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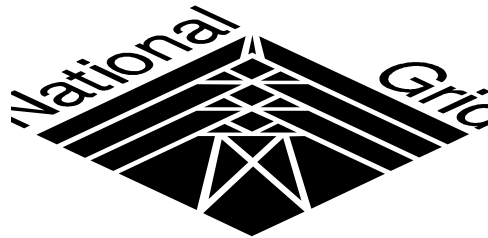
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Schedule of Site
Commissioning Tests
SCT 20.12.8
Issue 2
August 1998

GEC Quadramho (SHPM) Distance Protection

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Authorised for Issue by:

Chris Parker
Head of Protection & Measurements
Network Control and Telecommunications
Engineering & Technology

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Registered Office
National Grid House
Kirby Corner Road
Coventry
CV4 8JY

Registered in
England and Wales
No. 2366977

Published by:

The National Grid Company plc
Kelvin Avenue
Leatherhead
Surrey KT22 7ST

THE NATIONAL GRID COMPANY plc

SCHEDULE OF SITE COMMISSIONING TESTS

SCT 20.12.8 GEC QUADRAMHO (SHPM) DISTANCE PROTECTION

Station:

Circuit:

Manufacturer's Contract No:

Contractor's Signature:

NGC Contract No:

Accepted by:
(Engineer's Signature)

Contractor:

Date:

GEC QUADRAMHO (SHPM) DISTANCE PROTECTION

1 GENERAL DATA

1.1 CT Ratio

VT Ratio:

VT Type:

Capacitor/Wound:

1.2 Supplies

Trip Supply

Vdc

Relay Supply

Vx(1)

Vdc

Opto-Isolator Supply

Vx(2)

Vdc

Relay Rated Current

In

A

1.3 Local Primary Systems Diagram

1.4 Circuit Parameters

Line Angle

°

Line Length

km

1.5 Primary Impedances

Positive Sequence Z_1

Ω

Zero Sequence Z_0

Ω

Earth Fault Loop = $\frac{2Z_1 + Z_0}{3}$

Ω

1.6 Relay Serial No

(Caution: See notes on handling electronic equipment in Section 5)

Relay Type No

2 RELAY SETTINGS

2.1 Setting Data (refer to setting sheets provided)

<u>Z_{ph}</u>	<u>ZN</u>	<u>Zone 1</u>	<u>Z1Z</u>
K1 =	K4 =	K11 =	K15 =
K2 =	K5 =	K12 =	K3 = (If Quad
	K6 =	K13 =	option fitted)
		K14 =	

<u>Zone 2</u> <u>Zone 3</u>	<u>Zone 3 Rev</u>
-----------------------------	-------------------

K21 =	K31 =	K35 =
K22 =	K32 =	K36 =
K24 =	K33 =	K37 =
	a/b =	

Z ₂ Timer t _{z2} =	Blocking Timers t _p =
Z ₃ Timer t _{z3} =	t _D =

Power Swing DIL Switches

Z1 LH/RH
Z2 LH/RH
Z3 LH/RH
SW 9 LH/RH

Scheme Options DIL Switches

SW 8 LH/RH
SW 7 LH/RH
SW 6 LH/RH
SW 5 LH/RH
SW 4 LH/RH
SW 3 LH/RH
SW 2 LH/RH
SW 1 LH/RH

Ph phase angle =
N phase angle =

Mode of Operation

(required selection)

Plain

Accelerated

Block

CSN01

CSN03

CSN07

Selection No

X

Y

Aspect Ratio (Lenticular Zone 3)

Type of Signalling Equipment

2.2 Setting Applied

2.2.1 Ground Faults

$$\text{Zone 1} = \frac{K14 (K1 + K2 + K4 + K5 + K6) (K11 + K12 + K13)}{I_n} =$$

ohms

$$\text{Zone 2} = \frac{(K1 + K2 + K4 + K5 + K6) (K21 + K22) K24}{I_n} =$$

ohms

$$\text{Zone 3 (Reverse)} = \frac{(K1 + K2 + K4 + K5 + K6) (K35 + K36) K33 \cdot K37}{I_n} =$$

ohms

$$\text{Zone 3 (Forward)} = \frac{(K1 + K2 + K4 + K5 + K6) (K31 + K32) \cdot K24}{I_n} =$$

ohms

2.2.2 Phase Faults

$$\text{Zone 1} = \frac{2 \times K14 (K1 + K2) (K11 + K12 + K13)}{I_n} =$$

ohms

$$\text{Zone 2} = \frac{2 \times (K1 + K2) (K21 + K22) K24}{I_n} =$$

ohms

$$\text{Zone 3 (Forward)} = \frac{2 \times (K1 + K2) (K31 + K32) K33}{I_n} =$$

ohms

$$\text{Zone 3 (Reverse)} = \frac{2 \times (K1 + K2) (K35 + K36) K33 \times K37}{I_n} =$$

ohms

3 CALIBRATED TEST EQUIPMENT

(i) Record of Calibrated Test Equipment used during Commissioning

	<u>Manufacturer and Type</u>	<u>Serial No</u>	<u>Date Last Calibrated</u>	<u>Date Next Calibration Due</u>
<u>Insulation Resistance Tester</u>				
<u>Voltmeter or Multimeter</u>				
<u>Ammeter or Multimeter</u>				
<u>Injection Test Set</u>				
<u>Timer</u>				
<u>Others (state function)</u>				

4 WIRING

4.1 Insulation Tests. Caution: Use an electronic or brushless tester of 500 V d.c.

4.1.1 Measure insulation of VT Circuits to earth.

 MΩ

4.1.2 Measure insulation of CT Circuits to earth links are replaced.

 MΩ

4.1.3 Measure insulation resistance between the external d.c. terminals and including earths.

 MΩ

4.2 Insulation tests on general and cubicle wiring (see Document 099/500 Guidance Notes Issue 3).

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4.3 Inter Relay and Cubicle Wiring Checked to:

	NGC No	Manuf No
Circuit Diagram No		
Wiring Diagram No		

5 MECHANICAL INSPECTION

Caution: The equipment contains components sensitive to electrostatic voltage discharge. To avoid damage handle modules by the front plate, avoid contact with electrical components or connections and use electrostatic precautions.

- 5.1** Check proper mounting and access in addition to requirements of Guidance Notes contained in Document 099/500.

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- 5.2** Check fuse and links for correctness to standard and rating.

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- 5.3** Check that the module identification numbers agree with the list on the relay 'rating card' and that the relay ratings are as expected. (The 'rating card' is to be found inside the case at the top left hand end).

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- 5.4** Inspect each module for signs of damage, and check that the serial no painted on one PCB in each module is the same as that on the relay's front label.

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6 INITIAL CHECKS

Isolate the relay from the CT and VT by applying shorts between Terminals 1, 3, 5 and 7 on an MMLB01 test plug and inserting it into the MMLG test socket, thus shorting the CT, and disconnecting the CT and VT from the relay. Also remove CB trip links, remove the heavy duty bridging plugs and replace with test plugs.

- 6.1** Check voltage and polarity of the relay d.c. supply at the relay with a test plug in the 1Z slot. Red terminal 5 is positive and 6, negative.

- 6.2** On test plug 1Z link through (ie live-side to relay-side) terminal 5 and terminal 6 to connect the supply to the relay. Note that the red LEDS all light for a short time during the relay self test sequence.

- 6.3** On test plug 1Z link terminals 10. Check that the relay available LED on module 6 lights and that the 'main prot power supply fail' alarm clears.

7 CHECK TESTS USING TEST OPTIONS

7.1 Timer DIL Switch Settings

Check and record correctness of Timer DIL switch Settings using test options 54, 55 and 56

Test Option No	LED INDIC	A	B	C	Z ₂	Z ₃	AT	SOTF	VT~ FAIL
54	Zone 2 Time	1280	640	320	160	80	40	20	10
55	Zone 3 Time	∞	2560	1280	640	320	160	80	40
56	tp Time ms	48	24	12	6	-	-	-	-
	tD	-	-	-	-	48	24	12	6

7.2 Output Contacts

Check output contacts by selecting the test options and switch settings shown below and operating reset push button.

Test Option No	DIL Switch No	Output	Output Contacts	Check Operation
88	4	Main Trip	94T1	
			94T2	
	5	Main Protection	94-2	
63	4	Block Auto Reclose	96-1	
62	1	VT Fuse Fail	97X-1	
	2	Tripped on Close	98-1	
	3	Aided Trip	94Y-1	
	4	Zone 3	Z ₃ -1	
	5	Zone 2	Z ₂ -1	
	8	Signal Send	85X-1 (Not CSN01)	
			85X-2 (Not CSN01)	

7.3 Opto Checks

Check opto isolator function using option 51 and applying d.c. volts to the relevant opto-isolator.

Test Option No	Opto Isolator	LED	Check Operation
51	Signal Receive (A9-A10) (Not for CSN01) Channel in Service (A7-A8) (Not for CSN01)	SOTF V~Fail	

7.4 Option DIL Switch Setting

Check and record correctness of Option DIL Switch Settings using test option 57 (LED lit, switch to right).

Test Option No	LED	A	B	C	Z ₂	Z ₃	AT	SOTF	V~Fail
57	INDIC	SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW8

8 SECONDARY INJECTION TESTS

8.1 Voltage Level Detectors

Note: All pick up levels should be $44.45 \text{ V} \pm 10\%$ of nominal except where otherwise stated. Select test option 43 and inject each VT voltage input at test plug 1Z.

Level Detector	LED Indic	Pick Up Volts	Drop Off Volts	$\frac{DO}{PU} \%$
A	A			
B	B			
C	C			

8.2 Phase and Residual Low Set Current Level Detector Checks

Select test option 43 and inject each CT input at plug 1Y

Nominal phase setting = $0.05 \times 4.8 \text{ In} \div (K1 + K2)$

Nominal N setting = $0.02 \times 4.8 \text{ In} \div (K1 + K2)$

Type	Level Detector	LED Indic	Nominal Setting Current	Pick Up Current A	Drop Off Current A	$\frac{DO}{PU} \%$
A	A	Z3				
B	B	Aided Trip				
C	C	SOTF				
A B or C	Residual *	V~Fail				

Note: The Drop-off should be within 10% of the Pick-up value.

8.3 Phase and Residual High Set Current Level Detector Checks

Select test option 53

Nominal phase setting $0.121 \times 4.8 \text{ In} \div (K1 + K2)$

Nominal N setting $0.16 \times 4.8 \text{ In} \div (K1 + K2)$

Phase	Level Detector	LED Indic	Nominal Current A	Pick Up Current A	Drop off Current A	$\frac{DO}{PU} \%$
A	A	Z3				
B	B	Aided Trip				
C	C	SOTF				
A B or C	Residual *	V~Fail				

* Tolerance $\pm 20\%$ of nominal. Measure Residual level detector PU and DO for each phase injected. The Drop-off should be within 10% of the Pick-up value.

9 ZONE REACH TESTS

Select the required scheme option.

For Zone setting checks, the injection quantities are derived from the ZFB test equipment. The required reach for each Zone must be referred to the ZFB test equipment.

The injection to the equipment is via test plugs 1Y and 1Z and these must be connected accordingly, ensuring that the current transformer's secondaries are correctly short circuited on the case side of the test plug 1Y.

The required connections to these are shown in GEC Althom Commissioning Instructions.

The reactance and resistance taps on the ZFB test set should be selected for each setting to give an impedance as near to the relay characteristic angle as possible with a magnitude slightly greater than the calculated relay setting.

The actual relay setting is found by decreasing the % tap and applying the fault condition to the relay repeatedly until the relay operates.

Note the error between P' (measured percentage tap) and P (the calculated percentage tap) should be less than 10%.

Additionally, for load encroachment conditions, there is a need to check the reach accuracy of the selected Zone 3 characteristic (circular or lenticular) at an angle other than the characteristic angle. This angle should be as close to 30 degrees lagging as possible and the measured reach should be checked against the calculated values determined by using information given in Appendix A. Check that the error between P' and P is within $\pm 15\%$.

Note: It may be necessary to temporarily desensitise the Zone 1 and Zone 2 settings to prevent these operating, because the Zone 3 reach is being checked under fault conditions rather than 3 phase load conditions and the Zone 1 and Zone 2 characteristics may expand beyond Zone 3 reach.

For calculating the Percentage Potential Setting and determining the measured reaches for Zone 1, Zone 2 and Zone 3 both phase to phase and phase to earth use the following information.

Z_R = Relay Zone Setting
 N = Ratio of ZFB Current Transformer
 K = Earth Fault Compensation Factor = $\frac{K4 + K5 + K6}{(K1 + K2)}$
 Z_F = Fault Impedance on ZFB Test Set
 P' = Measured Percentage Tap

Phase Faults

Required Impedance Reach $Z = \frac{2Z_R}{N}$

Calculated Percentage Potential Setting (% tap) = $\frac{2Z_R}{NZ_F} \times 100$

Measured Reach = $\frac{Z_F NP'}{200}$