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# OPS/ 007 /001 – Operational guidance and Training requirements associated with the Trial of Secondary transformers equipped with an integral on load tap changer.

## 1. Purpose

As part of the Customer-Led Network Revolution project, Northern Powergrid will install and trial 3 Distribution transformers with integral on load tap changers (OLTC) at Wooler Bridge, Darlington Melrose and Mortimer Road 45548 substations.

This document provides operational guidance and specifies the training requirements for individuals who are to access, operate or work at locations where a distribution transformer equipped with an OLTC has been installed and commissioned.

This document supersedes the following documents, all copies of which should be destroyed.

Ref	Version	Date	Title
N/A	N/A	N/A	N/A

## 2. Scope



Pictured are the Transformers as delivered from MR (Maschinenfabrik Reinhausen) to Castleford depot.

Transformers are configured with their HV windings connected through the tap changer with 9 tap positions, giving a range of +/- 8% in 2% increments.

The Transformer tap changer controls can be operated locally or remotely via a host connection.

This document outlines the approved operational procedures to allow safe access, operations and work at sites where these units are installed.

The transformers are being installed to improve voltage regulation on the trial networks and utilise a three phase 9 position tap changer which is oil filled and of a combined selector/diverter construction that requires inspection after either 2 years or 50,000 taps whichever occurs first.

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At all trial sites the transformer tap changer control panel is located to ensure physical separation between the operator and the Transformer/OLTC unit. In the event of a disruptive failure of the unit, operator safety will be ensured as a result of the operator being remote from the Transformer/OLTC unit or by physical separation behind a reinforced partition wall.

Programming of the OLTC and any work related to the communication connections of the control mechanism Tapcon 230 are outside the scope of this document. Manufacturers OEM procedures shall be followed when commissioning, configuring or connecting this device.

All CLNR assets will be secured/ locked in accordance with current operational locking policy utilising stop and think rings or operational locks where appropriate.

Local operation of the OLTC is not permitted with the unit LIVE.

**Access restrictions apply to all CLNR trial sites where Transformers equipped with OLTC are installed and the unit is LIVE.**

### 3. Procedure

#### 3.1. Site identification

All assets installed as part of Northern Powergrid's CLNR project are suitably labelled on site and are recorded within the Company's asset registers and on all other asset recording systems GIS, Mains records and the Network Management System where appropriate. Confirmation of site location shall be by reference to the operational labelling on site.

#### 3.2. PPE requirements.

While operating or working at a CLNR Trial site PPE will be worn at all times in accordance with the DSR/OPM and the Northern Powergrid Arc Flash Personal Protective Equipment (PPE) requirements.

#### 3.3. Authorisation requirements.

Staff requiring access to CLNR Trial sites will be in possession of the following authority codes:-

A1 or A1.1 (Substation access competence)

O2 or O2.1 (LV switching competence to select tap-changer to non – auto or auto)

LV authorised staff carrying out LV switching / testing and holding authorisation code O2.1 are permitted to set the OLTC to non-automatic for the duration of the activity and reset to automatic on completion of the activity under the authority of the HV control engineer.

Staff required to operate the on load tap-changer will be in possession of the following authority codes:- O4.5, O7.5, O8.4 (Tap changer operations competence). All LIVE tap-changer operations involving the changing of tap position shall be carried out from the remote control panel.

Any work associated with the OLTC or associated control panel requires the appropriate HV authorisation code, only staff that hold operational code O4.5, O7.5, O8.4 or have had specialist training highlighted and approved by the Safety Health and Environment Team are authorised to configure this equipment in line with the procedures contained in this document.

(See training requirements table in Appendix 1)

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### 3.4. Operational Procedures

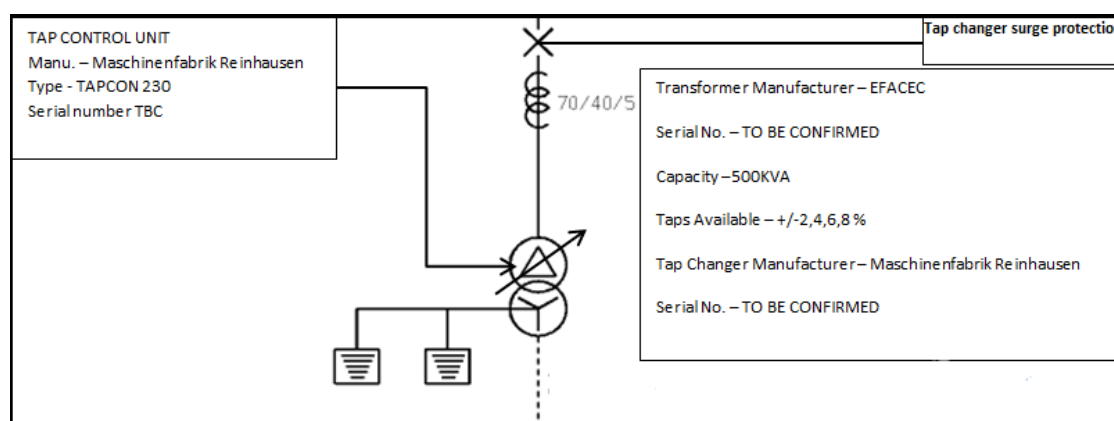
#### 3.4.1. Access/Egress to CLNR Trial sites.

All CLNR Trial sites containing Transformer/OLTC units are designated as “Restricted Access” sites. Labels are fitted to the appropriate access doors notifying staff of the restricted access arrangements. Prior to entry into the site, contact shall be made with the HV Control Engineer. The Control Engineer will issue appropriate instructions to set the tap-changer on site to Non - Auto. (See section 3.5.2 for the detailed operational instructions).

#### 3.4.2. Operations at CLNR Trial sites.

All High Voltage and Low Voltage operations at trial sites will be carried out in accordance with Northern Powergrid’s DSR/OPM. In addition the OLTC on site will be selected to Non – Auto, under the instruction of the HV Control Engineer and will remain on Non - Auto for the duration of operations. On completion of the required operations the OLTC will be returned to Auto operation under the instructions of the HV Control Engineer.

#### Schematic Overview



#### 3.4.3. Work on Low voltage Apparatus at CLNR Trial sites.

All work on Low Voltage Apparatus at CLNR trial sites will be carried out in accordance with Northern Powergrid’s DSR/OPM. In addition the OLTC on site will be selected to Non – Auto, under the instruction of the HV Control Engineer and will remain on Non - Auto for the duration of the works. On completion of the required works the OLTC will be returned to Auto operation under the instructions of the HV Control Engineer.

The motor supplies and the voltage reference for the OLTC are supplied from a designated LV Distributor, the records of which shall be available on site. In all circumstances where the distributor LV Fuses operate or are removed on the designated distributor this will render the OLTC inoperative.

#### 3.4.4. Work on High Voltage apparatus at a CLNR Trial site

All work on High Voltage Apparatus at CLNR trial sites will be carried out in accordance with Northern Powergrid’s DSR/OPM. In addition the OLTC on site will be selected to Non – Auto, under the instruction of the HV Control Engineer and will remain on Non - Auto for the duration of the

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works. On completion of the required works the OLTC will be returned to Auto operation under the instructions of the HV Control Engineer.

Where work is to be carried out on the Transformer/OLTC unit all necessary auxiliary tap change supplies will be isolated and a caution notice posted at the low voltage points of isolation.

#### **3.4.5. Work at a CLNR trial site that affects the LV network supply arrangements.**

In circumstances where the LV network at a CLNR Trial site is to be supplied from an alternative source (network transferred or generation) the OLTC shall be selected to Non- Auto operation. This will ensure tap change operations are not initiated as a result of variations in supply from the alternative source.

Note: The voltage reference is taken from the same feed as the motor drive supply.

### **3.5. OLTC controls and operating instructions**

**Access to substations fitted with this transformer tap changer is restricted. This requires the permission of the control engineer.**

All operations associated with the OLTC on site shall be carried out under instruction from the HV Control Engineer.

Use the switch labelled 'CONTROL SELECT' (S32) on the regulator switch panel and switch from automatic to manual "AUTO" to "MAN" or "MAN" to "AUTO". See 3.5.2 for more information.

#### **3.5.1. Tapcon 230 Regulator and Relay Control Panel**

The Control system on site consists of a regulator switch panel and relay control panel that work together to control the transformer and OLTC.

The pictures below show the regulator switch panel and Tapcon 230 Control Panel with associated labelling to assist understanding with the following Operation Instructions.

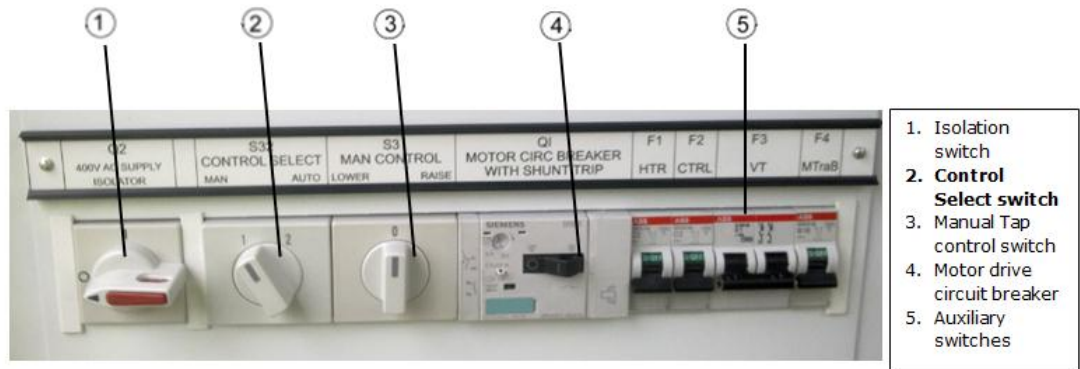
#### **3.5.2. Switching Between Manual and Automatic on the regulator switch panel**

The device can be operated in the following operating modes, manual or automatic. See the Regulator switch panel picture following. The MAN/AUTO control select switch S32 is the second switch from the left.

In auto mode (**AUTO**), the voltage is automatically controlled in accordance with the set parameters in the relay protection unit.

In manual mode (**MANUAL**), no automatic control occurs (TAP FREEZE), the Tapcon230 relay control is overridden. The motor-drive unit can be controlled via the regulator switch panel, using the manual control lower and raise switch (S3).

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Regulator switch panel

### 3.5.3. Switching operations on the relay control panel (for protection or trained personnel ONLY)

REMOTE/MANUAL/AUTO modes of the relay control panel

In remote mode (**REMOTE**), commands from an external control interface are executed. In this case, manual operation of the relay control panel **Raise and Lower** keys is disabled.

In manual mode (**MANUAL**), commands from the external interface are disabled. Manual operation of the relay control panel control **Raise and Lower** keys are enabled.

In auto mode (**AUTO**), commands from the external interface are disabled, manual operation of the relay control panel control **Raise and Lower** keys are disabled.

To switch between each mode use the buttons to the left hand side of the Control display. The Keypad may be locked, pressing the 'Esc' and 'F5' keys simultaneously will unlock the keypad.



Tapcon 230 relay control panel

### 3.5.4. Resuming normal operation

On completion of the work and after the LV/HV network has been restored, contact System Control to advise them of the current status of the OLTC Control. Follow their instructions as to the mode in which to leave the OLTC control (Manual/Remote/Auto). If the Keypad was locked at the start of the operations, re-lock using the 'Esc' and 'F5' buttons simultaneously. Remove Caution Notice and secure Control Panel with a STOP and THINK ring.

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### 3.5.5. Connection of Synchronising Generators

Prior to the connection and synchronisation of a Generator set to the Associated transformer LV board then the Tap changer shall be set to manual using the S32 control switch in the **MAN** position as in section 3.5.2.

## 3.6. Procedures in the Event of a Fault/Emergency

**If the Transformer/OLTC on site shows any signs of distress then unit shall be made dead by remote switching and operations will be in accordance with OPM section OA2.1**

### 3.6.1. Failure of Transformer/OLTC

If an on-site failure of an OLTC transformer has occurred; all staff on site shall be informed immediately to keep a safe distance from the transformer until such time as it has been confirmed by the Senior Authorised Person that the transformer has been made safe in accordance with the DSR/OPM.

LV supplies to the OLTC shall be made dead and isolated as soon as practicable by withdrawing the fuses/links associated with these supplies. These shall be clearly labelled on site, Caution Notices shall be posted at all points of isolation.

### 3.6.2. Failure of the Tapcon 230 Control Panel

In the event of the Tapcon 230 Control Panel failing then both the Control Panel and the external OLTC supply shall be isolated and made safe by removal of the associated links/fuses, where possible this will be locked off and a Caution Notice posted.

## 4. References

### 4.1. External Documentation

Reference	Title

### 4.2. Internal documentation

Reference	Title

## 5. Definitions

Reference	Title
CLNR	Customer Led Network Revolution
DSR	NPG Distribution Safety Rules
OPM	Operational Practice Manual

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## 6. Authority for issue

### 6.1. CDS Assurance

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		Sign	Date
Lynn Donald	Governance and Risk Officer	Lynn Donald	28/08/13

### 6.2. Author

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		Sign	Date
Ian Lloyd	LCNF Network Manager	Ian Lloyd	29/08/13

### 6.3. Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

		Sign	Date
Mike Storey	Operations Assurance Manager	Mike Storey	29/08/13
Paul Norton	Head of Safety	Paul Norton	29/08/13
Geoff Earl	Director of Safety, Health & Environment	Geoff Earl	02/09/13

### 6.4. Authorisation

Authorisation is granted for publication of this document.

		Sign	Date
Nick Gill	Field Operations Director	N Gill	06/09/13

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## Appendix1 Training Requirements

### Training Check-List

<u>Activity</u>	<u>Evidence displayed</u>	<u>Signature</u>
Demonstrate competence in the operation of the Tapcon 230 and Control Panel activity keys and switches	Able to switch the Regulator and Tapcon 230 through sequence of Manual/Auto/Remote. Also able to disable/enable Keypad locking	
Demonstrate competence in the isolation of the Control Panel links/fuses and subsequently making safe for work to proceed	Able to identify the point/s of isolation and safely isolate the Control Panel from the supply	
Demonstrate competence in the isolation of the OLTC external supply links/fuses and subsequently making safe for work to proceed	Able to identify the point/s of isolation and safely isolate the OLTC drive from the supply	
Demonstrate competence in restoration of the Control Panel and/or the OLTC external supply	Able to identify the point/s of isolation and safely isolate the OLTC drive from the supply	
Can identify the procedures relating to the failure of an OLTC transformer	Able to describe the procedures in the event of an OLTC transformer failure	
Can identify the procedures relating to the failure of an OLTC drive mechanism	Able to describe the procedures in the event of an OLTC drive mechanism failure	