ENGINEERING COMMISSIONING PROCEDURE

ECP 11-0007

HV POLYMERIC CABLE SHEATH TESTING PROCEDURE

Network(s): EPN, LPN, SPN

Summary: This document details the sheath testing procedure for all new polymeric insulated underground cables, which shall be satisfied before a section of underground cable can be accepted for connection onto the UK Power Networks underground cable systems.

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Approved By: Paul Williams Approved Date: 16/02/2017

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## Revision Record

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**Why has the document been updated:** Alignment with other referenced documents.

**What has changed:**
- Document references updated (Sections 3 and 5).
- Test form references updated (ECP 11-0007a)

Document reviewed and review date extended

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**Why has the document been updated:** Renumbered to align with other commissioning documents and referenced documents updated.

**What has changed:**
- Document renumbered from ECP 11-0505 and format updated.
- Reference to HV insulation testing document reference updated (Sections 5 and 6.2).
- Test form ECP 11-0007a renumbered from ECP 11-0505a and updated to reflect above changes.

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Original
HV Polymeric Cable Sheath Testing Procedure

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1 Introduction

1.1 This procedure details the sheath testing requirements for all new polymeric insulated underground cables, which shall be satisfied before a section of underground cable can be accepted for connection onto the UK Power Networks underground cable systems.

1.2 This procedure shall be carried out by the Commissioning Engineer or his appointed representative, who shall be an Authorised Person having appropriate training and experience.

1.3 This procedure shall be carried out in accordance with the requirements of the UK Power Networks Distribution Safety Rules.

1.4 This procedure assumes that the underground cable has been installed in accordance with ECS 02-0019 (Installation of Underground Cables LV to 132kV).

1.5 The results of all tests, adjustments and all relevant remarks shall be recorded on the appropriate test form.

2 Scope

2.1 This procedure and the associated test form(s) applies to the sheath testing of 6.6kV, 11kV, 20kV, 33kV, 66kV and 132kV polymeric insulated underground cables.

2.2 Although not specifically covered within this procedure the principles can be applied to the sheath testing of any section(s) of polymeric insulated underground cable. The actual process should be agreed between the Authorised Person and the Control Engineer.

3 References

3.1 This procedure should be read in conjunction with the following references:

- HSS 40 043 High Voltage System Phasing Checks.
- ECP 11-0006 HV Insulation Testing.
- ECS 02-0019 Installation of Underground cables LV to 132kV.

3.2 This procedure should be used with the following test forms:

- ECP 11-0007a Cable Sheath Test Form.
- ECP 11-0501a Secondary Substation Commissioning Form.
4 Equipment

4.1 The following test equipment is required to carry out the tests detailed in this procedure:

- High voltage testing equipment (5kV insulation resistance tester or HV DC test set).

5 Cable Testing Procedure

5.1 Record the cable circuit section details on the test form ECP 11-0007a.

5.2 Carry out the cable sheath tests on each section of new HV cable prior to them being jointed together in accordance with ECP 11-0006 and record the results on the test form ECP 11-0007a.

5.3 Joint all new sections of cable together using approved joints, except the ends of the sections which will be either terminated directly onto an item of switchgear, an overhead line or an existing section of underground cable.

5.4 Carry out the cable sheath tests on the complete length of new HV cable prior to it being connected to the existing network in accordance with ECP 11-0006 and record the overall results on test form ECP 11-0007a and ECP 11-0501a (if commissioning a secondary substation).

6 Sheath Testing Procedure

6.1 Overview

6.1.1 The energisation process detailed in this section is based on high voltage system phasing checks outlined in HSS 40 043. The process shall be carried out in accordance with the Distribution Safety Rules ensuring that the correct safety documentation is in place.

6.2 Single Continuous Length of Cable Procedure

6.2.1 The new section of cable is named New Cable. It has been inserted in a ring between existing substations Sub A and Sub B as shown below.
6.2.2 The new section of cable shall not be physically connected to the network and all three single core cables to be tested, shall have both ends prepared so that the copper or aluminium wire screens are separated from both the ends of the cable and the surrounding general mass of earth as shown below.

6.2.3 The HV test equipment is connected between the screen wires at one end and a temporary earth stake driven into the ground adjacent to the ends to be tested, for each single core cable in turn. The test voltage as specified in ECS 11-0006 shall be applied for the required duration and the results recorded on test form ECP 11-0007a.

6.2.4 If the section of cable does not carry the voltage specified for the required duration, the sheath test has failed and the sheath fault shall be located and repaired before the test is repeated. The following minimum values shall be achieved:

- HV DC pressure test the maximum leakage current shall not exceed 10mA.
- 5kV insulation resistance tester $\geq 100\,\text{M}\Omega$.

6.3 Multiple Lengths of Cable Procedure

6.3.1 For simplicity, the following example only illustrates two sections of cable being jointed together to form a connection between two substations, but the same procedure would apply for any number of cable lengths.

6.3.2 The new cable circuit named *New Cable Circuit A* comprises of two new sections of cable are named *New Cable A* and *New Cable B*. It has been inserted in a ring between existing substations *Sub A* and *Sub B* as shown below.
6.3.3 Each new section of cable, for example *New Cable A* shall not be physically connected to the network and all three single core cables to be tested as specified in sections 6.2.2 and 6.2.3 of this document. The same tests shall then be carried out on *New Cable B*.

6.3.4 If a section of cable does not carry the voltage specified for the required duration or the maximum leakage current exceeds 10mA, the sheath test has failed and the sheath fault shall be located and repaired before the test is repeated.

6.3.5 If all sections of cable pass the required tests the new section of cable can be jointed together to form the *New Cable Circuit A*.

6.3.6 The complete cable circuit, *New Cable Circuit A* shall then be prepared and tested as specified in sections 6.2.2 and 6.2.3 of this document.

6.3.7 If the cable circuit does not carry the voltage specified for the required duration, the sheath test has failed and the sheath fault shall be located and repaired before the test is repeated. The following minimum values shall be achieved:

- HV DC pressure test the maximum leakage current shall not exceed 10mA;
- 5kV insulation resistance tester $\geq 100\,\Omega$.

6.4 Cable Sheath Fault Location Equipment

A number of different types of cable sheath fault location equipment are available on the market. The most commonly used type is the Biccotest Magpie system.

6.5 Cable Sheath Fault Repairs

Cable sheath fault repairs shall be completed using the methods and materials detailed in the relevant UK Power Networks Jointing Manual.

7 Test Equipment

7.1 Record the make, type, serial or asset number and calibration date of all test equipment used during commissioning on the test form.

8 Certification

8.1 When all the tests have been satisfactorily completed, sign and date the test form. The completed test form should be filed with the relevant job pack.