

1. SCOPE

This **Approved** procedure covers aspects of a *Marine Cable* repair which cannot reasonably comply with the requirements of the ScottishPower Safety Rules (Electrical & Mechanical).

The ScottishPower Safety Rules (Electrical & Mechanical) are not intended for marine electrical work. Work on *Marine Cables* is unique in several ways and as such requires a different approach from conventional methods and procedures used on land-based cable systems.

The Western **HVDC** Link is a 2250MW **HVDC** circuit between Connah's Quay (North Wales) and Hunterston (North Ayrshire, Scotland). The link comprises a **HVDC Converter Station** at both ends, plus a 420km cable route of which 380km is *Marine Cable*. SP Transmission has maintenance and repair responsibility for around 30% of the overall *Marine Cable* length. The safety rules boundary is defined at the interface of Scottish Territorial Waters.

This procedure is intended for use when working on the *Marine Cable* section owned by SP Transmission, when work is required on the section owned by National Grid this work shall be carried out as per National Grid safety rules, procedures and authorisation requirements. Where work is being carried out that are likely to cross the ownership boundary it shall be agreed which party will take responsibility for the repair and appropriate Safety Rules and procedures shall be followed.

This procedure confirms in writing the **Approved** manner for work or testing to proceed in order to comply with General Provision GP 3 – Special Instructions and OPSAF-11-015 (MSP 2.4) 'Procedure for Work on or Testing of **Plant** and **Apparatus** Where the Safety Rules Cannot or Should not be Applied'.

This procedure shall be used in conjunction with OPSAF-10-027 (PSSI 27).

2. ISSUE RECORD

This is a **Reference** document. The current version is held on the EN Document Library.

It is your responsibility to ensure you work to the current version.

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3. ISSUE AUTHORITY

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4. REVIEW

This is a **Reference** document which has a five year retention period after which a reminder will be issued to review and extend retention or archive.

5. DISTRIBUTION

This document is part of the Management Safety Procedures maintained by Document Control but does not have a maintained distribution list.

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7. REFERENCE AND RELATED DOCUMENTS

ScottishPower Safety Rules (Electrical & Mechanical)
OPSAF-10-005 (PSSI 5)
OPSAF-10-009 (PSSI 9)
OPSAF-10-027 (PSSI 27)

8. DEFINITIONS

Terms printed in bold type are as defined in the ScottishPower Safety Rules (Electrical and Mechanical). Terms printed in italic type are as defined in OPSAF-10-027 (PSSI 27) or OPSAF-11-002 Management Safety Procedures Definitions or are listed below:

Offshore Installation Manager (OIM) - A specialist individual who is on board the vessel, supervising and providing **Immediate Supervision** at the point of work. This person is the main point of contact between land-based **Senior Authorised Person** and **Safety Document** recipients (where it is not the **Senior Authorised Person**) and vessel. It is acceptable to appoint a deputy *Offshore Installation Manager* who will carry out the duties above during alternate shifts.

Offshore Working Party - Individuals or **Persons** working under the **Immediate Supervision** of the Offshore Installation Manager. This will be staff directly associated with the cable repair team(s) - the vessel's captain plus auxiliary staff (e.g. engine mechanic) is not included.

9. INTRODUCTION

Work on *Marine Cable* systems differ significantly from *Land Cable* installations in many ways, not least that special training and competence are required and that access and egress for **Persons** to and from the work **Location** is not readily available whilst work or testing is under way. *Marine Cable* working is usually carried out by specialist multi-national, multi-lingual personnel, working continuously offshore in round-the-clock shifts. Conventional procedures such as cable spiking cannot readily be undertaken and the submarine environment simply does not support established land-based practices normally requiring **Senior Authorised Person** involvement. Whilst other normal requirements of the Safety Rules could be implemented, certain aspects of the offshore working practices do not support compliance and in many cases would not improve overall safety.

It is likely that during work or testing on a *Marine Cable* it will not be reasonably practicable to comply with the following Safety Rule requirements:

Basic Safety Rules:

- The impracticality of the *Offshore Working Party* to be authorised in accordance with OPSAF-13-001 (MSP 5.1) or to receive standby supervision in accordance with OPSAF-11-035 (MSP 5.5).
- The requirement for a **Safety Document** holder to be present at the **Location** and to provide appropriate levels of **Supervision** to all members of an *Offshore Working Party*.
- The requirement to transfer a **Safety Document** (under **Senior Authorised Person Supervision**) at every shift change.

Explanation: It is not reasonable to expect an *Offshore Working Party* to be authorised conventionally when the work and testing they undertake requires such unconventional working practices – which they specialise in. *Marine Cable* repair contractors are highly capable specialists and will be appropriately selected to ensure their employees have suitable technical skills, knowledge, understanding and experience of the specific aspects of *Marine Cable* repair. The content of basic safety rule training is not relevant to offshore work.

The infrequent nature of offshore working and the required level of training and competence, in addition to the offshore number of workers, across three shifts, make it infeasible for one or more SP Energy Networks **Senior Authorised Persons** or **Authorised Persons** to be present offshore to undertake responsibilities and provide an appropriate level of supervision. In some cases attempting to comply with these requirements would result in a higher overall level of risk and/or no discernible improvement in the safe delivery of the work or testing. Experience within National Grid of attempting to implement a procedure that enabled the Safety Rules to be followed more closely was that it was too complicated for the international marine crew to adopt, introducing significant complexity for negligible benefit. Furthermore, the requirement for the **Safety Documents** to be cancelled and other **Safety Documents** issued through the course of work and testing make it impracticable to have the recipient offshore.

OPSAF-10-005 (PSSI 5).

- The requirement for the person in charge of work or testing to be in receipt of a **Safety Document** and be personally instructed by the **Senior Authorised Person** at the point of work.
- The requirement to spike a cable before cutting, using a spiking gun applied to the cable and subsequently cut by, or under the **Personal Supervision** of, the **Senior Authorised Person**. Also the requirement for subsequent cuts to be under the **Personal Supervision** of the recipient of the **Safety Document**.
- The requirement for the cable to be marked at the point of work by the **Senior Authorised Person** issuing the **Permit for Work**

Appendix 1:

- The requirement for the **Senior Authorised Person** to personally identify the cable to be worked on
- The requirement for the **Senior Authorised Person** to provide **Immediate Supervision** of the spiking operation
- The requirement for the insulation properties to be tested after spiking, before removal of the spiking gun

Explanation: It has already been identified that it is not feasible for a **Senior Authorised Person** to attend an offshore **Location** – especially sub-sea. It is common practice to identify *Marine Cables* using divers or Remote Operated Vehicles. Cable records are to a highly accurate standard with low risk of subsequent movement and *Marine Cables* carry specific markings. Combined with much reduced congestion on the sea-bed and the use of remotely operated cable cutting equipment the risk and impact of mis-identifying a cable is significantly lower. The use of sub-sea cameras and position detection equipment enables a **Senior Authorised Person** to agree cable identification without a requirement to be positioned offshore at the cable **Location**.

OPSAF-10-009 (PSSI 9).

- The requirement to visibly identify the test area boundary in accordance with OPSAF-10-006 (PSSI 6)
- The requirement for the recipient of the **Sanction for Test** to secure access to the remote ends of a cable under test.

Explanation: This procedure achieves the equivalent of having a **Sanction for Test** recipient at the point of work. If a *Marine Cable* is being tested to/from a cut end aboard a vessel it is infeasible for demarcation equipment to be delivered offshore, given the vessel's work area is itself self-defined. In addition, there is unlikely to be any other **Apparatus** aboard the vessel which may present **Danger** which is required to be distinguished from the *Marine Cable* under test.

9.1 Permanently Disconnecting the Marine Cables

A number of *Marine Cable* repairs were undertaken early in the post-commissioning stage by Permanently Disconnecting the *Marine Cable* by removal of sections of busbar at the *HVDC Converter Stations* and declaring the *Marine Cables* 'off rules'. Although OPSAF-10-027 (PSSI 27) does refer to this option for work on the *Marine Cables*, the effort to remove busbars, formally manage the **HV System** change, reinstate busbars etc is an unnecessary complication and distraction and has no benefit to the repair other than to provide physical separation for procedural reasons. There are fully-rated disconnectors and earth switches at each end of the cables – intended for use in this eventuality – and the removal of the busbars takes time and requires personnel availability at a point when critical focus is required on achieving the cable repair.

9.2 Contractor Capability

The *Marine Cable* contractors are international operators specialising solely in *Marine Cable* operations. Whilst SPEN has little influence over the process that the contractor needs to follow to locate and remedy the fault, SPEN can influence standards, hold points, briefings, communication etc

Repair processes can involve a workforce of over 130 experienced offshore personnel, and two or more specialist vessels equipped with the latest GPS, satellite communications, wi-fi, etc. With such a large and varied workforce good clear communication between land and sea is crucial and communication between the **Senior Authorised Person** and the vessel(s) must be maintained throughout work and testing, therefore the roles defined in section 8 are required.

Multiple vessels may be used during both testing and repair. If this is the case a lead vessel shall be appointed to be responsible for cascading communications between vessel and land-based staff.

There is no requirement for any of the cable repair staff, the captain or auxiliary staff to be authorised under the ScottishPower Safety Rules (Electrical & Mechanical). They shall however be fully conversant with the planned operation, the management structure when offshore and the communication methods in use.

It is accepted that overall control of marine safety including wellbeing of crew and safe operation of the vessel will fall to the Captain. If there is an incident at sea or conditions change they can implement their own safety or emergency procedures as required and can instruct all work or testing to cease and return the vessel to port or other safe position if required. Such incidents could be but are not limited to:

- Adverse weather or storm conditions
- Mechanical issues on board
- Medical emergency

10. PROCEDURE FOR TESTING MARINE CABLE

- 10.1 A specialist contractor shall be appointed who shall be able to demonstrate competence and experience in **High Voltage** cable systems and be conversant in *Marine Cable* repair practise.
- 10.2 The contractor shall submit a detailed risk assessment and method statement (RAMS) for the work and testing, including:
- Confirmation of division of responsibility with Energy Networks responsible for **Safety from the System** and the contractor responsible for **General Safety** offshore.
 - Description and functional proving of communication channels between land and vessel(s) and between vessels whilst at sea
 - Clearly definition of the work areas with reference to physical attributes (e.g. cable deck, jointing tent etc).
 - The process for the application of test voltages or signals under a **Sanction for Test**
- 10.3 The **Senior Authorised Person** shall acquaint them self with the intended testing approach and shall agree communication and liaison arrangements, including the hold points at specific milestones requiring liaison, for example when there is a requirement to remove or apply an **Earthing Device**, or when applying test voltages etc.
- 10.4 On confirmation of required **Safety from the System** precautions being completed by National Grid and confirmed to relevant **Control Person** a **Sanction for Test** shall be issued by the **Senior Authorised Person** in charge of testing to them self.
- 10.5 Overall control of testing procedures will be responsibility of recipient of the **Sanction for Test**. This will include testing from both Hunterston *HVDC Converter Station* and Flintshire Bridge *HVDC Converter Station* and all testing being carried out on the vessel(s).
- 10.6 There is no requirement for the **Senior Authorised Person** to provide **Immediate Supervision** (or, where required, **Personal Supervision**) at the offshore **Location** as would normally be required of a **Safety Document** recipient during the course of work or testing. The **Senior Authorised Person** shall instead establish regular and robust liaison with the contractor at frequent intervals via the *Offshore Installation Manager* during the normal working day. Regular out-of-hours contact is unlikely to be required.
- 10.7 Requests relating to the removal of **Primary Earth(s)** or other **Earthing Devices** to facilitate testing shall be passed to the **Senior Authorised Person** holding the **Sanction for Test**. Positive confirmation shall be received that all testing has ceased prior to **Switching** being carried out. The **Senior Authorised Person** holding the **Sanction for Test** may then carry out, or instruct others to carry out, **Switching** or shall request National Grid to remove required **Primary Earths** or other **Earthing Devices** as required at Flintshire Bridge *HVDC Converter Station*.
- 10.8 Application of test signals and equipment at Hunterston *HVDC Converter Station* shall be carried out under the **Immediate Supervision** of the **Senior Authorised Person** and agreed and communicated with all parties both on land and at sea.
- 10.9 Where application of test signals is required at Flintshire Bridge *HVDC Converter Station* this shall be requested by the recipient of the **Sanction for Test** and confirmed by a National Grid **Authorised Person** as being completed.

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- 10.10 Where test signals are required to be applied from a vessel the method and sequence shall be detailed in RAMS and agreed by the **Senior Authorised Person**. Where this requires removal of **Earthing Devices** at either *HVDC Converter Station* this shall be requested to the recipient of the **Sanction for Test** who will carry out required **Switching** or request **Switching** to be carried out by a National Grid **Authorised Person**.
- 10.11 When, under a **Sanction for Test**, a tone is injected into the cable from remote end(s) for several days with no requirement to interrupt or adjust the test equipment, it is acceptable that the test area may be vacated with **Primary Earth(s)** removed and test equipment still energised. Once the test equipment is running and stable, personnel shall be excluded from the test area and the area secured such as to restrict access to personnel. Access shall only be gained to the test area whilst **Primary Earth(s)** are removed when under the **Immediate Supervision** of the recipient of the **Sanction for Test**.
- 10.12 The cable shall be positively identified by **Senior Authorised Person** before work commences. Where being at the **Location** does not significantly aid positive identification (e.g. if a remote vehicle on the seabed is producing the image) this assessment and agreement may take place with the **Senior Authorised Person** on land.
- 10.13 During the identification process there is no requirement for the **Senior Authorised Person** to be at point of test nor is there a requirement to spike the Marine Cable. It is expected that the **Senior Authorised Person** shall be monitoring the work from land and be in constant communication with the *Offshore Installation Manager* during this process. They shall only give instruction to cut cable once they are satisfied that correct cable has been identified.
- 10.14 When the cable ends are brought onto the vessel(s) they shall be labelled in agreement with the **Senior Authorised Person**. The unique identification marking on each cable may provide a means of identification. Where there is any doubt all cables shall be made safe and positively identified using **Approved** testing procedures.
- 10.15 If contact cannot be maintained between the **Senior Authorised Person** and the vessel(s) offshore, then testing shall cease.
- 10.16 There is no requirement to implement the requirements of OPSAF-10-006 (PSSI 6) for offshore test areas. However, all test areas within Hunterston *HVDC Converter Station* shall comply with OPSAF-10-006 (PSSI 6) and OPSAF-10-009 (PSSI 9).
- 10.17 The contractor shall ensure strict adherence to the RAMS. Where several vessels are involved in the testing, the contractor shall ensure appropriate co-ordination between vessels with a suitable management structure in place.
- 10.18 Where the Captain has instructed testing to cease due to a marine incident this may happen without reference to the **Senior Authorised Person** and all testing on board may be stopped immediately. As soon as practicable the *Offshore Installation Manager* shall communicate to the **Senior Authorised Person** that testing has to cease who shall instruct that all test equipment be removed and **Primary Earths** be restored until confirmation is given that testing can resume.
- 10.19 On completion of testing the **Senior Authorised Person** shall confirm that all earths at Hunterston *HVDC Converter Station* have been replaced and shall request confirmation from National Grid that all earths at Flintshire Bridge have been replaced and also confirm with the *Offshore Installation Manager* the status of the *Marine Cable* and that all testing shall now cease.
- 10.20 The **Sanction for Test** may be cleared and cancelled.

11. PROCEDURE FOR WORK ON MARINE CABLES.

- 11.1 A specialist contractor shall be appointed who shall be able to demonstrate competence and experience in **High Voltage** cable systems and be conversant in Marine Cable repair practise.

The contractor shall submit a detailed risk assessment and method statement (RAMS) for the work, including:

- Description and functional proving of communication channels between land and vessel(s) and between vessels whilst at sea
- Clear definition of the work areas with reference to physical attributes (e.g. cable deck, jointing tent etc).
- Proposal for the management of **General Safety** throughout work, including managing induced voltage when working on the *Marine Cable*. This should detail the equipment to be used and precautions that will be taken throughout the work and shall be agreed with the **Senior Authorised Person** prior to work commencing.

- 11.2 On completion of all required testing a **Permit for Work** shall be issued to carry out the repair work on board the vessel(s). As the **Permit for Work** is likely to be issued with vessel(s) and *Offshore Working Party* already at sea it is impracticable for this **Safety Document** to be issued to an offshore recipient.

The main purpose of the **Permit for Work** will be to confirm the **Safety from the System** precautions taken on land and it will detail all **Points of Isolation** and **Primary Earths** applied at both Hunterston and Flintshire Bridge. The **Permit for Work** will therefore be issued to one of the following:

- The **Senior Authorised Person** in charge of the work
- A suitably **Authorised Person** appointed by the *Marine Cable* contractor who has the required knowledge and experience of *Marine Cable* operations including the co-ordination of such repairs and be authorised to receive the **Permit for Work**. This person may remain on shore throughout the work.

- 11.3 Where the **Permit for Work** is issued to the **Senior Authorised Person** all **General Safety** requirements and co-ordination of repair work on board the vessel(s) including management of induced voltage and required precautions are the responsibility of the appointed specialist contractor. The responsibility of the **Senior Authorised Person** is to confirm that all **Safety from the System** precautions are in place and remain so throughout the work.

- 11.4 As work on board the vessel(s) will continue around the clock there is no need to transfer the **Permit for Work** on a shift by shift basis or issue multiple documents to provide 24 hr cover. If the recipient has to leave the project for a prolonged period (e.g. sickness), then the **Permit for Work** shall be transferred to a new recipient.

- 11.5 If the recipient of the **Permit for Work** changes, the *Offshore Installation Manager* shall be notified and receipt of notification of the new recipient shall be confirmed in writing. Shift handovers for the *Offshore Installation Manager* shall be recorded and the records made available to the **Senior Authorised Person**. Similarly, handovers carried out as part of crew change shall be recorded.

- 11.6 The recipient of the **Permit for Work** shall remain in regular communication with the *Offshore Installation Manager* throughout the work as to ensure land-based staff are kept updated on

work progress. The frequency of contact should be agreed by all parties and maintained throughout work.

- 11.7 There is no requirement for the work area on board the vessel(s) to comply with OPSAF-10-006 (PSSI 6). It would be expected that the specialised contractor would implement their own safe system of work and detail this in the RAMS agreed prior to work commencing.
- 11.8 Where the Captain of the vessel has instructed the work to cease due to a marine incident this may happen without reference to the recipient of **Permit for Work** and all work at sea may be stopped immediately. When practicable the *Offshore Installation Manager* shall communicate this to the recipient of the **Permit for Work** and the **Senior Authorised Person**. Work shall not resume until agreement is in place between the Captain, *Offshore Installation Manager*, **Senior Authorised Person** and the recipient of the **Permit for Work**.
- 11.9 On completion of work the *Offshore Installation Manager* and the recipient of **Permit for Work** shall agree that all work is now complete and no further work on the cable shall be carried out. They shall also confirm that the **Safety Document** shall be treated as cancelled from this point.
- 11.10 The **Permit for Work** shall be cleared and cancelled.
- 11.11 SP EnergyNetworks may appoint an independent Marine Cable expert to board the vessel(s). They would be responsible for providing assurance that the method, quality and management of work is undertaken as agreed.