DISTRIBUTION COMMISSIONING FORM (DCF) 4.8 – Voltage regulator (star connection)

Purpose: This instruction covers the testing and commissioning of all replacements or new installations of Star-connected voltage regulators before energisation.

For more information refer to the *Distribution Commissioning Forms Guideline (EDM 34137510)*

Notes: The following tests must be carried out after installation and before the regulator is put into service.

Address/Pole No.			
Work Package No.		**SPIDAWeb Pick ID:**	

1. Pre-Installation Checks

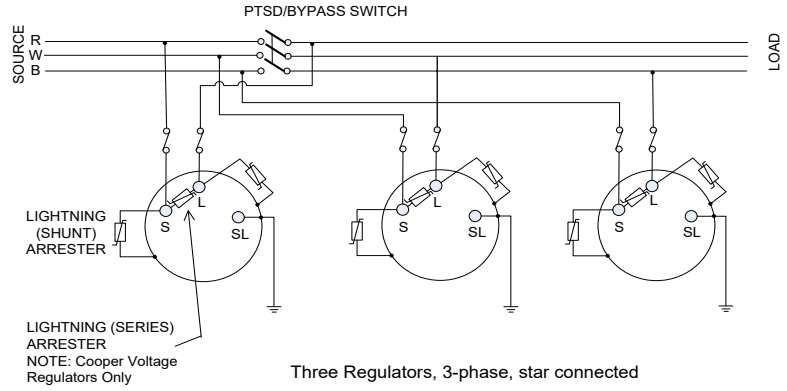
Earth resistance test and nameplate	Ensure that the earth resistance test result is acceptable (DCF 4.1).	☐
	Ensure that the voltage regulator rating matches the system voltage.	☐

2. Insulation Resistance Test

Use a 5 kV insulation resistance tester. Measure the resistance after 1 minute of testing.	Short together the S, SL, and L bushings using fuse wire or shorting cables/clamps. Connect the insulation resistance tester between the shorted bushings and earth. The regulator **must** be in a neutral tap position.	Test Results		Acceptable Results
		VR1	MΩ	1,000 MΩ/1 GΩ
		VR2	MΩ	
		VR3	MΩ	

3. Installation Check

Structure	Check that the construction complies with the distribution construction standards and applicable design drawings (DCSH H-33).							☐
	Check the regulator for damage, cracks, oil leaks, bushings and excessive dirt.							☐
	Ensure that the earthing system is complete and undamaged.							☐
	Ensure that insulated caps or extension skirts are fitted (if required).							☐
Nameplate plug indicator connection	Check that the plug indicator is set at the voltage at which the voltage regulator has been connected for each phase.							☐
	Example: Cooper							
	TAP IN USE	LOAD VOLTS	CONTROL WDG TAP (TANK)	INTERNAL PT RATIO	RCT TAP (CONTROL)	TEST TERMINAL VOLTAGE	OVERALL POTENTIAL RATIO	R
	O	23,000	E1/P1	183.3 : 1	120	125.5	183.3 : 1	
	O	22,000	E1/P1	183.3 : 1	120	120	183.3 : 1	
	O	20,000	E1/P1	183.3 : 1	110	119	168 : 1	W
	O	19,100	E1/P1	183.3 : 1	104	120	159.2 : 1	
	O	15,000	E2/P2	119.8 : 1	120	125.5	119.8 : 1	
	O	12,700	E2/P2	119.8 : 1	104	122.5	103.9 : 1	B
	O	11,000	E3/P3	91.6 : 1	120	120	91.6 : 1	
	O	10,000	E3/P3	91.6 : 1	110	119	84.1 : 1	

<table>
<tr><td rowspan="8">Nameplate plug indicator connection</td><td colspan="6">Example: GE</td></tr>
<tr><td colspan="6">POTENTIAL AND CONTROL POWER</td></tr>
<tr><td colspan="2" rowspan="2">LOAD TERMINAL VOLTS</td><td rowspan="2">POTENTIAL RATIO</td><td rowspan="2">CONTROL VOLTS</td><td colspan="3">CONNECT</td></tr>
<tr><td>NN22 to</td><td>NN9 to</td><td>F1-2 to</td></tr>
<tr><td>O</td><td>22,000</td><td>183.3 : 1</td><td>120</td><td>NN21</td><td>T4-2</td><td>T4-3</td></tr>
<tr><td>O</td><td>19,100</td><td>159.2 : 1</td><td>120</td><td>NN21</td><td>T4-2</td><td>T4-1</td></tr>
<tr><td>O</td><td>12,700</td><td>105.8 : 1</td><td>120</td><td>NN20</td><td>T4-2</td><td>T4-4</td></tr>
<tr><td>O</td><td>11,000</td><td>91.6 : 1</td><td>120</td><td>NN20</td><td>T4-2</td><td>T4-3</td></tr>
<tr><td colspan="6">Note: For the GE controller, ensure that the connection of the power circuit board, which is located inside the control cabinet in the upper RHS corner, is wired according to the regulator nameplate.
Example: For 19,100 V, the power circuit board is connected NN22 to NN21, NN9 to T4-2, and F1-2 to T4-1.</td></tr>
<tr><td colspan="5">Confirm that the regulator is connected as per the diagram.</td><td>☐</td></tr>
<tr><td colspan="6"> 

Three Regulators, 3-phase, star connected</td></tr>
</table>

4. Handover of Responsibility for the Completion of Items 1-3

I hereby certify that items 1 to 3 have been completed with the above results and transfer control to the network operating authority.			
Checked by		BNA	
Signature		Date & Time	

1. **DO NOT ENERGISE THE REGULATOR**. All the high voltage disconnectors connecting the regulator to the high voltage line must be open.
2. The PTSD/BYPASS/ring main switch position must be set as per the network configuration.
3. Control unit doors must be locked with two (NMK2) Western Power approved padlocks.
4. Attach an **"Out of Service (Warning)"** tag to the padlock on the front of the control cabinet.
5. Inform NOCC of the status of the voltage regulator.
6. Ensure the work area is left tidy with no hazards to the public.
7. Hand over responsibility to Asset Operations/Operation Maintenance (Primary Response for commissioning.

5. Control Setting and Testing

<table>
<tr><td rowspan="4">Controller power supply setting instructions</td><td colspan="2">Select the power switch to OFF and the control switch to OFF.</td><td>☐</td></tr>
<tr><td>Cooper</td><td>GE</td><td></td></tr>
<tr><td>The knife switches on the back panel should be set with V1 (potential switch) and V6 (differential voltage, if fitted) closed and C (shorting switch) closed. V6 may be fitted to CL5A on earlier controllers.</td><td>The knife switches on the back panel should be set with DS1 (potential switch) closed and DS2 (CT shorting switch) closed.</td><td>☐</td></tr>
<tr><td colspan="2">Close the S (source) disconnectors.</td><td>☐</td></tr>
<tr><td></td><td colspan="2">Set the power switch to INTERNAL and the control switch to MANUAL.</td><td>☐</td></tr>
</table>

Controller power supply setting instructions	Operate the RAISE/LOWER switch to bring the regulator tap position indicator to the neutral position (zero), if required. The controller neutral lamp/LED is lit while in the neutral position. Check that the tap position indicator and the lamp/LED are synchronised before continuing.		☐
	Upload the settings to the control.		☐
	Cooper	GE	
	Measure the voltage at the voltmeter terminals to check if the measured voltage closely matches that of the voltage displayed on the panel.	Measure the voltage at the meter out terminals to check if the measured voltage closely matches that of the voltage displayed on the panel.	☐
	Cooper	GE	
	Depress 1, SET VOLTAGE (band centre) keypad.	Press the UP, DOWN and ENTER buttons until the display indicates the band centre.	☐
	Set the control switch to MANUAL. Operate the RAISE/LOWER switch to activate a raise operation. Allow the tap changer to operate for enough steps to take voltage out of the bandwidth. Set the control switch to AUTO. After a time delay (30 seconds), the control should cause the regulator to step down to the top bandwidth edge. **Note**: If bi-directional (Cooper) is set, it must be disabled (zero) before AUTO can be used. **Example**: A setting of 120 V (band centre) and 2 V bandwidth = 121 V top bandwidth edge should be shown in the display. When the voltage is in band and the tap changing has stopped, set the control switch to MANUAL.		☐ ☐ ☐ ☐ ☐
	Operate the RAISE/LOWER switch to activate a lower operation.		☐
	Allow the tap changer to operate for enough steps to take the voltage out of the bandwidth. Set the control switch to AUTO. After time delay (30 seconds), the control should cause the regulator to step up to the lower bandwidth edge. **Example**: A setting of 120 V (band centre) and 2 V bandwidth = 119 V lower band edge should be shown in the display. Set the control switch to MANUAL.		☐ ☐ ☐
	Operate the RAISE/LOWER switch and set the regulator to the neutral position. Reset the drag hands to zero.		☐
	Phase out and then close the L (load) disconnecting switch.		☐
	Open the bypass switch.		☐
	Cooper	GE	
	Open the CT shorting switch C and return the control switch to the AUTO position.	Open the CT shorting switch DS2 and return the control switch to the AUTO position.	☐

6. Handover of Responsibility

I hereby certify that item 5 has been completed with the above results and transfer control to the network operating authority.			
Commissioned by		BNA	
Signature		Date & Time	

Note: Bolts and screws in all electrical connections across the Western Power network must be properly tightened.
All lug crimps confirmed intact visually or with a pull test.

1. Ensure the work area is left tidy with no hazards to the public.
2. Hand over responsibility to the operating authority.
3. Return this form to the project file folder and file as a record of commissioning.
4. After the on-site project officer signs off on the DCF, a scanned copy of the DCF must be attached to the relevant project documentation.