the onset of second degree burn to the skin. This value is used by many standards as the benchmark that defines adequate protection against the thermal effects of arc flash. Limiting the incident energy exposure at the skin surface to no more than 1.2 cal/cm<sup>2</sup> means you can still receive some burn injury, however the primary objective of arc flash protection is to minimise the injury and probability of death.

In general, if the prospective incident energy exposure at a given location is below 1.2 cal/cm<sup>2</sup>, no additional thermal protection is required for the worker. However, if the incident energy exceeds this value, protection against the thermal effects may become necessary but it must be emphasised that PPE does not prevent the accident happening in the first place.

Personal Protective Equipment (PPE) used for arc flash protection includes garments made from Flame Retardant (FR) fabric. This fabric is designed to provide a thermal barrier and limit the incident energy exposure at the skin surface to no greater than 1.2 cal/cm<sup>2</sup>. Although FR fabric will burn when exposed to a flame, it is designed to stop burning when the flame is removed. It also must not break or burn open and expose the skin directly to the flame.

FR clothing is rated based on its Arc Thermal Performance Value (ATPV) in cal/cm<sup>2</sup>. To properly protect a worker, the ATPV rating of the FR clothing must exceed the prospective incident energy available at a given location.

Depending on the prospective short circuit current available at a switchgear a defined hazard is present to maintenance and operating personnel due to the possibility of a high-intensity electric arc. Maximum temperature of an arc can exceed 10,000 kelvin, and the radiant heat, expanding hot air, and explosive vaporization of metal and insulation material can cause severe injury and death to unprotected workers.

To try and avoid injury by high temperature arc flash discharge Mace and their specialist contractors will be required to carry out and submit to the CEE's office for approval prior to the commencement of any live working, an Arc Flash Study on the installed equipment and select the appropriate PPE to meet the Arc Flash Study requirements. It is recommended the highest level of PPE is used

**NOTE :** any Arc > 40 Cals cm/2 cannot be protected against and

therefore equipment giving this level of reading should not be energised at all. Please see section 6.9 for Arc Flash Assessment for Live testing.

**Category 1:** FR Garments and PPE Required: Safety glasses, hard hat, FR shirt and pants (or FR coveralls), leather protective gloves, and leather shoes  
Calories per cm<sup>2</sup>: 5

Minimum ATPV: 4

**Category 2:** FR Garments and PPE Required: Safety glasses or goggles, hearing protection, hard hat, cotton underwear, FR shirt and pants (or FR coveralls), arc rated face shield (or arc flash hood), leather gloves, and leather shoes  
Calories per cm<sup>2</sup>: 8

Minimum ATPV: 8 \* Please note that a variation on this level, Category 2\*, has the same PPE requirements, with the exception that an arc flash hood must be worn at all times, with no option to use a face shield instead.

**Category 3:** FR Garments and PPE Required: Safety glasses or goggles, hearing protection, hard hat, cotton underwear, FR shirt and pants, FR coveralls (in addition to FR shirt and pants), arc flash hood, leather gloves, and leather shoes. Calories per cm<sup>2</sup>: 25

Minimum ATPV: 25

**Category 4:** FR Garments and PPE Required: Safety glasses or goggles, hearing protection, hard hat, cotton underwear, FR shirt and pants, FR coveralls (in addition to FR shirt and pants), full flash suit with hood, leather gloves, and leather shoes.

Calories per cm<sup>2</sup>: 40

Minimum ATPV: 40

Further guidance can be found in the following documentation:

- HSE guidance note HSG85 - Electricity at Work, Safe Working Practices
- HSE guidance note HR25 - Guidance on the EAWR 1989.
- Mace Technical Bulletin EL16-TN- Arc Flash Assessment.

# Appendix B Notice to trade Contractors who decline to sign a transfer of Operational Control

Draft of letter to trade contractors who are responsible for the energisation, operation, maintenance and/or fault-finding associated with fixed plant and equipment, and who fail to sign a ToC letter/agreement.

Ref: Project Name and Number

Date:

Dear:

Re: Declining to sign a ToC letter/agreement.

..... are responsible for the energisation, operation, maintenance and/or fault-finding associated with the ..... fixed plant and equipment installation on the above project.

..... having declined to sign a Transfer of Operational Control (ToC) letter in accordance with section 6.5.1 and Section 7 of the Mace Electrical Safety Rules & Procedures (ESR&P's) will, at all times, formally engage with the project's Permanent/Temporary (delete as appropriate) Building Services Contractor (PBS/TBS) (delete as appropriate) ..... to formally request an energisation or isolation of the electrical supply for the purposes of safe operation, maintenance and/or fault-finding of said fixed plant and equipment.

In this respect, ..... will, at all times, comply with the requirements of the PBS/TBS (delete as appropriate) Contractor, particularly those associated with the PBS/TBS (delete as appropriate) Contractor's ESR&P's / Electrical Safe Systems of Work (ESSoW).

**Note:** in all instances ..... will be required to provide a Task Specific Risk Assessment and Method Statement for review and acceptance by Mace and the PBS/TBS (delete as appropriate) Contractor at the time of requesting an energisation or isolation and prior to operation or any maintenance and/or fault-finding works proceeding.

Yours sincerely

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