# Appendix A – Plant Assembly Form

|  |  |  |  |
| --- | --- | --- | --- |
| Site Date: |  | Logistics ID |  |
| Project Title: |  | Plant to be used: |  |
|  |  | HV Switchgear |  |
|  |  | Transformer |  |
|  |  | LV Equipment |  |
|  |  | Details of any special assembly requirements: |
| Project No: |  |  |  |
|  |  |  |  |
| Proposed S/S name: |  | S/S No: |  |
| CABLE SIZES/FUSE SIZES/LABELS |
| HV | CIRCUIT | CABLE SIZE | FUSE SIZE | LABEL |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| LV | 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| LABELS FOR EXISTING SUBSTATIONS |
| *Note: Modern SW/GR label sizes are known, please indicate sizes of older units* |
| S/S NAME | MAKE/TYPE OF SW/GR | EXISTING LABEL | PROPOSED LABEL |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |
| Signed: |  | Tel: |  |
| Print: |  | Date: |  |

# Appendix B – Quality Control Checklist

|  |
| --- |
| **Contractor Details** |
|  |  |  |  |  |  |  |  |  |
| Company name |  |  | Preparation/Assembly location |  |  |
|  |  |  |  |  |  |  |
| Contractor reference |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |
| **Plant Details** |
|  |  |  |  |  |  |  |  |  |
| **Transformer** |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  | Manufacturer’s name |  |  | Type |  |  |
|  |  |  |  |  |  |  |  |  |
|  | Serial number |  |  | Rating |  |  |
|  |  |  |  |  |  |  |  |
|  | Cable connected or unit? |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| **HV Switchgear** |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  | Manufacturer’s name |  |  | Type |  |  |
|  |  |  |  |  |  |  |  |  |
|  | Serial number |  |  | Metering Unit Serial No |  |  |
|  |  |  |  |  |  |  |  |
| **LV Fuse cabinet** |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  | Manufacturer’s name |  |  | Type |  |  |
|  |  |  |  |  |  |  |  |  |
|  | Serial number |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| **Destination Details** |
|  |  |  |  |  |  |  |  |  |
| Substation name |  |  | Substation number (if known) |  |  |
|  |  |  |  |  |  |  |  |  |
| **(Continued)** |

|  |
| --- |
| **Quality Checks** |
| **Receipt** |  |  |  |  |  |  |  |  |
|  | Job details recorded? |  |  | Initial inspection complete? |  |  |
| **Transformer** |  |  |  |  |  |  |  |
|  | Drain valve operates? |  |  | HV connections complete? |  |  |
|  | Oil level correct? |  |  | Lid fixings secure? |  |  |
|  | LV connections complete? |  |  | Tap changer operates, and is locked off? |  |  |
|  | Earth connections complete? |  |  |  |  |
| **HV Switchgear** |  |  |  |  |  |  |  |
|  | Interlock check OK? |  |  | Oil tank examined? |  |  |
|  | Oil tank cleaned? |  |  | Oil level correct? |  |  |
|  | Oil seals fitted correctly? |  |  | Covers secured? |  |  |
|  | HV trip test complete? |  |  | Fuse(s) fitted? |  |  |
|  | HV connections complete? |  |  | Earth connections complete? |  |  |
|  | EFI/CT fitted and Tested? |  |  | Metering Unit fitted? |  |  |
|  | Destination Labels fitted? |  |  | X56 locks fitted? |  |  |
| **LV Fuse Cabinet** |  |  |  |  |  |  |  |
|  | Cable cleats drilled? |  |  | LV fuses prepared? |  |  |
|  | Ways/test sockets complete? |  |  | Stand-off pins positioned? |  |  |
|  | LV connections complete? |  |  | A4/2 additional lock supplied? |  |  |
|  | Termination fixings supplied? |  |  | MDI set? |  |  |
| **Metering CT & VT Testing** |  |  |  |  |  |  |
|  | Commissioning complete? |  |  | CP510 forms completed? |  |  |
|  | CP510 forms emailed to Data Management? |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |
|  | Ensure micro-ohmmeter readings are within range given in procedure (for cabinet type) and record readings in μΩ (below): |
|  | Way number: |  |  |  |  |  |  |  |  |
|  | R |  |  |  |  |  |  |  |  |
|  | Y |  |  |  |  |  |  |  |  |
|  | B |  |  |  |  |  |  |  |  |
|  | N |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Cabinet with ganged ways | Ganged R to cable conn. |  |  |  |  |  |  |  |  |
| Ganged Y to cable conn. |  |  |  |  |  |  |  |  |
| Ganged B to cable conn. |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | Destination labels fitted? |  |  | A4/2 locks fitted? |  |  |
|  |  |  |  |  |  |  |  |  |
| **Final Assembly** |  |  |  |  |  |  |  |
|  | HV connections made? |  |  | LV connections made?  |  |  |
|  | Final earth connections made? |  |  | Destination labels fitted? |  |  |
|  | S/S nameplates supplied? |  |  | Locked off? |  |  |
|  | Danger of Death labels fitted? |  |  | Free from oil leaks? |  |  |
|  | SF6 pressure OK? |  |  | Assembly secure and stable? |  |  |
|  | Cleaned? |  |  | Scratches touched up? |  |  |
|  | ‘Filled with oil’ label fitted |  |  | ‘Tested’ label, Transformer Test Cert and Protection Test Results attached |  |  |
| **Additional Comment?** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Name |  | Signature |  | Date |  |

# Appendix C – Protection Test Result Sheets

[C1 – TLF Protection Pre-Assembly Commissioning Sheet](#_C1_–_TLF)

[C2 – Relay Protection Pre-Assembly Commissioning Sheet (excluding RN2D / RN6D)](#_C2_–_Relay)

[C3 – Relay Protection Pre-Assembly Commissioning Sheet – RN2D](#_C3_–_Relay)

[C4 - Relay Protection Pre-Assembly Commissioning Sheet – RN6D](#_C4__)

[C5 - Relay Protection Pre-Assembly Commissioning Sheet – Lucy Sabre VRN2a with 7SR45 Relay](#_C5_–_Relay)

[C6 - Earth Fault Indicator(s) (EFI) Pre-Assembly Commissioning Sheet](#_C6_-_Earth)

[C7 - Relay Protection Pre-Assembly Commissioning Sheet – CE2](#_C7_-_Relay)

[C8 - Relay Protection Pre-Assembly Commissioning Sheet – CE6](#_C8_-_Relay)

**NOTE: The appropriate MICOM P116 SET Files for Depot Testing are available from the Electricity North West Library under the files named P116 Test 200, P116 Test 400 and P116 Test 800**.

**The SET files named Default 200 & 400 are the files to be uploaded to the relay for despatch to site, these set files have minimum settings applied.** **The correct site settings shall be applied during the commissioning process as per ES320.**

**The appropriate Set Files for the Lucy Sabre VRN2a Argus 7SR45 relay are available on the Electricity North West Library under the files named 7SR45 Test 100 and 200.**

**The SET files for the Argus 7SR45 relay in Lucy Sabre VRN2a for site commissioning is named 7SR45 Prot ENW. The correct site settings shall be applied during the commissioning process as per ES320.**

September 2022

## C1 – TLF Protection Pre-Assembly Commissioning Sheet

Manufacturer / Type /

Serial Number:

CT Ratio: CT Serial Numbers: R:

Y:

AC Wiring Insulation Resistance: Ω B:

**DC Resistance Tests**

|  |  |  |  |
| --- | --- | --- | --- |
| CT | RESISTANCE MEASURED (Ω) | RESISTANCE OF MEASURING CIRCUIT (Ω) | TRUE RESISTANCE (Ω) |
| 100/5 Ratio | R (L1) |  |  |  |
| Y (L2) |  |  |  |
| B (L3) |  |  |  |
| 50/5 Ratio | R (L1) |  |  |  |
| Y (L2) |  |  |  |
| B (L3) |  |  |  |

**CT Magnetisation Characteristics**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Secondary Current | 50 mA | 100mA | 200mA | 300mA | 400mA | 500mA | 600mA | 750mA | 1A | 1.5A | 2A |
| Sec Volts | 100/5 Ratio | R (L1) |  |  |  |  |  |  |  |  |  |  |  |
| Y (L2) |  |  |  |  |  |  |  |  |  |  |  |
| B (L3) |  |  |  |  |  |  |  |  |  |  |  |
| 50/5 Ratio | R (L1) |  |  |  |  |  |  |  |  |  |  |  |
| Y (L2) |  |  |  |  |  |  |  |  |  |  |  |
| B (L3) |  |  |  |  |  |  |  |  |  |  |  |

**NOTE:** For Schneider RN2c CT Magnetisation Characteristic testing the maximum range used is 600mA.

**CT Ratio & Polarity**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | R-Y (L1-L2) | R-B (L1-L3) |
| Ratio | Primary Current (A) | Secondary Current R (L1) CT (A) | Secondary Current Y (L2) CT (A) | Spill Current (mA) | Secondary Current B (L3) CT (A) | Spill Current (mA) |
| 100/5 | 100 |  |  |  |  |  |
| 50/5 | 50 |  |  |  |  |  |

**Primary Injection Overcurrent Test** CT Ratio (use service setting, if known)

|  |  |  |  |
| --- | --- | --- | --- |
| PRIMARY CONNECTIONS | VOLT DROP AT 8A (V) | CURRENT TO TRIP (A) | EARTH FAULT SPILL AT 100A (MA) |
| R (L1) | B (L3) |
| R-Y (L1-L2) |  |  |  |  |
| R-B (L1-L3) |  |  |  |  |
| Y-B (L2-L3) |  |  |  |  |

**Primary Injection Earth Fault Test** CT Ratio (use service setting, if known)

|  |  |  |
| --- | --- | --- |
| PRIMARY CONNECTIONS | VOLT DROP AT 16A (V) | CURRENT TO TRIP (A) |
| R-R (L1-L1) |  |  |
| Y-Y(L2-L2) |  |  |
| B-B(L3-L3) |  |  |

**Voltage Presence Indication System (VPIS) Tests** (if fitted)

**NOTE:** Sheet assumes RMU, if extensible switch make entries for (a) – (c) only

(a) 250V ac applied to L1 and Earth on Right Hand Switch Bushings

|  |  |  |
| --- | --- | --- |
|  | LHS VPIS TEST POINTS | RHS VPIS TEST POINTS |
| VPIS Points | L1-Earth | L2-Earth | L3-Earth | L1-Earth | L2-Earth | L3-Earth |
| Voltage (V) |  |  |  |  |  |  |

(b) 250V ac applied to L2 and Earth on Right Hand Switch Bushings

|  |  |  |
| --- | --- | --- |
|  | LHS VPIS TEST POINTS | RHS VPIS TEST POINTS |
| VPIS Points | L1-Earth | L2-Earth | L3-Earth | L1-Earth | L2-Earth | L3-Earth |
| Voltage (V) |  |  |  |  |  |  |

(c) 250V ac applied to L3 and Earth on Right Hand Switch Bushings

|  |  |  |
| --- | --- | --- |
|  | LHS VPIS TEST POINTS | RHS VPIS TEST POINTS |
| VPIS Points | L1-Earth | L2-Earth | L3-Earth | L1-Earth | L2-Earth | L3-Earth |
| Voltage (V) |  |  |  |  |  |  |

(d) 250V ac applied to L1 and Earth on Left Hand Switch Bushings

|  |  |  |
| --- | --- | --- |
|  | LHS VPIS TEST POINTS | RHS VPIS TEST POINTS |
| VPIS Points | L1-Earth | L2-Earth | L3-Earth | L1-Earth | L2-Earth | L3-Earth |
| Voltage (V) |  |  |  |  |  |  |

(e) 250V ac applied to L2 and Earth on Left Hand Switch Bushings

|  |  |  |
| --- | --- | --- |
|  | LHS VPIS TEST POINTS | RHS VPIS TEST POINTS |
| VPIS Points | L1-Earth | L2-Earth | L3-Earth | L1-Earth | L2-Earth | L3-Earth |
| Voltage (V) |  |  |  |  |  |  |

(f) 250V ac applied to L3 and Earth on Left Hand Switch Bushings

|  |  |  |
| --- | --- | --- |
|  | LHS VPIS TEST POINTS | RHS VPIS TEST POINTS |
| VPIS Points | L1-Earth | L2-Earth | L3-Earth | L1-Earth | L2-Earth | L3-Earth |
| Voltage (V) |  |  |  |  |  |  |

|  |
| --- |
| Tested by (signature):  |
| Print Name:  |
| Company:  |
| Date:  |

## C2 – Relay Protection Pre-Assembly Commissioning Sheet (excluding RN2D / RN6D with Micom P116 & VRN2a with 7SR45)

Manufacturer / Type /

Serial Number:

CT Ratio: CT Serial Numbers: R:

Y:

AC Wiring Insulation Resistance: Ω B:

**DC Resistance Tests**

|  |  |  |  |
| --- | --- | --- | --- |
| CT | RESISTANCE MEASURED (Ω) | RESISTANCE OF MEASURING CIRCUIT (Ω) | TRUE RESISTANCE (Ω) |
| R (L1) |  |  |  |
| Y (L2) |  |  |  |
| B (L3) |  |  |  |

**CT Polarity Check (Flick Test)**

|  |  |
| --- | --- |
| CT | POLARITY CHECKED |
| R (L1) |  |
| Y (L2) |  |
| B (L3) |  |

**Primary Injection Tests**

|  |  |  |
| --- | --- | --- |
| PRIMARY CURRENT (A) | R-Y (L1-L2) | R-B (L1-L3) |
| Secondary Current R (L1) CT (A) | Secondary Current Y (L2) CT (A) | Spill Current (mA) | Secondary Current B (L3) CT (A) | Spill Current (mA) |
|  |  |  |  |  |  |

**Ammeter Check**

Primary Current (A): Ammeter Reading (A):

**CT Magnetisation Characteristics**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SECONDARY CURRENT | 1MA | 4MA | 8MA | 10MA | 15MA | 30MA | 100MA |
| SecVolts | R (L1) |  |  |  |  |  |  |  |
| Y (L2) |  |  |  |  |  |  |  |
| B (L3) |  |  |  |  |  |  |  |

**CT Star Point Earth Link Resistance: Ω**

**Overcurrent Minimum Operation**

|  |  |
| --- | --- |
| PRIMARY CURRENT SETTING (A) | SECONDARY CURRENT AT MINIMUM OPERATION (A) |
| R-Y (L1-L2) | R-B (L1-L3) | Y-B (L2-L3) |
|  |  |  |  |

**Overcurrent Timing Test**

|  |  |  |  |
| --- | --- | --- | --- |
| CURRENT MULTIPLE | TIME MULTIPLIER | INJECTED CURRENT (A) | OPERATING TIME (S) |
| R-Y (L1-L2) | R-B (L1-L3) | Y-B (L2-L3) |
| 2X |  |  |  |  |  |
| 4X |  |  |  |  |  |
| High Set |  |  |  |  |  |

**Earth Fault Minimum Operation**

|  |  |
| --- | --- |
| PRIMARY CURRENT SETTING (A) | SECONDARY CURRENT AT MINIMUM OPERATION (A) |
| R-E (L1-E) | Y-E (L2-E) | B-E (L3-E) |
|  |  |  |  |

**Earth Fault Timing Test**

|  |  |  |  |
| --- | --- | --- | --- |
| CURRENT MULTIPLE | TIME MULTIPLIER | INJECTED CURRENT (A) | OPERATING TIME (S) |
| 2X |  |  |  |
| 4X |  |  |  |
| High Set |  |  |  |

**Relay Left Set At:**

|  |  |  |
| --- | --- | --- |
| ELEMENT | NORMAL SETTING | HIGH SET SETTINGS |
| Current | Curve | Time Multiplier | Current Multiple | Time Multiplier |
| Overcurrent |  |  |  |  |  |
| Earth Fault |  |  |  |  |  |

|  |
| --- |
| Tested by (signature):  |
| Print Name:  |
| Company:  |
| Date:  |

## C3 – Relay Protection Pre-Assembly Commissioning Sheet – RN2D

|  |  |  |  |
| --- | --- | --- | --- |
| Site |   | Circuit |   |
| **Unit Type** | **Schneider RN2D-M-N4/21** |  | **Relay Type** | **Micom P116A1N2N14121111N** |
| **Unit Serial No.** |  | **Relay Serial No.** |  |
| **CT Ratio** | **200/1** | **Prot CT Serial No.** | **L1.** |  |
|  | **L2.** |  |
| **L3.** |  |

**Insulation Tests @1kV**

**CT IR Test @ 1kV: Ω**

**DC Resistance Tests**

|  |  |  |  |
| --- | --- | --- | --- |
|  | MEASURED VALUE Ω | MEASURING CIRCUIT Ω | TRUE VALUE Ω |
| CT Earth Link |  |  |  |
| L1 CT C11-C70 |  |  |  |
| L2 CT C31-C70 |  |  |  |
| L3 CT C51-C70 |  |  |  |

**Magnetisation Characteristics**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1mA | 2mA | 5mA | 10mA | 25mA | 50mA | 100mA |
| L1 CT C11-C70 |  |  |  |  |  |  |  |
| L2 CT C31-C70 |  |  |  |  |  |  |  |
| L3 CT C51-C70 |  |  |  |  |  |  |  |

**Ratio Check**

|  |  |  |  |
| --- | --- | --- | --- |
| PHASE | PRIMARY CURRENT | SECONDARY CURRENT | RELAY CURRENT DISPLAY |
| C12 | C32 | C52 | C71 | IA | IB | IC  | IN |
| L1-L2 | 50 |  |  |  |  |  |  |  |  |
| L1-L3 | 50 |  |  |  |  |  |  |  |  |
| L1-E | 50 |  |  |  |  |  |  |  |  |

**Relay Minimum Operation**

|  |  |
| --- | --- |
| ELEMENT  | MIN OP CURRENT |
| IA Start |  |
| IB Start |  |
| IC Start |  |
| IN\_1 Start |  |

**Relay Timing Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ELEMENT  | INJECTION POINT | SECONDARY CURRENT | EXPECTED TIME (S)  | ACTUAL TIME (S) |
| L1-L2 | C11-C31 | 0.50 | 10.03 |  |
| L2-L3 | C31-C51 | 0.50 | 10.03 |  |
| L3-L1 | C51-C11 | 0.50 | 10.03 |  |
| L1-E | C11-C70 | 0.20 | 10.03 |  |

**VPIS Tests**

|  |  |  |
| --- | --- | --- |
| APPLIED VOLTAGE | RING SWITCH 1 VPIS (V) | RING SWITCH 2 VPIS (V) |
| 300V | L1 | L2 | L3 | L1 | L2 | L3 |
| Ring Switch 1 L1 |  |  |  |  |  |  |
| Ring Switch 1 L2 |  |  |  |  |  |  |
| Ring Switch 1 L3 |  |  |  |  |  |  |
| Ring Switch 2 L1 |  |  |  |  |  |  |
| Ring Switch 2 L2 |  |  |  |  |  |  |
| Ring Switch 2 L3 |  |  |  |  |  |  |

**NOTE:** Left set a minimum setting. Service settings to be applied on site and confirmed by secondary injection tests.

|  |
| --- |
| Tested by (signature):  |
| Print Name:  |
| Company:  |
| Date:  |

## C4 - Relay Protection Pre-Assembly Commissioning Sheet – RN6D

|  |  |  |  |
| --- | --- | --- | --- |
| Site |   | Circuit |   |
| **Unit Type** | **Schneider RN6D-M-N4/21** |  | **Relay Type** | **Micom P116A1N2N14121111N** |
| **Unit Serial No.** |  | **Relay Serial No.** |  |
| **CT Ratio** | **800/400/1** | **Prot CT Serial No.** | **L1.** |  |
|  | **L2.** |  |
| **L3.** |  |

**Insulation Resistance Tests @1kV**

|  |  |  |
| --- | --- | --- |
| CT IR Test @ 1kV |   | Ω |

**DC Resistance Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RATIO |   | MEASURED VALUE Ω | MEASURING CIRCUIT Ω | TRUE VALUE Ω |
|   | CT Earth Link |   |   |   |   |
| 400/1 | L1 CT C11-C210 |   |   |   |
| L2 CT C31-C230 |   |   |   |
| L3 CT C51-C250 |   |   |   |
| 800/1 | L1 CT C11-C110 |   |   |   |
| L2 CT C31-C130 |   |   |   |
| L3 CT C51-C150 |   |   |   |

**Magnetisation Characteristics**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RATIO |   | 1MA | 2MA | 5MA | 10MA | 25MA | 50MA | 100MA |
| 400/1 | L1 CT C11-C210 |   |   |   |   |   |   |   |
| L2 CT C31-C230 |   |   |   |   |   |   |   |
| L3 CT C51-C250 |   |   |   |   |   |   |   |
| 800/1 | L1 CT C11-C110 |   |   |   |   |   |   |   |
| L2 CT C31-C130 |   |   |   |   |   |   |   |
| L3 CT C51-C150 |   |   |   |   |   |   |   |

**Ratio Check**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | PHASE | PRIMARY | SECONDARY CURRENT MA | RELAY CURRENT DISPLAY |
|   |   | Current | C12 | C32 | C52 | C71 | IA | IB | IC | IN |
| 800/1 | L1-L2 | 200 |   |   |   |   |   |   |   |   |
| L1-L3 | 200 |   |   |   |   |   |   |   |   |
| L1-E | 200 |   |   |   |   |   |   |   |   |
| 400/1 | L1-L2 | 100 |   |   |   |   |   |   |   |   |
| L1-L3 | 100 |   |   |   |   |   |   |   |   |
| L1-E | 100 |   |   |   |   |   |   |   |   |

**Relay Minimum Operation**

|  |  |
| --- | --- |
| ELEMENT | MIN OP |
|   | Current |
| IA Start |   |
| IB Start |   |
| IC Start |   |
| IN\_1 Start |   |

**7. VPIS Tests**

|  |  |  |
| --- | --- | --- |
| APPLIED VOLTAGE | RING SWITCH 1 VPIS (V) | RING SWITCH 2 VPIS (V) |
| 300V  | L1 | L2 | L3 | L1 | L2 | L3 |
| Ring Switch 1 L1 |   |   |   |   |   |   |
| Ring Switch 1 L2 |   |   |   |   |   |   |
| Ring Switch 1 L3 |   |   |   |   |   |   |
| Ring Switch 2 L1 |   |   |   |   |   |   |
| Ring Switch 2 L2 |   |   |   |   |   |   |
| Ring Switch 2 L3 |   |   |   |   |   |   |

**NOTE:** Left set a minimum setting. Service settings to be applied on site and confirmed by secondary injection tests.

|  |
| --- |
| Tested by (signature):  |
| Print Name:  |
| Company:  |
| Date:  |

# C5 – Relay Protection Pre-Assembly Commissioning Sheet – VRN2a with 7SR45 Relay

September 2022

|  |  |  |  |
| --- | --- | --- | --- |
| Site |   | Circuit |   |
| **Unit Type** | **Lucy Sabre VRN2a** |  | **Relay Type** | **Siemens 7SR4504-1HB20-1AA0/HH** |
| **Unit Serial No.** |  | **Relay Serial No.** |  |
| **CT Ratio** | **200/100/1** |

1. **Insulation Tests @1kV**

**CT IR Test @ 1kV: Ω**

1. **DC Resistance Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Ratio |  | MEASURED VALUE Ω | MEASURING CIRCUIT Ω | TRUE VALUE Ω |
|  | CT Earth Link |  |  |  |
| 100/1 | L1 CT C11-C210 |  |  |  |
| L2 CT C31-C230 |  |  |  |
| L3 CT C51-C250 |  |  |  |
| 200/1 | L1 CT C11-C110 |  |  |  |
| L2 CT C31-C130 |  |  |  |
| L3 CT C51-C150 |  |  |  |

**3 Magnetisation Characteristics**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RATIO |  | 1mA | 2mA | 5mA | 10mA | 25mA | 50mA | 100mA |
| 100/1 | L1 CT C11-C70 |  |  |  |  |  |  |  |
| L2 CT C31-C70 |  |  |  |  |  |  |  |
| L3 CT C51-C70 |  |  |  |  |  |  |  |
| 200/1 | L1 CT C11-C70 |  |  |  |  |  |  |  |
| L2 CT C31-C70 |  |  |  |  |  |  |  |
| L3 CT C51-C70 |  |  |  |  |  |  |  |

**4 Ratio Check**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RATIO | PHASE | PRIMARY CURRENT | SECONDARY CURRENT | RELAY CURRENT DISPLAY |
| C110 (1) | C130 (2) | C150 (3) | C72 (4) | Ia | Ib | Ic | Ig/In |
| 200/1 | L1-L2 | 50 |  |  |  |  |  |  |  |  |
| L1-L3 | 50 |  |  |  |  |  |  |  |  |
| L1-E | 50 |  |  |  |  |  |  |  |  |
|  |  |  | C210 (5) | C230 (6) | C250 (7) | C72 (4) | Ia | Ib | Ic | Ig/In |
| 100/1 | L1-L2 | 25 |  |  |  |  |  |  |  |  |
| L1-L3 | 25 |  |  |  |  |  |  |  |  |
| L1-E | 25 |  |  |  |  |  |  |  |  |

**5 Relay Minimum Operation**

|  |  |
| --- | --- |
| ELEMENT  | MIN OP CURRENT |
| IL1 Pickup |  |
| IL2 Pickup |  |
| IL3 Pickup |  |
| IE Pickup |  |

**6 Relay Timing Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ELEMENT  | INJECTION POINT | SECONDARY CURRENT | EXPECTED TIME (S)  | ACTUAL TIME (S) |
| L1-L2 | C11-C31 | 1.00 | 10.03 |  |
| L2-L3 | C31-C51 | 1.00 | 10.03 |  |
| L3-L1 | C51-C11 | 1.00 | 10.03 |  |
| L1-E | C11-C70 | 0.50 | 10.03 |  |

**7 VPIS Tests**

|  |  |  |
| --- | --- | --- |
| APPLIED VOLTAGE | RING SWITCH 1 VPIS (V) | RING SWITCH 2 VPIS (V) |
| 300V | L1 | L2 | L3 | L1 | L2 | L3 |
| Ring Switch 1 L1 |  |  |  |  |  |  |
| Ring Switch 1 L2 |  |  |  |  |  |  |
| Ring Switch 1 L3 |  |  |  |  |  |  |
| Ring Switch 2 L1 |  |  |  |  |  |  |
| Ring Switch 2 L2 |  |  |  |  |  |  |
| Ring Switch 2 L3 |  |  |  |  |  |  |

**NOTE:** Left set a minimum setting. Service settings to be applied on site and confirmed by secondary injection tests.

|  |
| --- |
| Tested by (signature):  |
| Print Name:  |
| Company:  |
| Date:  |

## C6 - Earth Fault Indicator(s) (EFI) Pre-Assembly Commissioning Sheet

Manufacturer / Type /

September 2022

Serial Number:

CT Ratio: Normally 500/1

|  |  |
| --- | --- |
| Ring Switch 2 | CT Serial Number |
| L1 |  |
| L2 |  |
| L3 |  |

**CT Serial Numbers:**

|  |  |
| --- | --- |
| Ring Switch 1 | CT Serial Number |
| L1 |  |
| L2 |  |
| L3 |  |

**AC Wiring Insulation Resistance: Ω**

**CT IR Test @ 1kV: Ω**

**DC Resistance Tests**

|  |  |  |  |
| --- | --- | --- | --- |
| CT | MEASURED VALUE Ω | MEASURING CIRCUIT Ω | TRUE VALUE Ω |
| Ring Switch 1 | L1 |  |  |  |
| L2 |  |  |  |
| L3 |  |  |  |
| Ring Switch 2 | L1 |  |  |  |
| L2 |  |  |  |
| L3 |  |  |  |

**Magnetisation Characteristics**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Secondary Current | 1mA | 2mA | 5mA | 10mA | 25mA | 50mA | 100mA | 200mA |
| Ring Switch 1 | L1 |  |  |  |  |  |  |  |  |
| L2 |  |  |  |  |  |  |  |  |
| L3 |  |  |  |  |  |  |  |  |
| Ring Switch 2 | L1 |  |  |  |  |  |  |  |  |
| L2 |  |  |  |  |  |  |  |  |
| L3 |  |  |  |  |  |  |  |  |

**CT Ratio and Polarity Check**

|  |  |  |  |
| --- | --- | --- | --- |
| RATIO | PRIMARY CURRENT (A) | L1 – L2 | L1 – L3 |
| Secondary Current R CT (A) | Secondary Current Y CT (A) | Spill Current (mA) | Secondary Current B CT (A) | Spill Current (mA) |
| 500/1 | 125 |  |  |  |  |  |
| 500/1 | 125 |  |  |  |  |  |

**NOTE:** **EFI Shorting Links Shall be Replaced After Testing**

|  |
| --- |
| Shorting Links Replaced:  |
| Tested by (signature):  |
| Print Name:  |
| Company:  |
| Date:  |

## C7 - Relay Protection Pre-Assembly Commissioning Sheet – CE2

September 2022

|  |  |  |  |
| --- | --- | --- | --- |
| Site |   | Circuit |   |
| **Unit Type** | **Schneider CE2-N121/21** |  | **Relay Type** | **Micom P116A1N2N14121111N** |
| **Unit Serial No.** |  | **Relay Serial No.** |  |
| **CT Ratio** | **200/1** | **Prot CT Serial No.** | **L1.** |  |
|  | **L2.** |  |
| **L3.** |  |

**Insulation Resistance Tests @1kV**

|  |  |  |
| --- | --- | --- |
| CT IR Test @ 1kV |   | Ω |

**DC Resistance Tests**

|  |  |  |  |
| --- | --- | --- | --- |
|   | MEASURED VALUE Ω | MEASURING CIRCUIT Ω | TRUE VALUE Ω |
| CT Earth Link |   |   |   |   |
| L1 CT C11-C70 |   |   |   |
| L2 CT C31-C70 |   |   |   |
| L3 CT C51-C70 |   |   |   |

**Magnetisation Characteristics**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|   | 1mA | 2mA | 5mA | 10mA | 25mA | 50mA | 100mA |
| L1 CT C11-C70 |   |   |   |   |   |   |   |
| L2 CT C31-C70 |   |   |   |   |   |   |   |
| L3 CT C51-C70 |   |   |   |   |   |   |   |

**Ratio Check**

|  |  |  |  |
| --- | --- | --- | --- |
| PHASE | PRIMARY | SECONDARY CURRENT MA | RELAY CURRENT DISPLAY |
|   | Current | C12 | C32 | C52 | C71 | IA | IB | IC | IN |
| L1-L2 | 50 |   |   |   |   |   |   |   |   |
| L1-L3 | 50 |   |   |   |   |   |   |   |   |
| L1-E | 50 |   |   |   |   |   |   |   |   |

**Relay Minimum Operation**

|  |  |
| --- | --- |
| ELEMENT | MIN OP |
|   | Current |
| IA Start |   |
| IB Start |   |
| IC Start |   |
| IN\_1 Start |   |

**Relay Timing Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ELEMENT | INJECTION | SECONDARY | EXPECTED | ACTUAL |
|   | Point | Current | Time (s) | Time (s) |
| L1-L2 | C11-C31 | 0.50 | 10.03 |   |
| L2-L3 | C31-C51 | 0.50 | 10.03 |   |
| L3-L1 | C51-C11 | 0.50 | 10.03 |   |
| L1-E | C11-C70 | 0.20 | 10.03 |   |

**VPIS Tests**

|  |  |
| --- | --- |
| APPLIED VOLTAGE | VPIS (V) |
| 300V  | L1 | L2 | L3 |
| L1 |   |   |   |
| L2 |   |   |   |
| L3 |   |   |   |

**NOTE:** Left set a minimum setting. Service settings to be applied on site and confirmed by secondary injection tests.

|  |
| --- |
| Tested by (signature):  |
| Print Name:  |
| Company:  |
| Date:  |

## C8 - Relay Protection Pre-Assembly Commissioning Sheet – CE6

September2022

|  |  |  |  |
| --- | --- | --- | --- |
| Site |   | Circuit |   |
| **Unit Type** | **Schneider CE6-N213/21** |  | **Relay Type** | **Micom P116A1N2N14121111N** |
| **Unit Serial No.** |  | **Relay Serial No.** |  |
| **CT Ratio** | **800/400/1** | **Prot CT Serial No.** | **L1.** |  |
|  | **L2.** |  |
| **L3.** |  |

**Insulation Resistance Tests @1kV**

|  |  |  |
| --- | --- | --- |
| CT IR Test @ 1kV |   | Ω |

**DC Resistance Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RATIO |   | MEASURED VALUE Ω | MEASURING CIRCUIT Ω | TRUE VALUE Ω |
|   | CT Earth Link |   |   |   |   |
| 400/1 | L1 CT C11-C210 |   |   |   |
| L2 CT C31-C230 |   |   |   |
| L3 CT C51-C250 |   |   |   |
| 800/1 | L1 CT C11-C110 |   |   |   |
| L2 CT C31-C130 |   |   |   |
| L3 CT C51-C150 |   |   |   |

**Magnetisation Characteristics**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RATIO |   | 1mA | 2mA | 5mA | 10mA | 25mA | 50mA | 100mA |
| 400/1 | L1 CT C11-C210 |   |   |   |   |   |   |   |
| L2 CT C31-C230 |   |   |   |   |   |   |   |
| L3 CT C51-C250 |   |   |   |   |   |   |   |
| 800/1 | L1 CT C11-C110 |   |   |   |   |   |   |   |
| L2 CT C31-C130 |   |   |   |   |   |   |   |
| L3 CT C51-C150 |   |   |   |   |   |   |   |

**Ratio Check**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | PHASE | PRIMARY | SECONDARY CURRENT MA | RELAY CURRENT DISPLAY |
|   |   | Current | C12 | C32 | C52 | C71 | IA | IB | IC | IN |
| 800/1 | L1-L2 | 200 |   |   |   |   |   |   |   |   |
| L1-L3 | 200 |   |   |   |   |   |   |   |   |
| L1-E | 200 |   |   |   |   |   |   |   |   |
| 400/1 | L1-L2 | 100 |   |   |   |   |   |   |   |   |
| L1-L3 | 100 |   |   |   |   |   |   |   |   |
| L1-E | 100 |   |   |   |   |   |   |   |   |

**Relay Minimum Operation**

|  |  |
| --- | --- |
| ELEMENT | MIN OP |
|   | Current |
| IA Start |   |
| IB Start |   |
| IC Start |   |
| IN\_1 Start |   |

**Relay Timing Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ELEMENT | INJECTION | SECONDARY | EXPECTED | ACTUAL |
|   | Point | Current | Time (s) | Time (s) |
| L1-L2 | C11-C31 | 0.50 | 10.03 |   |
| L2-L3 | C31-C51 | 0.50 | 10.03 |   |
| L3-L1 | C51-C11 | 0.50 | 10.03 |   |
| L1-E | C11-C70 | 0.20 | 10.03 |   |

**VPIS Tests**

|  |  |
| --- | --- |
| APPLIED VOLTAGE | VPIS (V) |
| 300V  | L1 | L2 | L3 |
| L1 |   |   |   |
| L2 |   |   |   |
| L3 |   |   |   |

**NOTE:** Left set a minimum setting. Service settings to be applied on site and confirmed by secondary injection tests.

|  |
| --- |
| Tested by (signature):  |
| Print Name:  |
| Company:  |
| Date:  |