EI 3606-9

Switching, earthing and testing of high voltage apparatus

Wind turbine system safety rules
Support procedure nine

Edition: First | Version 1

SafetyOn

G+ Global Offshore Wind
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SUPPORT PROCEDURE NINE

[Company A] wind turbine system safety rules procedure Switching, earthing and testing of high voltage apparatus

First edition

March 2026

Version one

Published by
Energy Institute, London
The Energy Institute is a professional membership body incorporated by Royal Charter 2003
Registered charity number 1097899

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The EI gratefully acknowledges the Operational Safety Rules Group, and financial contributions towards the development of this publication from members of SafetyOn, the Health and Safety Organisation for the Onshore wind sector, and the G+ Global Offshore Health and Safety Organisation:

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ISBN 9781787255562

Published by the Energy Institute

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FOREWORD

The purpose of this procedure is to detail the minimum requirements that will allow [Company A] to produce a **management instruction** that details the process of **switching, earthing** and **testing** on assets operated by [Company A] as required to comply with [Company A]'s wind turbine system safety rules (WTSSR).

[COMPANY A] WIND TURBINE SYSTEM SAFETY RULES (FIRST EDITION) 2026

SUPPORT PROCEDURE NINE

Procedure for switching, earthing and testing of high voltage apparatus

CHANGE LOG

Rev	Modification	Issue date	Page
0	New document	2026	–

Note: Where [Company A] is written, please delete and replace with relevant company name. Delete this sentence after completion of [Company A] insertion.

1 SCOPE

This procedure should be followed when any of the following activities are carried out on assets operated by [Company A]:

– Switching of any **high voltage apparatus**.
– Earthing of any **high voltage apparatus**.
– Testing of any **high voltage apparatus**.

This procedure does not apply to any **switching** or **testing** of **apparatus** outside the boundary of the wind turbine system safety rules.

2 DEFINITIONS AND ABBREVIATIONS

2.1 LIST OF DEFINITIONS AND ABBREVIATIONS

For the purposes of this procedure:

The '**responsible manager**' means the person who will have responsibility for the implementation and management of the [Company A] wind turbine system safety rules at the location.

Testing means, taking measurements or carrying out checks to confirm the quality, performance or reliability of **plant** or **apparatus** before it is placed into a service condition.

Impressed voltage conditions could be one or all the following:

i) induced or capacitive voltage;
ii) environmental conditions, and/or
iii) trapped charge.

Field equipment earths are usually applied to the following:

i) scaffold;
ii) mobiled elevating work platforms (MEWPS) and cranes when in final position;
iii) ladders;
iv) vehicles, and
v) any other portable conductive object.

Where maintaining of the integrity of the **point of isolation** is dependent on the use of a gas, it is known as 'isolation gas density dependent' or 'IGDD'.

2.1.1 Abbreviations

AWP – Approved written procedure

HV – High voltage

IGDD – Isolation gas density dependent

SCADA – Supervisory control and data acquisition

WTSSR – Wind turbine system safety rules

3 SWITCHING

3.1 **High voltage switching** shall only be carried out by a level two **authorised technician**.

For training reasons only, a level one **authorised technician** who is adequately informed of the hazards involved and is personally supervised by a level two **authorised technician** can carry out **high voltage** switching operations. The supervising level two **authorised technician** remains responsible for the switching activity being executed.

3.2 Following **transfer of control** of **high voltage apparatus** from the **operational controller** to the level two **authorised technician** all **high voltage** switching shall be carried out by following a HV **approved written procedure** that has been approved by a level two **authorising engineer**.

3.3 HV **apparatus** on which **high voltage switching** operations are to be carried out shall have clear and unambiguous identification.

3.4 HV **apparatus** on which **high voltage switching** operations are to be carried out shall where practicable be checked to confirm it is in an operable state, free from damage and defects.

3.5 When specifying safety precautions to achieve safety from the system for a HV **approved written procedure** the level two **authorising engineer** shall create the sequence of operations:

i) De-load the network or **apparatus;**

ii) **high voltage isolations** to be applied;

iii) **low voltage** and **voltage transformer** isolations to be applied where applicable;

iv) apply circuit main earths, and

v) the return to service shall where reasonably practicable be a reverse of the above steps iv to i.

3.6 All **high voltage** switching operations shall be carried out without undue delay.

3.7 When **high voltage** switching is required outside the scope of WTSSR for work within the scope of the WTSSR, then this shall be carried out in accordance with support procedure seven – *Control and management of cross boundary safety precautions between the wind turbine system safety rules and other safety rules*.

3.8 All personnel not required for the completion of the **high voltage switching** shall remain in a safe location, remote from the switching activity, as instructed by the level two **authorised technician**.

3.9 Prior to any **high voltage switching** where the level two **authorised technician** is in the vicinity of the switchgear, the switchgear shall be visually checked to ensure it is in a safe operable condition and that the mimic panel is in the expected position. This is not applicable if carrying out remote switching using SCADA.

3.10 If any **plant** or **apparatus** shows any sign of distress, prior to HV switching or at any other time all persons shall be warned and kept clear of the area. For any apparatus in distress, no switching shall be carried out on that apparatus. A level two **authorising engineer** shall be informed without delay who shall provide instruction on how to proceed.

3.11 Any HV **apparatus** that has tripped under fault conditions shall be subject to the following checks:

i) The HV apparatus shall be inspected before any attempt is made to operate it.

ii) All associated protection relay alarms shall where practicable be recorded and analysed before reset and prior to any further HV switching operations.

iii) All fuses shall be checked correct prior to any further HV switching operations.

iv) No **apparatus**, circuit or section of network shall be returned to service until the source of fault has been established and isolated or confirmed safe to restore by a level two **authorising engineer** in accordance with a HV **approved written procedure.**

4 OPERATIONAL HV SWITCHING

4.1 **Operational switching** is used to reconfigure the network into a specific running arrangement and is outside the scope of the WTSSR and this **support procedure**.

5 EMERGENCY HV SWITCHING

5.1 **Emergency switching** shall only be carried out where there is a direct risk to human life. If **apparatus** is in distress, then unless human life is at risk the **apparatus** shall be left to the system functions to clear any fault.

5.2 **Emergency switching** shall be a justified last resort to achieve the safety of human life and can be carried out by any person with knowledge of the operation of the switchgear and knowledge of the outcome of those operations.

5.3 There is no requirement to prepare a HV **approved written procedure** before carrying out **emergency switching**. Upon completion the person carrying out the **switching**, shall explain the status of the **apparatus** and network to the level two **authorising engineer**.

6 HIGH VOLTAGE ISOLATION

6.1 Only points of isolation detailed on a HV **approved written procedure** shall be applied.

6.2 All isolations shall be secured where practicable by use of a **safety lock**. The placement of a **safety lock** shall ensure that no further operation of the isolating device is possible.

6.3 A **caution notice** shall be fixed at all points of isolation.

6.4 Where fuses or links are used for isolation purposes the carriers shall be withdrawn and blanks fitted; where blanks are not available, alternative security arrangements shall be made.

6.5 Where a section of network is removed for isolation purposes it shall be stored and secured so that it cannot be inadvertently reinserted. It shall remain secured under the control of the level two **authorised technician** until completion of work.

6.6 Where an arc suppression medium is used to maintain a point of isolation (e.g. dielectric gas) then a visual inspection of the switchgear shall be carried out by the level two **authorised technician** including, where reasonably practicable, confirmation that the gas or 'clean air' is at a sufficient pressure to safely operate the HV **apparatus**.

6.6.1 Any IGDD shall be checked by the level two **authorised technician** before work commences, and then monitored or checked throughout the work package and finally checked after removal of isolation before return to service.

6.6.2 IGDD checks or confirmation can be carried out by use of an installed automatic monitoring system or by visual inspection. If an automatic monitoring system is used to check and confirm the levels of liquid or gas it shall where reasonably practicable have service and maintenance records in place to prove correct operation.

6.7 If an alarm relating to falling or low levels gas which secure a point of isolation is triggered during work, the level two **authorised technician** shall withdraw the working party from the work area and inform the level two **authorising engineer** without delay.

6.8 All keys for points of isolation shall be placed in safe custody, by the level two **authorised technician** in accordance with [Company A] **management instructions**.

6.9 When a key for a **safety lock** has been lost then the appropriate [Company A] **management instruction** or general provision three of the WTSSR shall be followed.

6.10 Where isolations are to be applied on automatically or remotely controlled **plant** or **apparatus,** the control function of the **plant** or **apparatus** shall be inhibited or rendered inoperative prior to the application of the isolation.

Steps taken to achieve this shall consider the following:

(i) locking of local/remote switches to local position, and

(ii) removal of control system power supplies.

Either of the above steps taken when forming part of an isolation process shall where reasonably practicable be locked and shall have **caution notices** fixed to them.

6.11 If work is to be carried out adjacent to automatically or remotely controlled **plant** or **apparatus**, the level two **authorising engineer** shall decide between allowing the continued operation of the **plant** or **apparatus** or inhibiting or rendering inoperative the automatic or remote functions of the **plant** or **apparatus**. The outcome of the decision taken shall be implemented within a HV **approved written procedure.**

7 EARTHING HIGH VOLTAGE APPARATUS

7.1 The WTSSR only recognise the following types of earth:

i) circuit main earth. Either fixed **apparatus** or portable type;

ii) additional earth. Either fixed **apparatus** or portable type, and

iii) field equipment earth. Either fixed **apparatus** or portable type.

7.2 When **high voltage apparatus** is to be **earthed**, in accordance with the WTSSR A.4.6.(iii) and A.4.11, the following hierarchy and methods shall be followed:

i) The first **circuit main earth** shall where reasonably practicable be applied using a **circuit breaker** or fully rated **earth switch**.

When using a **circuit breaker** its manual trip function shall be locked or rendered inoperative before closing to earth.

Following completion of the operation, a **safety lock** and **caution notice shall** be applied so that the **circuit breaker** or **earth switch** is secured in the earthed position.

ii) Where it is not possible to use a **circuit breaker** or **earth switch,** a **portable circuit main earth** shall be used. Before application of a **portable circuit main earth** all conductors shall be checked to confirm absence of line voltage using an approved voltage detection device.

The **portable circuit main earth** shall then be connected to a corrosion free earth point before being connected to all phases in turn using an earthing pole or other approved means. The earth end connection shall where reasonably practicable, be secured with a **safety lock** and it shall have a **caution notice** applied.

7.3 The level two **authorised technician** shall where reasonably practicable confirm the absence of **system** voltage by checking integral installed voltage measurement and indication devices. When a **circuit main earth** is applied using a **circuit breaker** or rated **earth switch** there shall be no requirement to confirm absence of **system** voltage using an approved voltage detection device prior to application.

7.4 Fixed **apparatus** used to apply a **circuit main earth** or an **additional earth** shall have clear and unambiguous identification.

7.5 All portable earthing leads and end clamps used for **portable circuit main earths** shall be of suitable cross-sectional area to carry and dissipate the full fault current at point of application. Consideration should be given to the use of additional **portable earths** to achieve the correct cross-sectional area when high fault levels are present.

7.6 All **portable earths** shall be maintained in line with manufacture requirements and [Company A]'s **management instruction**. **Portable earths** shall be visually examined before each use. A register of all **portable earths** shall be retained at the location in accordance with [Company A]'s **management instruction**.

CIRCUIT MAIN EARTH

7.7 A **circuit main earth** is applied to protect against inadvertent energisation of the circuit or **apparatus** to be worked upon.

7.8 The application of a **circuit main earth** shall only be carried out by a level two **authorised technician** who is following a HV **approved written procedure**.

7.9 **Circuit main earths** shall be applied between all HV points of isolation and point of work. They shall be applied and secured so that they cannot be disturbed during the work.

ADDITIONAL EARTH

7.10 An **additional earth** is a fixed or **portable earth** applied to safeguard against impressed voltage conditions.

7.11 The level two **authorising engineer** is responsible for deciding on the location and number of **additional earths** required to achieve safety from the system. These shall be documented in a HV **approved written procedure** and applied by a level two **authorised technician.**

7.12 Where the **circuit main earth** is not visible at the point of work, the level two **authorising engineer** may, in addition to the **circuit main earth**, include the requirement to apply an **additional earth**, at the point of work, as visual confirmation that an earth has been applied.

7.13 **Additional earths** shall where practicable be sited inside the zone of work.

7.14 There is no requirement to apply a **safety lock** and **caution notice** to an **additional earth**.

FIELD EQUIPMENT EARTH

7.15 A **field equipment earth** is applied to temporary conductive structures, objects or equipment to ensure an equipotential zone is created and to reduce the risk of electric shock due to direct contact with or infringement of safety distance to live **apparatus** or by impressed voltage conditions.

7.16 The level two **authorised technician** in consulation with the level two **authorising engineer** is responsible for deciding on location and number of **field equipment earths** required to achieve safety from the system. The requirement for any **field equipment earth** shall be written into a HV **approved written procedure**.

8 PROVING DEAD HIGH VOLTAGE APPARATUS

8.1 In the context of HV switching the operation of proving dead is intended as a verification of the absence of operating voltage prior to the application of an earth.

8.2 This is carried out at the point of switching by the use of an approved voltage absence tester.

8.3 Despite this operation being defined as a test for dead this verification does not negate the requirement of the need to test for dead as close as possible to the point of work prior to work commencing.

9 TESTING HIGH VOLTAGE APPARATUS

9.1 All **high voltage** testing shall be carried out using a HV **approved written procedure**.

9.2 **Safety from the system** when testing **high voltage apparatus** shall be established and maintained according to the WTSSR at all times.

9.3 A zone of testing shall be defined by the level two **authorising engineer** and written into the HV **approved written procedure**. Demarcation shall be considered for remote ends where the **apparatus** may become live.

9.4 Communications shall be established between the level two **authorised technician** and all **persons** in the vicinity of the testing activity before any testing is initiated. The communications shall be maintained for the duration of the testing.

9.5 If testing is to take place adjacent to live **apparatus**, then the level two **authorising engineer** shall consider the potential of induced voltage conditions that could cause danger or interfere with the expected test outcome. Any safety precautions shall be written into a HV **approved written procedure**.

ANNEX A – EXAMPLE SWITCHING TERMINOLOGY AND ACRONYMS

Instruction	Acronym	Definition
OPEN	n/a	The operation of the high voltage apparatus from the closed to the open position
CONFIRM	n/a	Positive establishment
CONFIRM OPEN	n/a	The confirmation that the high voltage apparatus is in the open position
CLOSE	n/a	The operation of the high voltage apparatus from the open to the closed position
CONFIRM CLOSED	n/a	The confirmation that the high voltage apparatus is in the closed position
CONTACT CONTROL PERSON FOR CONSENT TO COMMENCE HV SWITCHING	n/a	The process of contacting the control person for consent for HV switching in accordance with the HV-AWP Note: This is subject to any contractual obligations or local site agreements in place. Where applicable and required, consent must be obtained from the designated control person responsible for the HV network. These requirements shall be formally documented within [Company A]'s management instructions
APPLY EARTH	n/a	Connection of the high voltage apparatus to earth
REMOVE EARTH	n/a	Removal of the high voltage apparatus from earth
CHECK FOR SIGNS OF DISTRESS	CFSoD	Non-intrusive inspection to confirm no sign of distress
CHECK IN SAFE LOCATION	n/a	All personnel in relation to the ongoing current switching activities are in a place that is safe, away from any potential hazards that may arise from the planned switching activities
SELECT LOCAL	n/a	Sets the device to control from local position only
SELECT REMOTE	n/a	Sets the device to control from remote position only

Instruction	Acronym	Definition
SELECT AUTO	n/a	The high voltage apparatus will operate under automatic control
APPLY SAFETY LOCK and CAUTION NOTICE	APPLY SL and CN	Using an appropriate keyed safety lock to secure condition or point of isolation. A caution notice will be secured on the same lock
REMOVE SAFETY LOCK and CAUTION NOTICE	REMOVE SL and CN	The removal of a safety lock and caution notice that was used to secure a condition or as a point of isolation
REMOVE FUSES	n/a	The removal of fuses for the purposes of providing an isolation
ISOLATE	n/a	Disconnection of device to form a point of isolation
PROVE DEAD	n/a	Verifying absence of voltage using approved equipment and procedures, to prove conductors are dead at the point of work
OPERATE AS REQUIRED	OAR	Operate the stated device as required
CLOSE BLOCKING COIL	n/a	The operation of the blocking coil to the blocking position
OPEN BLOCKING COIL	n/a	The operation of the blocking coil from the blocking position

This publication has been produced as a result of work carried out within the Technical Team of the Energy Institute (EI), funded by the EI's Technical Partners and other stakeholders. The EI's Technical Work Programme provides industry with cost effective, value adding knowledge on key current and future issues affecting those operating in the energy industry.

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ISBN 9781787255562
Registered Charity Number: 1097899