



## Health & Safety Series

Best Practice Guidelines for Operation of Wind Farm

High Voltage Electrical Installations

Key contributor: Padraig Plunkett BE C.Eng M.IEI

[windenergyireland.ie](http://windenergyireland.ie)

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## 1. Introduction

This series of health and safety guidance documents has been produced and updated by Wind Energy Ireland's Health & Safety Committee and is aimed at members of the Irish wind energy sector. The Health and Safety Committee is dedicated to promoting excellent health and safety standards and creating a forum for discussion and shared learnings on recommended health and safety guidance and best practice.

We welcome and encourage any comments, queries or updates on the content of this document in order to support the sharing of good practices within the industry, so please contact [office@windenergyireland.com](mailto:office@windenergyireland.com) if you have any enquiry.

## 2. Context

Windfarm Owners, Asset Managers and Contractors have Duties under the **Safety, Health & Welfare at Work Act 2005 (SHAWW 2005)** in relation to the risks to the safety, health and welfare of their employees and of individuals (not being their employees) posed by the electrical installation.

In accordance with Section 15 of the 2005 Act, it is the duty of each person (or company) who has control to any extent of any place of work, or any part of a place of work, to take such measures as are reasonable for them to take to ensure, so far as is reasonably practicable, that the place of work is safe and without risk to health.

Section 17 of the 2005 Act specifies duties to be complied with by persons who commission or procure construction work, including appointment in writing of a competent person(s) to ensure, so far as is reasonably practicable, that the project is designed and is capable of being constructed to be safe and without risk to health.

The **Safety, Health & Welfare at Work (General Applications) Regulations 2007 to 2016 Part 3: Electricity** sets out specific requirements in the context of all electrical installations (including high voltage) in any workplace.

Further information on the General Applications Regulations Part 3 is available at;

[https://www.hsa.ie/eng/Publications\\_and\\_Forms/Publications/Retail/Gen\\_Apps\\_Electricity.pdf](https://www.hsa.ie/eng/Publications_and_Forms/Publications/Retail/Gen_Apps_Electricity.pdf)

This document provides guidance in relation to best practice in compliance with the Act and Regulations.

Of particular note is *SHAWW regulation 76* which requires that;

*“An employer shall ensure that—*

*(a) all electrical equipment and electrical installations are—*

*(i) designed,*

*(ii) constructed,*

*(iii) installed,*

*(iv) maintained,*

*(v) protected, and*

*(vi) used*

*so as to prevent danger”.*

The **Safety Health and Welfare at Work (Construction) Regulations 2013** place duties on the Client (person for whom a project is carried out including network owner, or an owner of an independent HV electrical installation) to;

- only appoint competent designers and contractors for the works.
- appoint a competent Project Supervisor Design Process (PSDP) and a competent Project Supervisor Construction Stage (PSCS) if the construction project involves more than one contractor, has a “Particular Risk” (Schedule 1 of the Construction Regulations) or will last longer than 30 days/500 person days.
- be reasonably satisfied that the appointed Project Supervisors are competent to carry out their roles and will dedicate sufficient resources to the project to comply with their legal obligations.

In the following chapters, compliance with the SHAWW Act and Regulations is considered in regard to the particular requirements of **S.R. 61936/ISEN 61936 Power installations exceeding 1kV (1.5kV dc)** and

**ISEN 50110 Operation of electrical installations**, as they apply to windfarm HV installations.

### 3. Electrical Risk and Hazards

ISEN 50110-1: 2013 3.1.6 defines electrical injury as death or personal injury from electric shock, electric burn, arcing, or from fire or explosion initiated by electrical energy caused by any operation of an electrical installation.

Electrical Risks can be categorized as;

- 1) Electrocution by touching / getting close to live conductor.
- 2) Electrocution by exposure to fault current.
- 3) Exposure to fault current or arc.
- 4) Induction.
- 5) Proximity (as operator or observer) to electrical fault and resulting explosion.

ISEN 50110-1: 2013 3.1.6 defines Risk Mitigation measures as;

- Detailed Planning (clauses 4.1, 4.3, 4.4 & 4.7)
- Risk Assessment (clauses 4.1, 4.9 & B.6.3)
- Controlled Access (clauses 4.5 & 4.8)
- Management and Execution by Competent Persons (clause 4.2)
- Use of appropriate Tools and PPE (clauses 4.6 & B.7)

These measures are explored further in the following chapters.

## 4. Design and Installation

ISEN 61936 (2014) is the applicable standard for the design, installation and commissioning of Power installations exceeding 1kV (1.5kV dc).

SR 61936 (2019) provides additional guidance in relation to compliance with Irish Regulations including Grid and Distribution Codes. This document can be purchased from NSAI at;

[https://shop.standards.ie/en-ie/standards/s-r-61936-1-2019-1167856\\_saig\\_nsai\\_nsai\\_2779892/](https://shop.standards.ie/en-ie/standards/s-r-61936-1-2019-1167856_saig_nsai_nsai_2779892/)

If a HV installation is therefore certified in accordance with SR 61936 it could provide strong evidence that the owner had complied with 2007 SHAWW (General Application) regulation 76 (a) (i), (ii), (iii) & (v).

While there is no particular guidance given in the Standard or Recommendation on design certification, SR 61936 Chapter 11, Annex F and Annex G provides guidance in regard to appropriate commissioning tests and certification for HV installations.

It is a requirement of 2007 SHAWW (General Application) regulation 89 that;

*An employer shall ensure that—*

*(a) a new electrical installation and a major alteration of, or extension to, an existing electrical installation is, after completion, inspected and tested by a competent person and a report of the test is completed verifying that the relevant requirements of this Part have been complied with,*

It is therefore necessary to ensure that the design, installation and commissioning are carried out by competent persons and that the final commissioning report demonstrates compliance with the regulations.

The employer and/or PSDP may rely on the professional judgement of a Chartered Electrical Engineer in regard to determining appropriate competence for design and commissioning engineers.

## 5. Roles and Responsibilities

The principal roles covered by Irish (EN) standards and Regulations for which persons should be authorized as having appropriate competence are defined in **I.S.EN 50110-1** as;

### **3.2.1 person responsible for an electrical installation**

*(nominated person with the overall responsibility to ensure the safe operation of the electrical installation by setting rules and organisation or framework)*

This is a management role (commonly known as **HV System Manager**) applicable to all high voltage equipment on the windfarm including the substation, underground cabling and wind turbine HV equipment.

The person nominated is therefore directly responsible for the safety and welfare of all persons who may work on or near the HV installation or gain access to or near the HV installation at any time.

### **3.2.2 nominated person in control of an electrical installation during work activities**

*(person who is responsible during work activities for the safe operation of the electrical installation)*

In certain circumstances, the HV System Manager may delegate control of the installation to another nominated person commonly known as the “**Control Engineer**”.

The HV System Manager, may also transfer control of all or part of HV installation, to a third party nominated person, who will act as Control Engineer during a work activity and assume responsibility for the safety and welfare of all persons who may work on or near that part of the HV installation, or gain access to or near that part of the HV installation during work being carried out by a third-party organisation such as a contractor.

While the person nominated as “**Control Engineer**” may be an employee of the owner, contractor or other third-party organisation, the responsibility for determining and approving their competence to carry out the role remains with the HV System Manager.

### **3.2.3 nominated person in control of a work activity**

*(person nominated with the ultimate responsibility for the work activity at work location)*

This role is commonly known as “**Work Supervisor**” or “**Person in Charge of Work**”.

The person carrying out this role will normally be nominated by the party carrying out the work (contractor).

While the contractor is primarily responsible for ensuring that the person has an appropriate level of competence and is formally authorised to carry out the role, the Control Engineer and/or HV System Manager should also take reasonable measures to satisfy themselves that the nominated person is fully competent and authorised.

### **3.2.4 skilled person (electrically)**

*(person with relevant education, knowledge and experience to enable him or her to analyse risks and to avoid hazards which electricity could create)*

This role covers many commonly used job titles including but not limited to;

- Senior Authorised Person
- Authorised Person
- Commissioning Engineer
- Test Engineer
- Electrician
- Technician
- Turbine Technician
- Site Manager

In each case the person or organisation nominating the person to carry out the role, should satisfy themselves, that the person possesses the particular competence, required for the role and should issue a formal authorisation to this effect.

As in 3.2.3, the Control Engineer and/or HV System Manager should also take reasonable measures to satisfy themselves that each skilled person is fully competent and authorised.



## 6. Planning and Organisation

### 6.1 Planning

As stated above in chapter 2, Detailed Planning and Risk Assessment are two of the primary mitigation measures which should be taken in regard to the risks and hazards posed by electrical installations.

The following extracts from IS-EN 50110-1 are relevant;

#### **4.1 Safe operation**

*Before carrying out any operation on an electrical installation an **assessment of the electrical risks** shall be made. This assessment shall specify how the operation shall be carried out and what safety measures and precautions are to be implemented to ensure safety.*

#### **4.3.1 Organisation**

*The **nominated person in control of a work activity** and the **nominated person in control of an electrical installation during work activities** shall **agree both the arrangements of the electrical system** to allow the work to take place and a **description of the work activity** on, with or near the electrical installation before any changes to the arrangements of the electrical installation are made or work takes place.*

*Where the work activity is complex, the **preparation shall be made in writing**.*

It is therefore a requirement that a comprehensive Plan is prepared to include selection of appropriate Work Procedures as set out in ISEN 50110 and comprehensive Risk Assessment identifying the electrical risks and specification of appropriate mitigation measures.

The Plan should be reviewed and approved by a competent person on behalf of the Control Engineer and/or HV System Manager.

## 6.2 Organisation

As stated above in chapter 2, Management by Competent Persons and Controlled Access are two of the primary mitigation measures which should be taken in regard to the risks and hazards posed by electrical installations.

The following extracts from IS-EN 50110-1 are relevant;

**4.3.1 Each electrical installation shall be placed under the responsibility of a person, the person responsible for an electrical installation.**

*In absence of national regulations, the person responsible for an electrical installation can be a **person** from their own organisation or a **third party organisation**.*

*In the case of a person from another organisation, it is recommended to **document the nomination, the part of the installation** the person is responsible for and the **timescale** of nomination in writing.*

*The person responsible for an electrical installation can delegate a part of his duties to other persons and shall;*

- **Control Access** to all places where ordinary persons are exposed to electrical hazards.
- **Assess the risks** associated with the operation of electrical installations and, where necessary, develop and implement relevant emergency arrangements **(B.7)** .

It would seem reasonable to conclude, that where there is no specific appointment in place, the Asset Manager appointed to manage the complete windfarm also assumes the role and duties of the **person responsible for an electrical installation** defined in ISEN 50110 paragraph 3.2.1 .

It follows that the Asset Manager will be required to have competence (knowledge, training and experience) relevant to the operation of the windfarm HV installation and to implement **Rules** relevant to the operation of the complete HV installation.

If the HV installation is managed and operated in accordance with ISEN 50110, it could provide strong evidence that the owner has complied with Regulation 76 (a) (vi) of the 2007 SHAWW (General Application) Regulations.

## 7. Maintenance

Carrying out maintenance work in accordance with ISEN 50110 paragraph 7 “Maintenance Procedures” should ensure that the work is carried out safely and so could assist in assuring compliance with Regulation 76 (a) (iv) of the 2007 SHAWW (General Application) Regulations.

However, the requirement of the Regulations that the installation be maintained “*so as to prevent danger*”, goes beyond carrying out the maintenance work safely.

In this regard the HSA guide to the Regulations part 3 recommends that, “Regular maintenance must be carried out to ensure the safety of electrical equipment or installations. The nature and frequency of maintenance should be adequate to prevent danger”.

Therefore, there is a duty placed on the windfarm owner and/or asset manager to ensure that the equipment is maintained to an extent that guarantees that it is safe to use and does not present a risk of harm to the nominated operators, other persons who are given access or members of the public.

A windfarm owner or asset manager wishing to demonstrate compliance with Regulation 76 (a) (iv) of the 2007 SHAWW (General Application) Regulations would therefore be advised to put a Maintenance Policy including Procedures in place clearly demonstrating that all reasonably practicable measures are being taken to prevent danger.

## 8. Competence

ISEN 50110 requires that allocation of responsibility and determination of appropriate levels of competence should be in accordance with national legislation but states that *“where there are no national requirements for competence, the following criteria shall be used in assessing the competence of persons;*

- *knowledge of electricity*
- *experience of electrical work*
- *understanding of the installation to be worked on and practical experience of that work*
- *understanding the hazards which can arise during the work and the precautions to be observed*
- *ability to recognise at all times whether it is safe to continue working”*

Regulation 88 [Persons to be competent to prevent danger] of the 2007 SHAWW (General Application) Regulations requires that;

*An employer shall ensure that no person is engaged in any work activity to which this Part relates where technical knowledge and experience is necessary to prevent danger unless that person is competent or is under such degree of supervision as is appropriate, having regard to the nature of the work.*

The HSA Guide to the SHAWW Regulations states that;

*“For the duration of the work, control must be under a person who possesses sufficient technical knowledge and experience, or be supervised, so as to ensure that danger is prevented.*

Technical knowledge and experience includes:

- Adequate knowledge of electricity
- Adequate experience of electrical work
- Adequate understanding of the installation type to be worked on and practical experience of that class of installation
- Understanding of the hazards which may arise during the work and the precautions which need to be taken
- Ability to recognise at all times whether it is safe for work to continue”

The ISEN 50110 requirement of an understanding of the particular *installation to be worked on and practical experience of that work* rather than an “Adequate understanding of the installation type to be worked on and practical experience of that class of installation” is more onerous, but when the 2005 SHAWW Act duties are considered, it can be argued, particularly in regard to the increased complexity and risks associated with HV installations, that where reasonably practicable, ISEN 50110 should apply.

In regard to windfarm HV installations, it would therefore be a minimum requirement that all persons working on or near the HV installation are given sufficient familiarisation training on the particular HV installation so that they have at all times an;

- *understanding of the installation to be worked on and practical experience of that work*
- *understanding the hazards which can arise during the work and the precautions to be observed*
- *ability to recognise at all times whether it is safe to continue working.*

## 9. Rules

In ISEN 50550 clause 3.2.1, the **person responsible for an electrical installation** is defined as a nominated person with the overall responsibility to ensure the safe operation of the electrical installation by setting **rules** and organisation or framework.

These Rules should be approved by a competent person and specify procedures, instructions and documentation required to control all operations and works carried out on or near the HV Installation and ensure compliance with IS EN 50110 – 1.

*If you have any questions, please feel free to contact us at [office@windenergyireland.com](mailto:office@windenergyireland.com).*