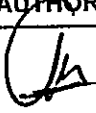


## RECORD OF REVISION

DOCUMENT NO: SCT 20.12.6

ISSUE NO: 3

This issue has been revised and amended as follows:

| DATE      | DETAILS OF REVISION                                                      | AUTHORISATION                                                                                               |
|-----------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| June 1998 | Record of calibrated test equipment added to meet ISO 9002 requirements. |  C. M. PARKER<br>13/6/98 |



**Schedule of Site  
Commissioning Tests  
SCT 20.12.6  
Issue 3  
June 1998**

**Reyrolle THR  
Distance Protection**

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Authorised for Issue by:

A handwritten signature in black ink, appearing to read "Chris Parker".

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**THE NATIONAL GRID COMPANY plc**

**SCHEDULE OF SITE COMMISSIONING TESTS**

**SCT 20.12.6 REYROLLE THR DISTANCE PROTECTION**

Station:

Circuit:

Manufacturer's Contract No:

Contractor's Signature: .....

NGC Contract No:

Accepted by: .....  
(Engineer's Signature)

Contractor:

Date:



## REYROLLE THR DISTANCE PROTECTION

Note:

- + signifies that the item applies to blocking scheme only.
- \* signifies that item applies to acceleration scheme only.

### 1 CALIBRATED TEST EQUIPMENT

(i) Record of Calibrated Test Equipment used during Commissioning

|                              | Manufacturer and Type | Serial No. | Calibration Date | Date next calibration due |
|------------------------------|-----------------------|------------|------------------|---------------------------|
| Insulation Resistance Tester |                       |            |                  |                           |
| Ammeter or Multimeter        |                       |            |                  |                           |
| Voltmeter or Multimeter      |                       |            |                  |                           |
| Timer                        |                       |            |                  |                           |
| Others (state function)      |                       |            |                  |                           |
|                              |                       |            |                  |                           |
|                              |                       |            |                  |                           |
|                              |                       |            |                  |                           |

### 2 GENERAL DATA

CT Ratio:

VT Ratio:

Type of VT Capacitor/Wound:

Trip Supply Volts D.C.:

(i) Local Primary System Diagram:

(ii) Circuit Parameters:

Line Angle

Length

Primary Impedance

Positive Sequence  $Z_1$

Zero Sequence  $Z_0$

Phase Fault Loop  $2Z_1$

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

|        |
|--------|
| Feeder |
| °      |
| km     |

|      |
|------|
| ohms |
| ohms |
| ohms |
| ohms |

|                         |                      |                      |                      |
|-------------------------|----------------------|----------------------|----------------------|
|                         | Block                | Acceleration         | Plain                |
| (iii) Mode of Operation | <input type="text"/> | <input type="text"/> | <input type="text"/> |

(iv) Relay/Serial Numbers:

This is sometimes supplied as one relay with one Article No and one Serial No and sometimes as three separate cases with their Article Nos and Serial Nos. Select the boxes below appropriate to the installation:

- (a) Complete relay
- (b) Phase fault case
- (c) Earth fault case
- (d) D.C./D.C. converter

| Article No           | Serial No            | Rating               |
|----------------------|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> | <input type="text"/> |
| <input type="text"/> | <input type="text"/> | <input type="text"/> |
| <input type="text"/> | <input type="text"/> | <input type="text"/> |
| <input type="text"/> | <input type="text"/> | <input type="text"/> |

(v) Required Relay Reach and Settings:  
(Primary ohms at relay angle)

Relay angle ( $45^\circ/60^\circ/75^\circ$ )

Zone 1 impedance

Zone 2 impedance

Zone 3 impedance

Zone 3 percentage offset

Zone 3 direction (FORWARD or REVERSE)

+Zone 4 impedance

| Phase Fault          | Earth Fault          |
|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> |
| ohms                 | ohms                 |
| ohms                 | ohms                 |
| ohms                 | ohms                 |
| %                    | %                    |
| <input type="text"/> | <input type="text"/> |
| ohms                 | ohms                 |

Zone 3 characteristic

Circular

Shaped



W ratio (minor axis to major axis) - symmetrical shape.

W ratios (asymmetrical shape).

Link position (upper curve -  $K_1$ ).

Link position (lower curve -  $K_2$ ).

Note: For circular characteristic Links  $K_1$  and  $K_2$  should be out.

Voltage transformer supervision.

 %

High set overcurrent.

 %

Zone 2 timer.

 s

Zone 3 timer.

 s

PTT timer (timer 5).

 ms

Signal equipment operating time (end-to-end)

 ms

### 3 RELAY SETTING

(i) Directional Impedance (mho) Measuring Elements:

Required settings (required primary ohms x  $\frac{CT \text{ ratio}}{VT \text{ ratio}}$ )

- Zone 1 secondary ohms at relay angle setting.
- Zone 2 secondary ohms at relay angle setting.
- Zone 3 secondary ohms at relay angle setting.
- Zone 3 reverse, secondary ohms at relay angle setting.
- +Zone 4 secondary ohms at relay setting.

Link and dial setting

(a) Earth Fault  
(secondary impedance)

| Phase Fault | Earth Fault |
|-------------|-------------|
|             |             |
|             |             |
|             |             |
|             |             |
|             |             |

Zone 1 setting link (A).

 ohms

Zone 1 multiplier (G).

Zone 1 multiplier (E).

Zone 1 setting = Zone 1 setting link (A) x (E) x (G).

 ohms

Zone 1 setting as a percentage of feeder length (P1).

 %

Zone 2 impedance multiplier (H).

Zone 2 impedance multiplier (S).

Zone 2 setting = Actual Zone 1 setting x Zone 2 impedance multiplier (H) x  
(S) x  $\frac{1}{(E)}$

Zone 2 setting as a percentage of feeder length (P2).

Zone 3 direction switch P.

Zone 3 impedance multiplier (K).

Zone 3 impedance multiplier (M).

Zone 3 offset selection switch (N).

Zone 3 setting = Zone 1 setting x Zone 3 impedance multiplier (K) x Zone 3  
impedance multiplier (M) x  $\frac{1}{(E)}$

Residual compensation factor =

$$\frac{1}{3} (Z_0/Z_1-1) = \frac{B \times F}{A \times G}$$

Neutral compensation setting link (B).

Neutral compensation multiplier (F).

+Zone 4 impedance multiplier (C).

Zone 4 setting = Zone 1 setting x Zone 4 impedance multiplier (C) x  $\frac{1}{(E)}$

(b) Phase Fault  
(secondary impedance)

Zone 1 setting link (A).

ohms

Zone 1 multiplier (G).

Zone 1 multiplier (E).

Zone 1 setting = Zone 1 setting link (A) x (E) x (G).

ohms

Zone 1 setting as percentage of feeder length (P1).

%

Zone 2 impedance multiplier (H).

Zone 2 impedance multiplier (S).

Zone 2 setting = Zone 1 setting x Zone 2 impedance multiplier (H) x Zone 2  
impedance multiplier (S) x  $\frac{1}{(E)}$

ohms

Zone 2 setting as percentage of feeder length (P2).

%

Zone 3 directional switch (P).

Zone 3 impedance multiplier (K).

Zone 3 impedance multiplier (M).

Zone 3 offset selection switch (N).

Zone 3 setting = Zone 1 setting x Zone 3 impedance multiplier (K) x Zone 3  
impedance multiplier (M) x  $\frac{1}{(E)}$

ohms

+Zone 4 impedance multiplier (C).

Zone 4 setting = Zone 1 setting x Zone 4 impedance multiplier (C) x  $\frac{1}{(E)}$

ohms

Zone 2 timer

Switch J

ms

Zone 3 timer

Switch L

ms

PTT timer

Switch R

ms

(ii) **High Set Overcurrent**

### HSOC setting

Op  
Current

A

%

(iii) VT Supervision

(a) VT Supervision setting

Op  
Current

A

%

(b) Mode of operation

Link A

**Link B**

1

**Note:** Normally Link A and Link B should be in positions 2 and 4 respectively, giving delay operation of 10 seconds and instantaneous reset.

|         |       |
|---------|-------|
| Operate | Reset |
| s       | s     |

(iv) **Dual Directional Earth fault**

**Remove the Directional Earth Fault measuring card if fitted, from the Earth Fault Module, place it in an anti-static bag and store safely for possible future use.**

(v) A.C. Line Check

**Check timer 3 link position L8 (normally this should be in position B)**

## 4 WIRING

Where THR is part of a TPS 5/33 system it is not necessary to perform insulation tests or to check the cubicle wiring. The tests below should be performed on all wiring where the cubicle has been wired on site and on the site made connections for TPS 5/33 systems. See also SCT 20.18.

**Caution:** Transistorised equipment using reed relays. Special care to be taken.

(i) Insulation, relay tests

In view of the number of transistors in the equipment, only the following insulation resistance tests should be carried out:

(a) Measure the insulation resistance between the current transformer circuits and the other circuits including earth. Short-circuit together all the current transformer terminals and apply a 500 V test set between this group and all the other terminals short-circuited together and connected to earth.

MQ

(b) Measure the insulation resistance between the voltage transformer circuits and the other circuits including earth. Short-circuit together all the voltage transformer terminals and apply a 500 V test set between this group and all the other terminals short-circuited together and connected to earth.

MQ

(c) With the D.C./D.C. converter isolated from the external supply connections and converter link out measure the insulation resistance between the input plus alarm terminals and the earthed frame. Short-circuit together all the input and alarm terminals and apply a 500 V test set between this group and the earthed frame. MΩ

(d) With the D.C./D.C. converter isolated from the external supply connections and converter link out measure the insulation resistance between the input plus alarm terminals plus earthed frame. Short-circuit together the input terminals and apply a 500 V test set between this group and the alarm terminals (shorted together and earthed) and the earthed frame. MΩ

(e) Measure the insulation resistance between the external D.C. terminals 1 to 40 inclusive and the other circuits including earth. Short-circuit together the D.C. external terminals and apply a 500 V test set between this group and all other external terminals (shorted together and connected to earth). MΩ

(ii) Insulation tests upon general and cubicle wiring. (See SCT No 20.4.1)

(iii) Inter relay and cubicle wiring checked to

Circuit Diagram No .....

Wiring Diagram No .....

## 5 MECHANICAL INSPECTION

(i) Check proper mounting and proper access in addition to requirements of Guidance Notes contained in Document 099/500.

(ii) Check fuses for correctness to standard and for rating.  #

# normally 6A

(iii) Check for correct position, in accordance with manufacturers instructions and drawings, all selectable links, diodes on tripping logic card, diode pins on matrix and VTs trip inhibit selection etc.

## 6 SECONDARY INJECTION TESTS

- (i) Caution: When checking the operation of reed relays care must be taken not to overstress (electrically) their contacts by the use of unsuitable test equipment, eg bell sets and test lamps. Ohmmeters and high resistance voltmeters are satisfactory for this duty.
- (ii) All injections to be via test points where provided and to include as much associated wiring as possible.

## 6.1 D.C./D.C. Converter

- (i) Check nominal voltage rating.

#

# Normally this should be 48 V, but under exceptional cases different supply voltage may be used. Then check that the links on the transformer (within converter) are set for supply voltage (110 V or 220 V).

- (ii) Check polarity of D.C. supply to converter before energising.

- (iii) With outputs isolated, measure and record: input volts, input current and output volts.

V in

V out

# mA in

#To be in the region of 300 mA - 400 mA (50 V in).

- (iv) Connect the converter output to THR, measure each output which should be  $14 \pm 1$  V. The difference between actual two voltages to be within 0.5 V. Determine +14 V input and -14 V output by measuring at test points 31, 32 and 33 in the phase fault and earth fault cases.

+14,0

V output

-14,0

V output

- (v) Check that the alarm contacts connected to terminals S1 and to terminals S2 close when the D.C. supply to the D.C./D.C. converter is interrupted, and that the alarm contacts open when the supply is restored.

S1

S2

- (vi) Connect a variable resistor of 3 A rating and not less than 7 ohm to the -14 V, 0 output and slowly increase output current until cut-off occurs. Record input current and output current using test point card. Check alarm contacts S1 and LED indication on the converter. Reset converter.

# A input

A output

LED

Note:

- (a) Test point 31 is negative with respect to test point 32.  
(b) The test duration must be kept short to avoid unnecessary overloading of converter.

# To be in the region of 250 mA (after cut-off).

Repeat test but by loading the +14 V, 0 output.

Note:

Test point 32 is negative with respect to test point 33.

# A input