

# National Wiring Rules for Installations over 1 kV ac - Launch of Consultation

19.01.12



# Introduction

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Chairman, ETCl



# Agenda

Background

CENELEC and IEC

ETCI

The Wiring Rules

Implications

The Consultation



# CENELEC and IEC



Founded 1906

*"a representative Commission to consider the question of the standardization of the nomenclature and ratings of electrical apparatus and machinery."*



- Founded 1973
- Associated with EU
- 18 countries
- harmonise standards
- Remove trade barriers



# NSAI and ETCI



Irish member of:

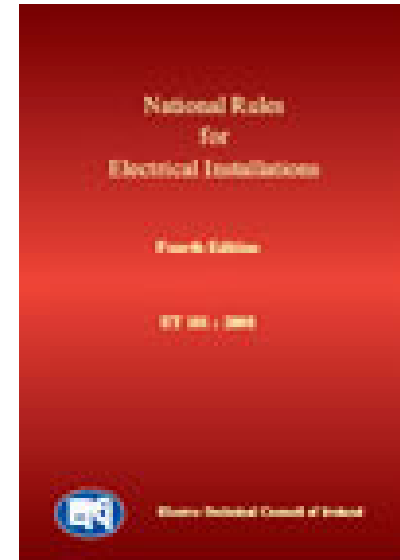
- IEC
- CENELEC



- Electrotechnical committee for Ireland
- 23 Member Organisations
- 18 Technical Committees
- 200 volunteers



# ETCI Publications





- 17 Technical Committees
- 200 Members
- Voluntary Work

### Technical Committees

- |  |   |
|--|---|
| 1 Household Appliances                 | 13 Alarm Systems                                      |
| 2 Electrical Installations             | 14 Electric Cables                                    |
| 3 Power Installations Exceeding 1 kV   | 15 Electromagnetic Fields                             |
| 4 Switchgear                           | 16 Electromagnetic Compatibility                      |
| 5 Elec. Safety and Statistics          | 17 Automatic and Programmable Systems                 |
| 6 Potentially Explosive Atmospheres    | 18 Marine Energy                                      |
| 10 Elec. Equipment in Medical Practice | 19 Insulators and Surge Arrestors                     |
| 11 Audio/Vide., IT and Comm. Tech.     | 20 Smart Grids, Renewables, EVs and Energy Efficiency |
| 12 Electronic Communication Systems    |   |



# TC3 Members

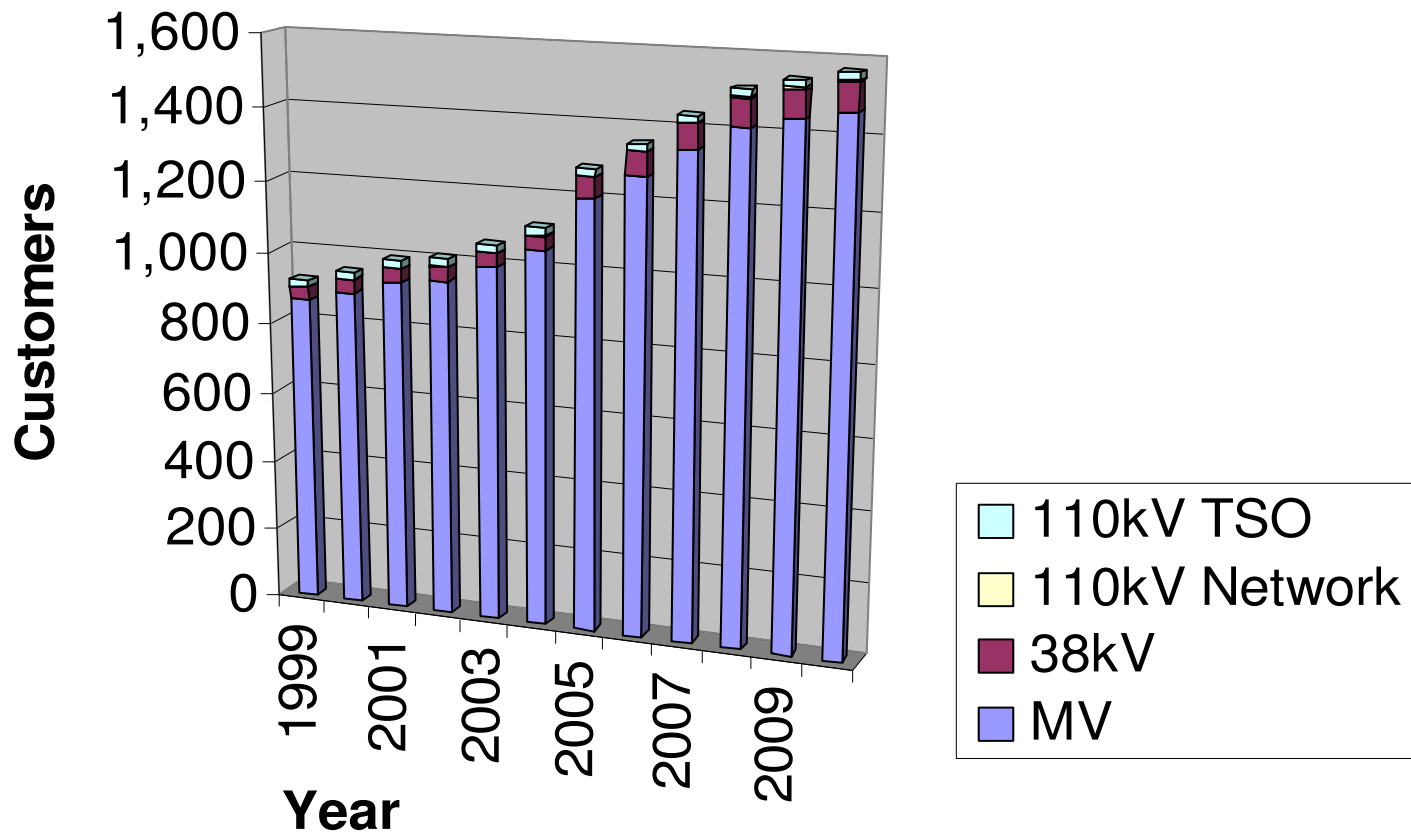
<b>Ian Cowan</b>	<b>NSAI</b>
<b>Dermot Hicks</b>	<b>Hivar Engineering Ltd.</b>
<b>Martin Keane</b>	<b>ABB</b>
<b>Patrick Lord</b>	<b>Lord Engineers</b>

<b>Iarla Moran</b>	<b>Mayo Co. Co.</b>
<b>Michael O'Hara</b>	<b>O'Hara Engineering</b>
<b>Pat Rathbourne</b>	<b>HVSM</b>
<b>Tim Moloney (sec.)</b>	<b>Alta Engineering</b>
<b>Cormac Madden (chair)</b>	<b>ESB</b>

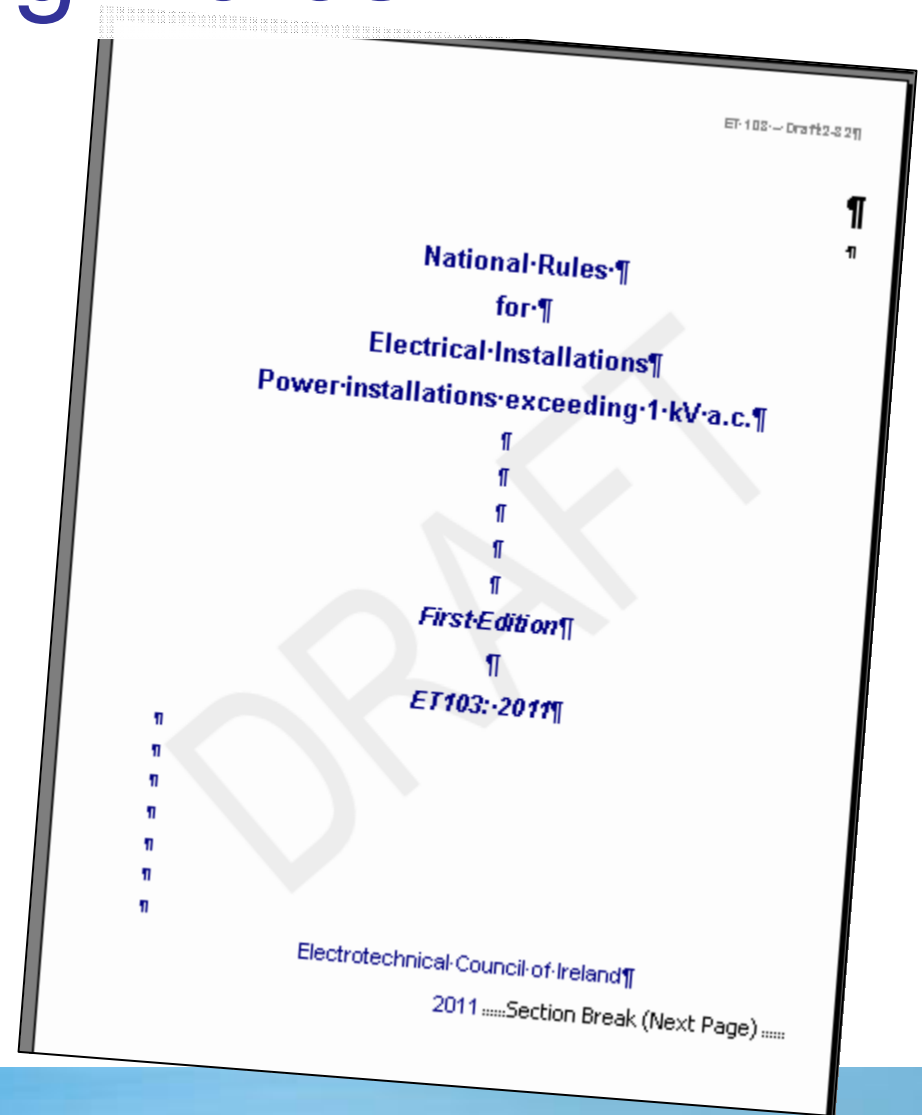


# Growth in MV and HV Installations

## MV and HV Customer Numbers



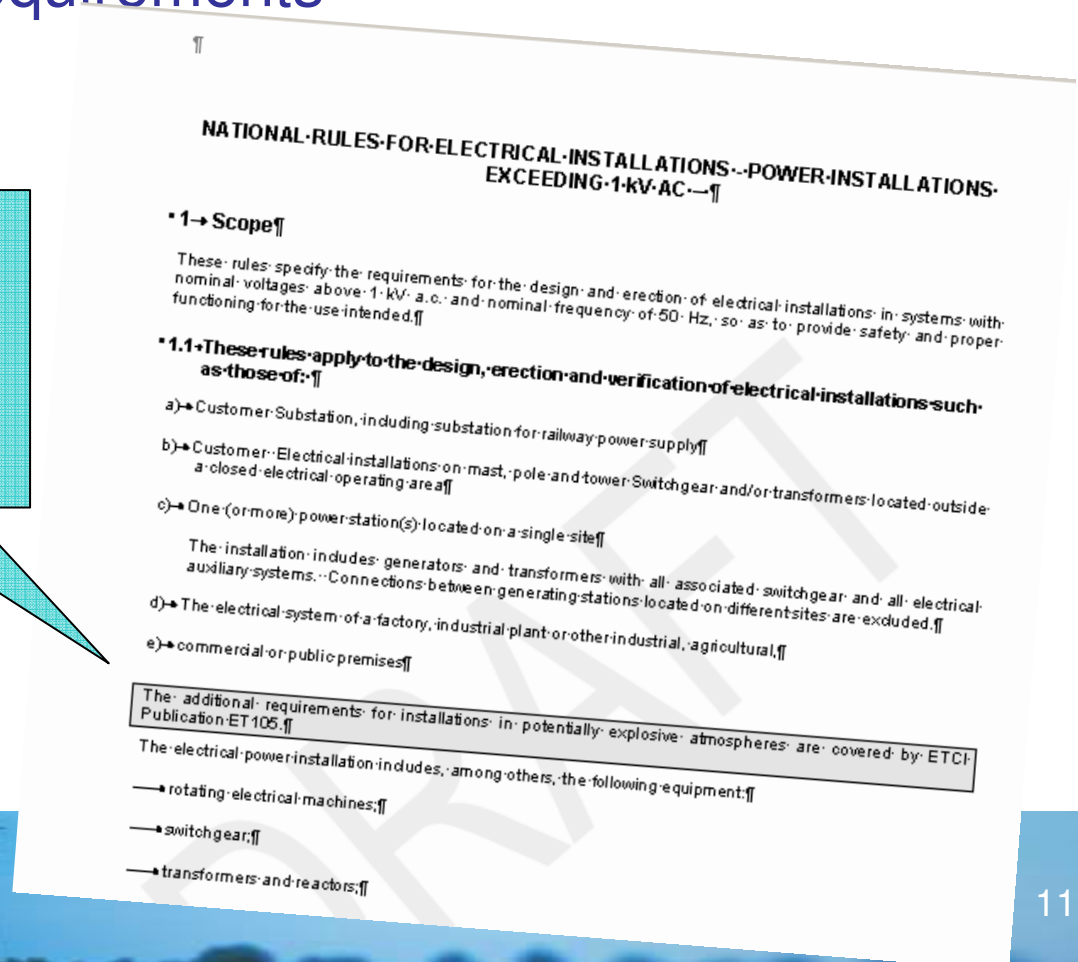
# The Wiring Rules



# Format of Wiring Rules

- Based on IEC Standard I.S. EN 61936-1
- Additional, national Requirements

National requirements are highlighted in shaded sections



## Overview of Rules

Scope

Normative References

Terms and Definitions

Fundamental Requirements

Insulation

Equipment

Installation

Safety Measures

Protection, Control and Auxiliary Systems

Earthing Systems

Inspection and Testing

Operation and Maintenance



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Terms and Definitions

## Preliminaries

Fundamental Requirements

Insulation

Equipment

Installation

Safety Measures

Protection, Control and Auxiliary Systems

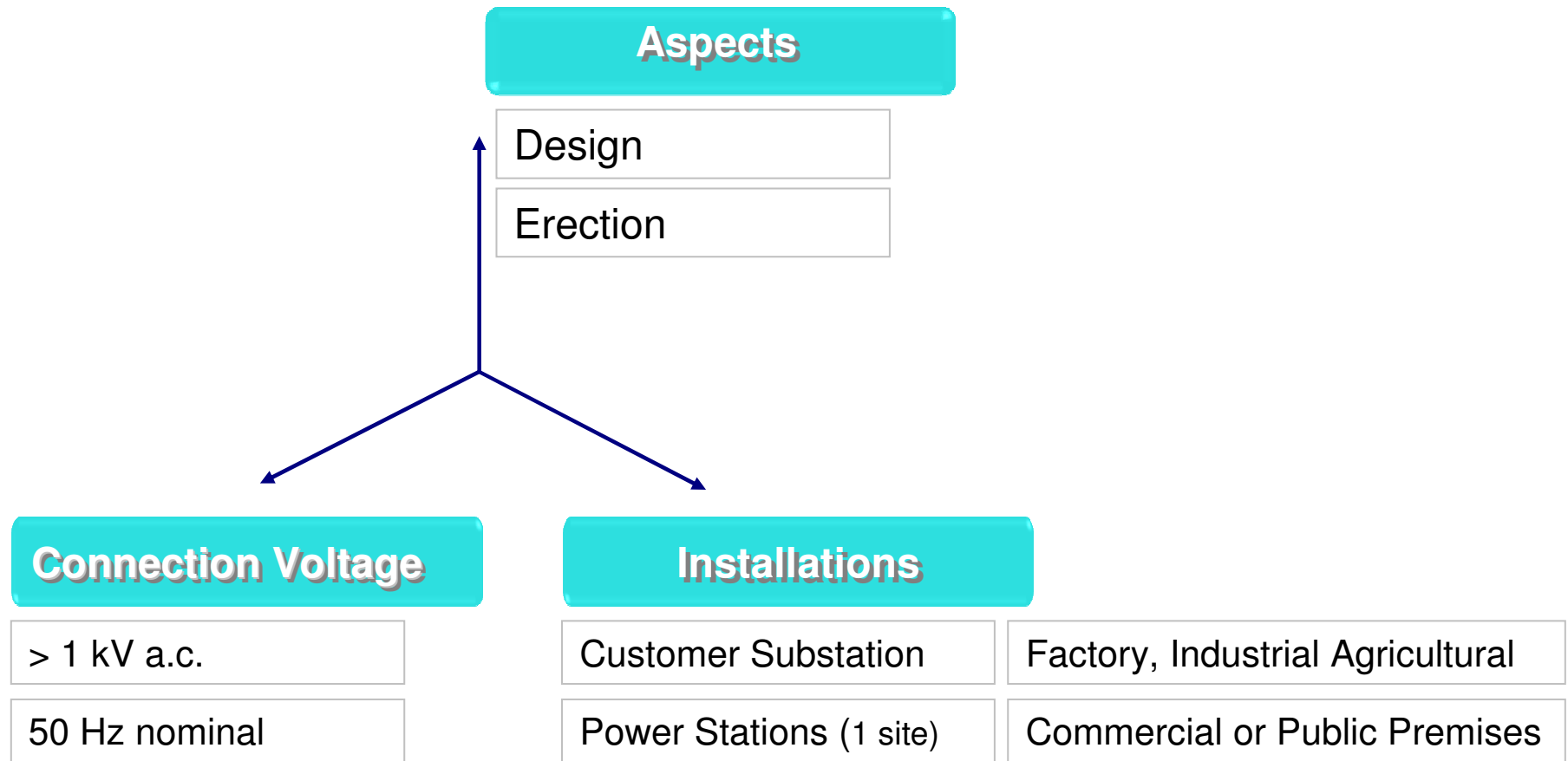
Earthing Systems

Inspection and Testing

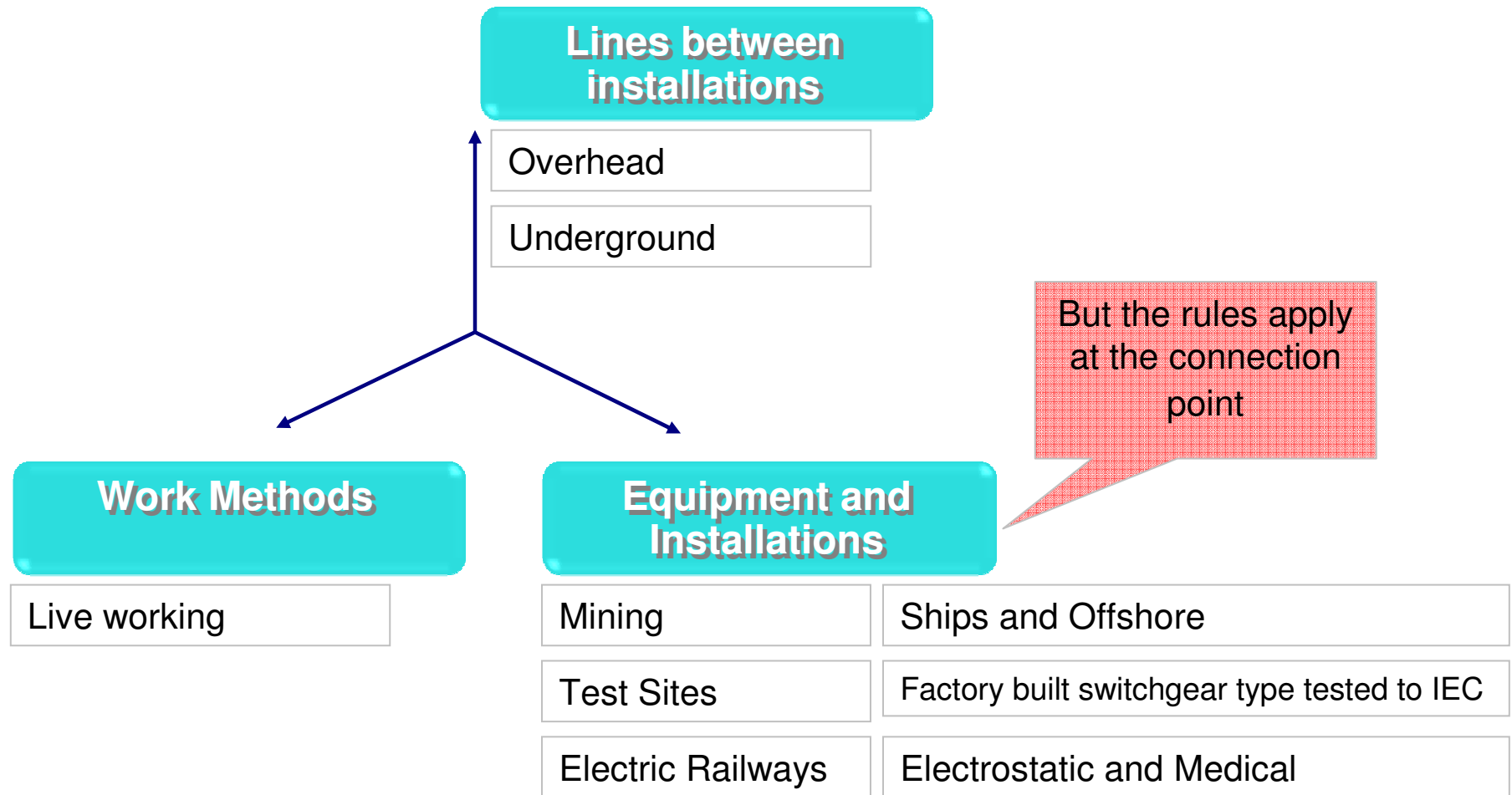
Operation and Maintenance



# Scope of Rules



# Excluded from Scope



## 2: Normative References

- A list of all the IEC standards referred to in the document
- E.g.
  - IEC 60909 determining short circuit currents
  - IEC 60617 sets out the symbols to be used on drawings and mimics.
- Incorrect use of symbols may result in a device being used to perform a duty for which it was not intended

# 3: Terms and Definitions

- List of definitions of terms used
- Important to avoid confusion in the construction and operation of High Voltage Installations



Scope

Normative References

Terms and Definitions

## **Design, Equipment and Installation**

Fundamental Requirements

Insulation

Equipment

Installation

Safety Measures

Protection, Control and Auxiliary Systems

Earthing Systems

Inspection and Testing

Operation and Maintenance



# 4: Fundamental Requirements

Design to take account of:

Purpose of Installation

User's Requirements

Safety of operators and public

Environment

Maintenance and Possibility of Extension

# 4: Fundamental Requirements

Voltage Class

Current Rating of Installation

Frequency

Corona

Overvoltages

Harmonics

Mechanical

Environmental

Special

Maximum operating voltages

Normal

Short Circuit

Note Distribution Code Requirements

Requirements for selection of equipment for Climatic and environmental conditions both indoor and outdoor are addressed in section 4.



# 5: Insulation

## Selecting Insulation Level

Highest voltage of installation

Impulse withstand voltage

Neutral earthing method

Environment

## Distribution Code Requirements

Basic insulation levels

Clearance distances for 10kV, 20kV and 38kV

Table 1 – Minimum clearances in air – Voltage range I ( $1 \text{ kV} < U_m \leq 245 \text{ kV}$ )

Voltage range	Highest voltage for installations	Rated short-duration power-frequency withstand voltage	Rated lightning impulse withstand voltage <sup>a</sup>	Minimum phase-to-earth <sup>f</sup> and phase-to-phase <sup>f</sup> clearance <sup>f</sup> $W_0$	
	$U_{ns}$ r.m.s.	$U_{ns}$ r.m.s.	$U_{imp}$ 1,2/50 $\mu$ s <sup>c</sup> (peak value) <sup>c</sup>	Indoor <sup>f</sup> installations <sup>a</sup>	Outdoor <sup>f</sup> installations <sup>a</sup>
	kV	kV	kV	mm	mm
3,6	10	20	40	60	120
			60	60	120
7,2	20	40	80	90	120
			120	120	150 <sup>d</sup>
12	28	56	80	90	150 <sup>d</sup>
			95	120 <sup>d</sup>	150 <sup>d</sup>
			145	160 <sup>d</sup>	160 <sup>d</sup>
17,5	38	76	95	120	160
			145	160	160
24	50	100	145	160 <sup>d</sup>	160 <sup>d</sup>
			170	220	220
			250	270	270
36	70	140	170	270	270
			250	320	320
52	95	190	320	480 <sup>f</sup>	480 <sup>f</sup>
72,5	140	280	480 <sup>f</sup>	630	630
123	185 <sup>b</sup>	370	550	900	900
			850	1-100	1-100
145	185 <sup>b</sup>	370	550	900	900
			850	1-100	1-100
			1250	1-500	1-500
170	230 <sup>b</sup>	460	850	1-100	1-100
			1250	1-300	1-300
			1750	1-500	1-500
245	275 <sup>b</sup>	550	1250	1-300	1-300
			1750	1-500	1-500
			2250	1-700	1-700
	305 <sup>b</sup>	610	2250	1-000	1-000

The Distribution Code requires 125 kV for all these in Ireland

180 mm in Ireland

220 mm in Ireland



# 5: Insulation

Change in the Distribution System: -  
Implications for existing installations

Moving to an unearthed 10 kV system

Earth fault protection

BIL of equipment

Overvoltages in event of arcing earth fault

Phase voltages

Insulation and clearances

Increase in prospective short circuit levels

In particular on the 10 kV system

Care in equipment selection

# 6:

# Equipment

- Selection for:
  - Safe construction
  - Safe operation
    - Environmental conditions
    - Normal operation
    - Reasonably expected conditions (overload, fault)
  - Protection of personnel during operation and maintenance
- Note installations such as Wind Farms:
  - Harsh environment
  - Remote, loss of supplies



# 6:

# Equipment

- Instrument transformers:
  - Protection class
  - Measurement class
  - Ratio
  - Safety Factor
  - Accuracy Limit Factor (ALF)
  - Burden
- Protection
  - Sensitive Earth Fault (SEF) protection:
    - Directional is recommended
  - Directional SEF:
    - monitoring of the secondary voltage of voltage transformers is crucial
    - loss of the residual voltage effectively disables the SEF
    - Loss of secondary voltage to directional SEF ideally should initiate other earth fault protection using parameter change over or similar.



# 6:

# Equipment

- Switchgear
  - Indication of position of primary contacts
    - Unambiguous
    - Clearly visible
  - Earth switch locking facilities at the point of connection to the Distribution System
  - Transformers and reactors
    - includes protection of the environment if loss of insulating fluid



# 6:

# Equipment

- Cables:
  - “Code of Practice for avoiding danger from Underground Services” from HSA
  - Installation of single core cables set out
  - Installation in unstable ground such as bog land
    - Ground movement may put pressure on cable terminations, bushings etc.



# 7: Installations

General

Outdoor installations – open design

Indoor installations – open design

Prefabricated type-tested switchgear

Requirements for buildings

Prefabricated substations

Installations on Mast, pole and tower



# 7:

# Installations

## General

Earth fault protection on each Installation

Locking of isolation equipment

Short circuit withstand

Circuit documentation : *each substation*

Transport routes

Lighting

Escape and rescue paths

Labelling



# 7: Installations

## Outdoor installations – open design

Clearances

Fences



# 7: Installations

## Indoor installations – open design

Clearances

Barriers

Escape routes



# 7: Installations

Prefabricated type-tested switchgear

Additional requirements for SF<sub>6</sub>



# 7: Installations

## Requirements for buildings

Ventilation

Battery rooms, emergency generators

Structure

Transport routes

Working areas



# 7: Installations

Installations on Mast, pole and tower

clearances



# 6: Safety Measures

- This section covers measures for protection in respect of :
  - direct contact
  - Indirect contact
  - Persons working on electrical installations
  - Arc fault
  - Lightning strokes
  - Fire
- Devices to prevent reclosing of isolating devices
- Devices for determining the de-energized state
- Devices for earthing and short-circuiting
- Protection against leakage of insulating liquid and SF<sub>6</sub>

Together with the requirements of IEC 60364-4-41 is the basis for safe operation of HV electrical installations

# 9:

# Protection

- This section covers:
  - Protection, overcurrent, Earth Fault etc.
  - DC and AC Supply Circuits
  - Compressed Air Systems
  - SF<sub>6</sub> Gas Handling Plants
  - Hydrogen Handling Plants
  - EMC of control systems
  - Measures to reduce the effects of high and low frequency interference



# 9:

# Protection

- DC Supply Unit Batteries must be sized to:
  - trip breakers and switches at the start of a discharge period
  - supply any continuous DC load
  - close the elements of the installation that will restore a.c. services



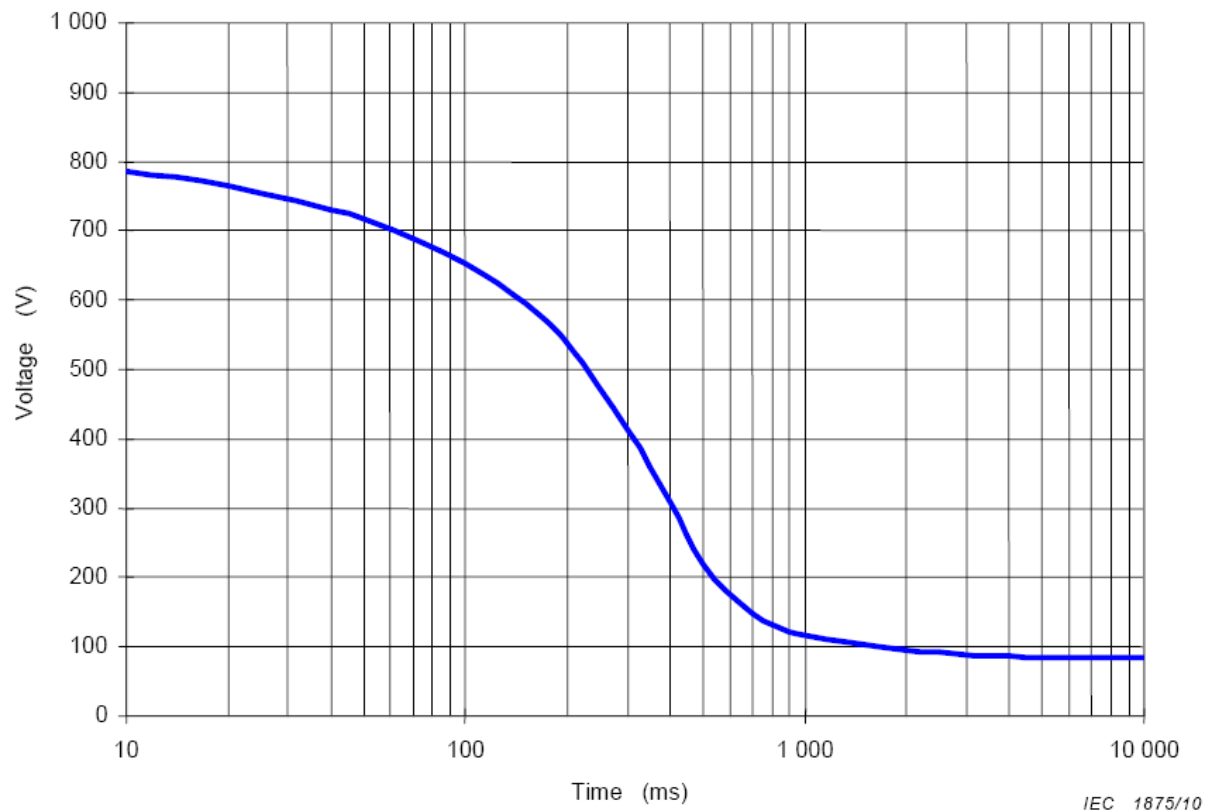
# 10:

# Earthing

- This section covers:
  - Design
  - Installation
  - Testing
  - Maintenance
- of earthing systems.
  
- Main points:
  - The requirements are designed to address the possibility of a current flowing through a human being
  - based on a probabilistic curve for touch voltage
  - In general, interconnection of HV and LV earths is recommended
  - The HV earthing system shall form part of the lightning protection system
  
- This section should be read in conjunction with the Low Voltage National Rules in particular Section 442.
- This section also sets out touch voltage and stress voltage limits arising from Earth Potential Rise (EPR)



# Permissible touch voltage $U_{Tp}$



Scope

Normative References

Terms and Definitions

## Commissioning and Maintenance

Fundamental Requirements

Insulation

Equipment

Installations

Safety Measures

Protection, Control and Auxiliary Systems

Earthing Systems

Inspection and Testing

Operation and Maintenance



# 11: Inspection and Testing

- This section covers:
  - Inspection and tests to verify:
    - compliance of the installation with the rules
    - Compliance of the equipment with the applicable technical specifications
- Main points
  - Description of verification by:
    - Visual inspection
    - Functional tests
    - Measuring
  - Completion certificate with generator supplement
- These tests must be carried out by a competent person as described in IS EN 5110.
- The following must be available to the person carrying out the inspection
  - Detailed Drawings and specification for the installation
  - Fault levels at the point of supply
  - Details of the supply system earthing (Earthed or Unearthed)
  - The necessary test equipment to carry out the tests set out in this section.



# 11: Inspection and Testing

- Note: setting and testing of protection systems:
  - the settings issued by SO are the maximum settings required to discriminate with the public system
  - May not:
    - adequately protect a consumer's installation
    - satisfy the requirements of these Rules
    - Satisfy the requirements of the HSA
  - In particular Earth Fault and Short Circuit Settings.
- Also true of synchronising generator protection settings [check TSO]

# 12: Maintenance Manual

- Each installation shall have:
  - An operation manual
    - Procedures: Normal, emergency and maintenance
    - Safety instructions for operation of HV installation
  - A set of up-to-date drawings and diagrams on premises
  - Manufacturers' operation and maintenance manuals
  - Visible display of emergency routes to nearest hospital and emergency phone numbers



# Completion Certificate

- **Site Details**
  - MPRN
  - LV Certificate No.
  - Customer
  - Address
  
- **Connection Ratings**
  - MIC/MEC
  - Site Fault Level
  - Connection Voltage
  - Maximum Current
  - **Minimum Short Circuit Current.** *This is normally used for Protection Relay settings.*
  
- **Supply System Neutral Arrangement.** *Current legalisation in relation to providing effective earth leakage protection*



# Completion Certificate

- **Protection Settings and Test Results**

- Earth Fault
- Sensitive Earth Fault
- Overcurrent
- Generator Y/N

- **Equipment Details**

- Switchgear
- Ring Main Units
- Transformers
- Generators
- Power Factor Correction
- Cable Circuit
- DC Supply Unit
- Generator Protection??

- **Verifications**

- Equipotential Bonding
- Switchgear compliance
- Interlocks Operational
- Facility to lock earth switch
- Operation of DC Units
- Operation of Protection
- Earth Fault Protection
- Transformers
- Cables
- General and Environmental





**EQUIPMENT DETAILS**

Quantity	Type	Ratings (as applicable)							Test Sheet nos.
		kV	A	kVA	kVA <sub>r</sub>	V <sub>DC</sub>	kA	BIL kV	
<input type="checkbox"/>	Switchgear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Ring Main Units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Transformers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Generators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Power Factor Correction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Cable Circuit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	DC Supply Unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Generator Protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**VERIFICATIONS**

	Main Substation		Other Substations	
	<i>(tick as appropriate)</i>			
	Yes	Yes	Yes	Yes
Equipotential Bonding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Switchgear Compliant?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are Interlocks Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Facility to Lock Earth Switch	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation of DC Units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation of Protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overcurrent Protection	at main switchboard <input type="checkbox"/>		at all sub switchboards <input type="checkbox"/>	
Earth Fault Protection	at main switchboard <input type="checkbox"/>		at all sub switchboards <input type="checkbox"/>	
Transformers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General and Environmental	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**COMMENT OR DETAILS**

**CONTRACTOR**

Reg. no.  Reg. Body

Name \_\_\_\_\_

Address \_\_\_\_\_

Tel:

Mob:

**CERTIFICATION**

Pre-connection tests completed and found to be satisfactory

Signed \_\_\_\_\_ For installation (tick as appropriate)

Constructor  Tester

Qualification

**NOTE:**

This certificate is issued and signed by the person responsible for the constructing and/or testing of the installation or a person duly authorised to act on his behalf. This certificate should be used only for installations connected at voltages over 1 kV ac. Installations connected at a lower voltage require a different certificate. Electrical Installations should be inspected periodically.

The Electro-Technical Council is not responsible for the electrical installation or for the accuracy of the information given on this certificate.

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Equipment Details

Verifications

Certification





Resistance of Earthing System		<input type="text"/> ohms		Resistance of Earth System Compliant? (Y/N)		<input type="text"/>							
<b>PROTECTION SETTINGS AND TESTS</b>													
<i>Protection at Main Incomer (Connection Point)</i>													
Earth Fault	relay manufacturer	<input type="text"/>				type	<input type="text"/>						
	settings	$I_0 >$	<input type="text"/>	A	time	<input type="text"/>	s	tripping curve	<input type="text"/>				
		$I_0 >>$	<input type="text"/>	A		<input type="text"/>	s	tripping curve	<input type="text"/>				
	injection test	$I_0 >$	<input type="text"/>	A	L1	<input type="text"/>	s	L2	<input type="text"/>	s	L3	<input type="text"/>	s
		$I_0 >>$	<input type="text"/>	A		<input type="text"/>	s		<input type="text"/>	s		<input type="text"/>	s
Sensitive Earth Fault	relay manufacturer	<input type="text"/>				type	<input type="text"/>						
	settings	$I_0 >$	<input type="text"/>	A	time	<input type="text"/>	s	tripping curve	<input type="text"/>				
	injection test	$I_0 >$	<input type="text"/>	A		<input type="text"/>	s						
Overcurrent	relay manufacturer	<input type="text"/>				type	<input type="text"/>						
	settings	$I >$	<input type="text"/>	A	time	<input type="text"/>	s	tripping curve	<input type="text"/>				
		$I >>$	<input type="text"/>	A		<input type="text"/>	s	tripping curve	<input type="text"/>				
	injection test	$I >$	<input type="text"/>	A	L1	<input type="text"/>	s	L2	<input type="text"/>	s	L3	<input type="text"/>	s
		$I >>$	<input type="text"/>	A		<input type="text"/>	s		<input type="text"/>	s		<input type="text"/>	s
Generator	Synchronising Generator (Y/N)		<input type="text"/>		If 'Y', complete Embedded Generator Interface Protection (EGIP) form								
<sup>1</sup> 3 phase fault current <sup>2</sup> Line to Earth Fault Current													



EQUIPMENT DETAILS

Quantity	Type	Ratings (as applicable)							Test Sheet nos.
		kV	A	kVA	kVAr	V <sub>DC</sub>	kA	BIL kV	
<input type="text"/>	Switchgear	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Ring Main Units	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Transformers	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Generators	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Power Factor Correction	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Cable Circuit	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	DC Supply Unit	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Generator Protection	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

VERIFICATIONS

	Main Substation		Other Substations	
	<i>(tick as appropriate)</i>		Yes	
Equipotential Bonding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Switchgear Compliant?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are Interlocks Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Operation of Protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overcurrent Protection	at main switchboard <input type="checkbox"/>	<input type="checkbox"/>	at all sub switchboards <input type="checkbox"/>	<input type="checkbox"/>
Earth Fault Protection	at main switchboard <input type="checkbox"/>	<input type="checkbox"/>	at all sub switchboards <input type="checkbox"/>	<input type="checkbox"/>
Transformers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General and Environmental	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



**National Rules for Electrical Installations Exceeding 1 kV ac  
Completion Certificate  
Part B. Synchronising Generator Installation**

MPRN  Completion Certificate No.

**Note: This supplementary sheet forms part of the Completion Certificate above**

GENERATOR PROTECTION SETTINGS AND TESTS PROT. TRANSFORMER RATIOS Current  5 Volt.  100

**Directional** relay manufacturer:  type

**Overcurrent** setting I>  A time  s tripping curve relay characteristic angle  °

timing test injected current, phase angle I>  A ∅  ° I>  A ∅  ° I>  A ∅  °  
trip time  s  s  s

directional injected current, trip ph. angle I>  A ∅  ° I>  A ∅  ° I>  A ∅  °  
test reset phase angle ∅  ° ∅  ° ∅  °  
 s  s  s

**Over/Under Voltage** relay manufacturer:  type

Over voltage setting V>  V time  s tripping curve

timing test injected voltage L1  V L2  V L3  V  
trip time  s  s  s

set point test trip voltage  V  V  V  
reset voltage  V  V  V

Under voltage setting V<  V  s tripping curve

timing test injected voltage  V  V  V  
trip time  s  s  s

set point test trip voltage  V  V  V  
reset voltage  V  V  V

**Over/Under Frequency** relay manufacturer:  type

Over frequency setting f>  Hz time  s tripping curve

timing test injected frequency f>  Hz trip time  s  
set point test trip frequency f>  Hz reset frequency  Hz

Under frequency setting f<  Hz  s tripping curve

timing test injected frequency f<  Hz  s  
set point test trip frequency  Hz reset frequency  Hz

**Earth Fault** relay manufacturer:  type

(NVD) settings  V time  s tripping curve

timing test injected voltage  V time  s  
set point test trip voltage  V reset voltage  V

**Loss of Mains** relay manufacturer:  type

1. Vector Shift settings ∅  ° time  s  
min. volt. Vector shift to trip ∅  ° max. shift, no trip ∅  °

2. Rate of Chang settings  Hz/s time  s

of frequency timing test inj. rate of change of frequency  Hz/s time  s  
(ROCOF) set point test ROCOF Trip  Hz/s ROCOF reset.  Hz/s

**Trip Circuit Supervision** correct operation of trip circuit supervision

**Site Safety** Warning notices in place advising of generator(s) in parallel operation

Signed \_\_\_\_\_ Generator tests completed and found to be satisfactory

Signed \_\_\_\_\_

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MPRN & Certificate no.

Directional Overcurrent

Over/under Voltage

Over/ Under Frequency

Earth Fault

Loss of Mains

Rate of Change of Freq.





<b>Over/Under Frequency</b>	relay manufacturer	<input type="text"/>		type	<input type="text"/>	
Over frequency setting	f>	<input type="text"/> Hz	time	<input type="text"/> s	tripping curve	<input type="text"/>
timing test	injected frequency	f>	<input type="text"/> Hz	trip time	<input type="text"/> s	
set point test	trip frequency	f>	<input type="text"/> Hz	reset frequency	<input type="text"/> Hz	
Under frequency setting	f<	<input type="text"/> Hz	<input type="text"/> s	tripping curve	<input type="text"/>	
timing test	injected frequency	f<	<input type="text"/> Hz	<input type="text"/> s		
set point test	trip frequency	<input type="text"/> Hz	reset frequency	<input type="text"/> Hz		
<b>Earth Fault (NVD)</b>	relay manufacturer	<input type="text"/>		type	<input type="text"/>	
settings		<input type="text"/> V	time	<input type="text"/> s	tripping curve	<input type="text"/>
timing test	injected voltage	<input type="text"/> V	time	<input type="text"/> s		
set point test	trip voltage	<input type="text"/> V	reset voltage	<input type="text"/> V		
<b>Loss of Mains</b>	relay manufacturer	<input type="text"/>		type	<input type="text"/>	
1. Vector Shift settings	$\emptyset$	<input type="text"/> °	time	<input type="text"/> s		
	min. volt. Vector shift to trip	$\emptyset$	<input type="text"/> °	max. shift, no trip	$\emptyset$	<input type="text"/> °
2. Rate of Chang settings		<input type="text"/> Hz/s	time	<input type="text"/> s		
of frequency timing test	inj. rate of change of frequency	<input type="text"/> Hz/s	time	<input type="text"/> s		
(ROCOF) set point test	ROCOF Trip	<input type="text"/> Hz/s	ROCOF reset	<input type="text"/> Hz/s		
<b>Trip Circuit Supervision</b>	correct operation of trip circuit supervision				<input type="checkbox"/>	
<b>Site Safety</b>	Warning notices in place advising of generator(s) in parallel operation				<input type="checkbox"/>	
Signed _____						
Generator tests completed and found to be satisfactory						

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# Next Steps

- Consultation
- Amendments
- Publication
- Arrangements
- Briefing and Communication
- Maintenance



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# Questions



Thank You





**Ireland must speed up the permitting process for investment in essential infrastructure**

