Note:

* The approved updated final settings should be applied and printed out from the relay by using the software of the relay.
* The approved final setting and the printout final setting should be attached with this test format.
* The print out final setting should be signed by SEC AND Contractor.
* The following test format contains minimum required tests and some of settings are mentioned as an example and not as limitation.

1. **GENERAL DATA & INFORMATION**

|  |  |  |  |
| --- | --- | --- | --- |
| Panel No. |  | Rated Voltage : \_\_\_\_\_\_ |  |
| Relay Type |  | Rated Current |  |
| Manufacturer |  | No. of contacts: |  |
| SERIAL NO |  | Draw. & Sh No. : |  |
| Order - No. |  | Conn.Diag.No. |  |
| Software Version |  | DC. Auxiliary. Voltage |  |
| pto-coupler supply: |  | Frequency Fn | 60 Hz |

1. **MECHANICAL CHECKS AND VISUAL INSPECTION**

As per TCS –P–105 Rev -1, Item no 4.1& 4.12.1.1

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Description | Remarks | |
|  | Inspect for any physical damage or defects. | ❑ Yes | ❑ N/A |
|  | Verify connections and ferrules as per approved drawings | ❑ Yes | ❑ N/A |
|  | Check tightness of all the connections. | ❑ Yes | ❑ N/A |
|  | Check Apparatus List | ❑ Yes | ❑ N/A |
|  | Check relay version and switching elements on printed circuit board | ❑ Yes | ❑ N/A |

1. **ELECTRICAL TESTS**

As per TCS –P–105 Rev -1, Item no 4.2& 4.12.1.2

* 1. **FUNCTION TEST**

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Description | Remarks | |
|  | Human Machine Interface (HMI) Checked. | ❑Yes | ❑N/A |
|  | Case Earthing checked. | ❑Yes | ❑N/A |
|  | LED’s Function Checked. | ❑Yes | ❑N/A |
|  | Trip Contacts Checked. | ❑Yes | ❑N/A |
|  | Reset Function Checked | ❑Yes | ❑N/A |
|  | Group active Functions Checked | ❑Yes | ❑N/A |
|  | Binary inputs checked. | ❑Yes | ❑N/A |
|  | Output Relays Checked | ❑Yes | ❑N/A |
|  | Event Display on HMI Screen Checked | ❑Yes | ❑N/A |
|  | Test switch / plug checked for correct function. | ❑Yes | ❑N/A |
|  | Watchdog contacts checked | ❑Yes | ❑N/A |
|  | Current shorting facility. | ❑Yes | ❑N/A |

* 1. **OPERATING DC SUPPLY CURRENT:**

|  |  |  |  |
| --- | --- | --- | --- |
| D.C. voltage (V) | D.C current w/o fault (mA**)** | D.C current with fault (mA) | Max calculated watt (w) |
|  |  |  |  |

Limit: D.C. burden ---12 watts (Ref to the Technical manual 7UT613 page no: 343)

* 1. **WATCH DOG CHECK:**

Supply off:

Terminals (closed):

Terminals (open):

Supply on:

Terminals (closed):

Terminals (open):

* 1. **TIME & DATE CHECK:**

To check time & date go to main menu on the display for 7UT 613 then system time and adjust time & Date.

To test this, remove the auxiliary supply from the relay for approx 30 sec, then restoring the aux supply, time and date should be correct.

RESULT:

* 1. **SECONDARY INJECTION TESTS:**
     1. **Measurements (HV Side):**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Phase | Injected Current | | Measured ( A ) | |
| R |  |  |  |  |
| Y |  |  |  |  |
| B |  |  |  |  |

* + 1. **Measurements (LV Side):**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Phase | Injected current | | Measured ( A ) | |
| R |  |  |  |  |
| Y |  |  |  |  |
| B |  |  |  |  |

Limits: Amplitude Accuracy, ± 0.5 % Ir According to the catalogue for Tech data -----------------------

* + 1. **PICK UP & DROP OFF TEST FOR DIFFERENTIAL CURRENT (Id):**
* This is single phase injection test
* Disable SOTF facility
* Disable any Negative sequence facility
* Disable Zero sequence removing facility

The Diff Eq for single phase injection, 2 windings will be:

HV WINDING:

To obtain rated voltage Vn calculate from the tab changer data:

Vn = 2 {(Vmax.\* Vmin.) / (Vmax. + Vmin.)}

Vmax = Vmin =

Then Vn = KV use this parameter in relay setting for HV voltage.

I Rated( pry) = = I Rated( sec.) = I Rated( pry) /  CT RATIO =

Idiff operating value = (I> set value) x (k from table depending on vector group) x (Irated of winding)



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| fault type | Id Min set value | Calculated value (A) | Measured value (A) | | Drop out  pick up Ratio | Operating Time @ 2.5x I pick up (ms) |
| Pick up | Drop out |
| R-N |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Y-N |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| B-N |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| R-Y |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Y-B |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| B-R |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| R-Y-B |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

LV WINDING:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| fault type | Id Min set value | Calculated value (A) | Measured value (A) | | Drop out  pick up Ratio | Operating Time @ 2.5x I pick up (ms) |
| Pick up | Drop out |
| R-N |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Y-N |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| B-N |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| R-Y |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Y-B |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| B-R |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| R-Y-B |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Limits: Pick up & Drop out ± -------- % of Ir for I < Ir or ± ------ % of I for I > Ir, Reset ratio > ------ %

Timing tolerance: Typically 25 ms for 2 Id & 12 ms for 5 Id of unrestrained function,

According to the catalogue for Technical Data ------------------

* + 1. **PICK UP & DROP OFF TEST FOR UNRESTRAINED DIFFERENTIAL CURRENT**

(Irest):

HV WINDING:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Phase | set value | Calculated value (A) | Measured value(A) | | Drop out  pick up Ratio | Operating Time @ 5x I pick up (ms) |
| Pick up | Drop out |
| R |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Y |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| B |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

LV WINDING:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Phase | set value | Calculated value (A) | Measured value (A) | | Drop out  pick up Ratio | Operating Time @ 5x I pick up  (ms) |
| Pick up | Drop out |
| R |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Y |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| B |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

* + 1. **BIAS CHARACTERISTIC TESTING:**

Inject H.V & L.V Phase with equal current on each and angle 0 for H.V and 180 for L.V then decrease L.V phase until trip, while leave H.V with fixed current which will be the bias current and record values and check that corresponds to following equation

END SECTION 1

END SECTION 2

**Idiff / IN**

**IREST / IN**

Id Min

Sec 1

Sec 2

1. Section 1:

Where bias current is between 0 ≤ Ibias≤ section 1, Idmin = 0.3, set End section 1 = 1.25

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Slope section 1 | I bias  ( A) | I H.V  ( A) | Expected  IL.V ( A) | Id  calculated | Measured IL.V (A) | | | Errors % | | |
| R | Y | B | R | Y | B |
| Id min |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |

Limits: ±-------- % Ir according to the technical ref catalogue

1. **Slope Section 2:**

When bias current is between End sections 1 ≤ Ibias ≤ End section 2

Trip Idiff = ( Idmin + slope section 2 /100 \* (Ibias – End section 1)) A

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| I bias ( A) | I H.V ( A) | Expected  IL.V ( A) | Id calculated | Measured IL.V (A) | | | Errors % | | |
| R | Y | B | R | Y | B |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

Limits: ±-------- % Ir according to the technical ref catalogue

1. **Slope Section 3:**

When bias current is more than Ibias ≥ End section 2

Trip = ( Idmin + slope section 2 / 100 \* ( End section 2 – End section 1 ) + slope section 3 / 100 \* ( Ibias – End section 2 ) A

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| I bias (A) | I H.V (A) | Expected  IL.V ( A) | Id calculated | Measured IL.V (A) | | | Errors % | | |
| R | Y | B | R | Y | B |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

Limits: ±-------- % Ir according to the technical ref catalogue

1. **TEST OF 2ND HARMONICS:**

Idmin = --------- lb

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Phase | I 2 / I 1 ratio % | I 1 ( f = 60 Hz)  Pick up value | I 2 (f = 120 Hz) | |
| Expected blocking | Measured |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

1. **TEST OF 5TH HARMONICS:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Phase | I 5 / I 1 ratio % | I 1 ( f = 60 Hz)  Pick up value | I 5 (f = 300 Hz) | |
| Expected blocking | Measured |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

1. **CROSS BLOCK TEST:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| winding | IR | IY | IB | Cross Block On | Cross Block  Off |
| H.V | I > Pickup With 2nd harmonic | I > Pickup Without 2nd harmonic |  |  |  |
|  | I > Pickup With 2nd harmonic | I > Pickup With out2nd harmonic |  |  |
| I > Pickup With out2nd harmonic | I > Pickup With 2nd harmonic |  |  |  |
| L.V | I > Pickup With 2nd harmonic | I > Pickup With out2nd harmonic |  |  |  |
|  | I > Pickup With 2nd harmonic | I > Pickup With out2nd harmonic |  |  |
| I > Pickup With out2nd harmonic | I > Pickup With 2nd harmonic |  |  |  |

* + 1. **SOTF TEST:**

This function used when energized the transformer with internal fault where it use current gap principle to overridden all harmonic and waveform block and trip quickly .To test it, enable SOTF function and inject phase with harmonic and current over pick up value …… at two conditions:

1. Direct injection

Expected: - ------------------- status; ---------------------

1. 2 stage, 1 st  state normal load without trip (note you must inject from both side H.V and L.V to stimulate the normal load ) and 2nd  state with value over pick up and have a2nd  harmonic over 12 / 11 setting

Expected: --------------------- status: ---------------------

* + 1. **NEGATIVE SEQUENCE TEST:**

1. Imin negative sequence test:

INeqseq = 1/3 (IR + a2 IY + a IB ) ,where a = I ---------

Irelay = Iinject \* K

And we at test inject single phase then

Irelay neg seq =  1 / 3 Iinject  \* k

|  |  |  |  |
| --- | --- | --- | --- |
| Imin neg seq setting | I H.V ( > IMinNegSeq setting) (A) | Expected IL.V (A) | Measured IL.V (A) |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

1. Negative sequence Relay operating Angle (Neg. seq. ROA ) test:

Inject H.V & L.V > IMinNegseq

Inject H.V with angle Zero degree and change the L.V to get the operating Zone

|  |  |  |
| --- | --- | --- |
| Neq seq ROA setting | Expected IL.V angle for operation Zone (Deg) | Measured IL.V angle for operation Zone (Deg) |
|  |  |  |
|  |  |  |
|  |  |  |

1. **SENSITIVE NEGATIVE SEQUENCE (TURN TO TURN FAULT) TEST:**

This function based on Negative sequence discriminator, where if there is no start signal (Independent on existence or not for start signal) and the fault is classified as internal fault and at same time for H.V & L.V sides the negative sequence current is greater than IminNegseq then trip Transformer.

To test it, inject single phase from 2 winding in phase and increase them at same time until trip (must happen by s/s neg only not restrain function). Status: -------------------

1. **UNRESTRAINED NEGATIVE SEQUENCE TEST:**

Any start signal activate that function (i.e, function independent on start signal ) where if the fault discriminate as internal fault then remove any harmonic which block relay and trip quickly and if fault discriminate as external fault then if the signal is polluted with harmonics this will block relay else request trip.

Internal trip action (Expected: Trip):----------

External trip (with harmonics) action (Expected: Block):--------

External trip (without harmonics) action (Expected: Trip):-------

|  |  |
| --- | --- |
| CT characteristics | |
| Transformer current Rating W 1 (A) |  |
| Transformer current Rating W 2 (A) |  |
| Transformer current Rating W 3 (A) |  |
| CT Rating W 1 (A) |  |
| CT Rating W2 ( A) |  |
| CT Rating W3 (A) |  |

|  |  |
| --- | --- |
| Differential characteristics | |
| Idmin |  |
| End section 1 |  |
| End section 2 |  |
| Slope section 2 |  |
| Slope section 3 |  |
| Zero seq subtract |  |

|  |  |
| --- | --- |
| parameters calculation | |
| Amplitude match for W1 |  |
| Amplitude match for W2 |  |
| Amplitude match for W3 |  |
| Multiplication factor |  |

For simple calculations, enable or disable Zero seq for 3 winding together not individually GT ------------- R - PHASE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| I bias | I H.V | Expected L.V | I Diff calc | Measured I L.V | Measured Diff | Error % |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

GT ------------- Y - PHASE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| I bias | I H.V | Expected L.V | I Diff calc | Measured I L.V | Measured Diff | Error % |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

GT ------------- B - PHASE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| I bias | I H.V | Expected L.V | I Diff calc | Measured I L.V | Measured Diff | Error % |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

* 1. **FINAL SETTINGS:**

Power Transformer Configuration

|  |  |
| --- | --- |
| Rated voltage W 1 |  |
| Rated voltage W 2 |  |
| Rated voltage W 3 |  |
| Rated current W 1 |  |
| Rated current W2 |  |
| W 1 connection Type |  |
| W 2 connection Type |  |
| W 3 connection Type |  |
| W 2 clock number |  |
| W 3 clock number |  |
| ZS currsubtr W1 |  |
| ZS currsubtr W2 |  |
| ZS currsubtr W3 |  |
| T configuration of W1 |  |
| CT1 Rating W 1 |  |
| CT2 Rating W1 |  |
| T configuration of W2 |  |
| CT1 Rating W 2 |  |
| CT2 Rating W2 |  |

Differential characteristics configuration

|  |  |
| --- | --- |
| Idmin |  |
| End section 1 |  |
| End section 2 |  |
| Slope section 2 |  |
| Slope section 3 |  |
| Id Unre |  |
| I2 / I1Ratio |  |
| I5 / I1 Ratio |  |
| Idiff Alarm |  |
| T Alarm delay |  |
| Op neq seq Diff |  |
| I min Neq Seq |  |
| Neq sequence ROA |  |
| SOTF |  |
| Cross blocking |  |

* + 1. **Matching of the Measured Values**

Calculated Amplitude Matching Factor (k):

KX = CTX / Rated current of ref winding

Where ref winding is first winding with ------------- connections, if no -------- connection then HV side selected automatically,

KHV = ---------------------------,

KLV= ----------------,

KTerit =---------------,

General Differential Equation:

(I M) = K. (K). (I n)

Where, (Im) – matrix of the matched currents IA, IB, IC,

k – Constant factor for magnitude matching,

(K) – coefficient matrix, dependent on the vector group,

(In) – Matrix of the phase currents IL1, IL2, IL3.

* + 1. **Pick up & Drop off Test for Differential current (Id)**

The diff equation for single phase injection, 2 windings will be

And after applying zero sequence removing facility then,

KH.V = ----------

KL.V= -----

H.V. Winding

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| fault type | Id Min set value | Calculated value (A) | Measured value (A) | | Drop out  pick up Ratio | Operating Time @ 2.5x I pick up (ms) |
| Pick up | Drop out |
| R-N |  |  |  |  |  |  |
| Y-N |  |  |  |  |  |  |
| B-N |  |  |  |  |  |  |
| R-Y |  |  |  |  |  |  |
| Y-B |  |  |  |  |  |  |
| B-R |  |  |  |  |  |  |
| R-Y-B |  |  |  |  |  |  |

L.V.Winding:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| fault type | Id Min set value | Calculated value (A) | Measured value (A) | | Drop out  pick up Ratio | Operating Time @ 2.5x I pick up (ms) |
| Pick up | Drop out |
| R-N |  |  |  |  |  |  |
| Y-N |  |  |  |  |  |  |
| B-N |  |  |  |  |  |  |
| R-Y |  |  |  |  |  |  |
| Y-B |  |  |  |  |  |  |
| B-R |  |  |  |  |  |  |
| R-Y-B |  |  |  |  |  |  |

* + 1. **Pick up & Drop off Test for unrestrained Differential current (Id)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| voltage side | Phase | Iunrest  set value | Calculated value (A) | Measured value (A) | | Drop out  pick up Ratio | Operating Time @ 2x I pick up (ms) |
| Pick up | Drop off |
| H.V side | R |  |  |  |  |  |  |
| Y |  |  |  |  |  |  |
| B |  |  |  |  |  |  |
| L.V side | R |  |  |  |  |  |  |
| Y |  |  |  |  |  |  |
| B |  |  |  |  |  |  |

* + 1. **Bias Characteristic Testing:**

Section 1:

Idiff = 0.25 Irest

When bias current is between 0 ≤ Ibias ≤ End section 1

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Slope section 1 | I bias  ( A) | I H.V  ( A) | Expected  IL.V ( A) | Id  calculated | Measured IL.V (A) | | | Errors % | | |
| R | Y | B | R | Y | B |
| Id min |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

Limits: ±-------- % Ir according to the technical ref. catalogue

Slope Section 2:

When bias current is between End sections 1 ≤ Ibias ≤ End section 2

Trip = (Idmin + slope section 2 / 100 \* ( Ibias – End section 1 ) A

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| I bias ( A) | I H.V ( A) | Expected  IL.V ( A) | Id calculated | Measured IL.V (A) | | | Errors % | | |
| R | Y | B | R | Y | B |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

Limits: ±-------- % Ir according to the technical ref catalogue

Slope Section 3:

When bias current is more than Ibias ≥ End section 2

Trip = (Idmin + slope section 2 / 100 \* ( End section 2 – End section 1 ) + slope section 3 / 100 \* ( Ibias – End section 2 ) A

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| I bias (A) | I H.V (A) | Expected  IL.V ( A) | Id calculated | Measured IL.V (A) | | | Errors % | | |
| R | Y | B | R | Y | B |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

Limits: ±-------- % Ir according to the technical ref catalogue

* + 1. Test of 2nd Harmonics:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Phase | I 2 / I 1 ratio % | I 1 ( f = 60 Hz)  Pick up value | I 2 (f = 120 Hz) | |
| Expected blocking | Measured |
|  |  |  |  |  |

* + 1. Test of 5th Harmonics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Phase | I 5 / I 1 ratio % | I 1 ( f = 60 Hz)  Pick up value | I 5 (f = 300 Hz) | |
| Expected blocking | Measured |
|  |  |  |  |  |

* + 1. Negative sequence test

Imin neg seq test:

|  |  |  |  |
| --- | --- | --- | --- |
| Imin neg seq setting | I H.V ( > IMinNegSeq setting) (A) | Expected IL.V (A) | Measured IL.V (A) |
|  |  |  |  |

* + 1. Negative sequence Relay operating Angle (Neg seq ROA) test:

Inject H.V & L.V > IMinNegseq

Inject H.V with angle Zero degree and change the L.V to get the operating Zone

|  |  |  |
| --- | --- | --- |
| Neq seq ROA setting | Expected IL.V angle for operation Zone (Deg) | Measured IL.V angle for operation Zone (Deg) |
|  |  |  |

* + 1. Sensitive negative sequence (turn to turn fault) test

Status: -------------------

Unrestrained negative sequence test:

Internal trip action (Expected: Trip):----------

External trip (with harmonics) action (Expected: Block):--

External trip (without harmonics) action (Expected: Trip):-------

* + 1. Trip indication test

|  |  |  |  |
| --- | --- | --- | --- |
| SN | Type of fault | Led colour | check |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

* + 1. Disturbance recorder checked
    2. Binary outputs and inputs checked

|  |  |
| --- | --- |
| CT characteristics | |
| Transformer current Rating W 1 (A) |  |
| Transformer current Rating W 2 (A) |  |
| Transformer current Rating W 3 (A) |  |
| CT Rating W 1 (A) |  |
| CT Rating W2 ( A) |  |
| CT Rating W3 (A) |  |

|  |  |
| --- | --- |
| Differential characteristics | |
| Idmin |  |
| End section 1 |  |
| End section 2 |  |
| Slope section 2 |  |
| Slope section 3 |  |
| Zero seq subtract |  |

|  |  |
| --- | --- |
| parameters calculation | |
| Amplitude match for W1 |  |
| Amplitude match for W2 |  |
| Amplitude match for W3 |  |
| Multiplication factor |  |

For simple calculations, enable or disable Zero seq for 3 winding together not individually

GT ------------- R - PHASE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| I bias | I H.V | Expected L.V | I Diff calc | Measured I L.V | Measured Diff | Error % |
|  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |

GT ------------- Y - PHASE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| I bias | I H.V | Expected L.V | I Diff calc | Measured I L.V | Measured Diff | Error % |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

GT ------------- B - PHASE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| I bias | I H.V | Expected L.V | I Diff calc | Measured I L.V | Measured Diff | Error % |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
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