**INDEX**

|  |  |  |
| --- | --- | --- |
| Item | Description | Remarks |
| 1 | Reactor data & characteristics |  |
| 2 | Mechanical checks and visual inspection |  |
| 3 | Core insulation resistance test |  |
| 4 | Insulation resistance of Reactor & polarizing index test |  |
| 5 | Winding resistance test |  |
| 6 | Magnetizing current test |  |
| 7 | Capacitance & tan delta of winding & bushing |  |
| 8 | Zero sequence impedance test |  |
| 9 | Winding temperature calibration by sec current injection |  |
| 10 | Oil & winding temperature gauge calibration |  |
| 11 | Oil breakdown test |  |
| 12 | Supervision equipment functional checks |  |

1. **NAME PLATE DETAILS**

Sl No. :

Make

Power capacity : MVA

Voltage rating : kV

Frequency : 60 Hz

No. Of phases : 3

Rated current : A

Type of cooling :

1. **MECHANICAL CHECKS AND VISUAL INSPECTION:**

(As per TCS – P -105.Rev – 01, Item no 3.2.1)

|  |  |  |
| --- | --- | --- |
| Item | Description | Checked |
| 1 | Inspect for physical damage/defects |  |
| 2 | Check nameplates information for correctness |  |
| 3 | Check quality for paint work, condition of lifting lugs |  |
| 4 | Check Tightness of All Bolted Connections (Torque Wrench Method) and refer manufacture’s recommendations |  |
| 5 | Check impact recorder for indication of abnormal impacts |  |
| 6 | Check integrity of diagram/airbag in the conservator |  |
| 7 | Check piping to buchholz relay has proper slope |  |
| 8 | Check that all grounding are securely connected |  |
| 9 | Check vertical/horizontal clearance of live parts to adjacent non-current carrying metallic/ground parts |  |
| 10 | Check HV bushing for damage |  |
| 11 | Check oil test enclosed result from lab |  |
| 12 | Check the silica gel breather for color and quantity |  |
| 13 | Check proper operation of all auxiliary devices. |  |

1. **ELECTRICAL TESTS:**

(As per TCS – P -105.Rev – 01, Item no 3.2.2)

* 1. **INSULATION RESISTANCE & POLARIZING INDEX TEST**

Instrument : megger 520

Average oil temperature : °C

* + 1. **Tested with : 5000 VDC**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Measurement | Insulation resistance with 5000 volt tester (Ω) | | | |
| Test voltage kv | At 60 th sec (Ω) | At 600 th sec (Ω) | PI=R600/R60 |
| HV to ground |  |  |  |  |

Criteria: Polarization Index (I.R at 10 min / I.R at 1 Min) Value > 1.3

* + 1. **Tested with : 1000 VDC**

|  |  |
| --- | --- |
| Insulation resistance between | Insulation resistance with 1000 v tester (G Ω) (1 min) |
| Core to ground |  |
| Main core frame to earth |  |

Criteria:

1. **WINDING RESISTANCE TEST**

Instrument : transformer winding resistance kit - Avo

Oil temperature : ° c

Injecting current : A

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Tap no. | Winding resistance  (Ω) @ ambient temp. | | | Average Res /ph @ amb.Temp (Ω) | \* res /ph @ 75 ° c (Ω) | Winding  Connection |
| U-N | V-N | W-N |
|  |  |  |  |  |  | STAR |

(235 + 75)

\* Res / Ph @ 75 ° C. = Avg. Res / Ph @ Amb. Temp. X --------------------------

(235 + Avg Oil Temp.)

Note

Factory value :

Tested value :

Error : %

1. **MAGNETIZING CURRENT TEST**

Condition**:**

1)Three phase voltage applied on HV side.

2) Current measurement carried at HV terminals.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Tap  no. | Applied voltage at primary  Winding in Volt | | | Magnetizing current at primary  Winding in mA | | |
| H1-H2 | H2-H3 | H3-H1 | I H1 | I H2 | I H3 |
| --- |  |  |  |  |  |  |

I calculated = AVG. VOLTAGE X RATED TAP CURRENT

RATED TAP VOLTAGE

I0 % = MEASURED AVG.CURRENT X 100 =

I Calculated

1. **CAPACITANCE & TAN DELTA OF WINDING**

Instrument: Biddle Delta 2000- 10KV automated insulation test set

Oil Temperature : ° C

Correction Factor :

(To convert % Dissipation Factor to 20 ° C, Divide the measured % Dissipation

Factor value with Correction Factor)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test  No. | Insulation  Tested | Test  Mode | Test Connection | | | Test  KV | mA | Capacitance  Ρf | P.f  % | P.f %  At 20 ̊ C | Watts |
| Eng | Gnd | Gar |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |

Limit: p.f % at 20 ° C < 0.5

1. **ZERO SEQUENCE IMPEDANCE MEASUREMENT**

Instrument: digital multimeter & clamp meter

* Shorted U , V ,W on HV side
* Single phase voltage applied on HV side, (H1,H2,H3)&(H0)
* Measure the voltage & current on HV side

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Tap** | **measured** | | **z0** | **Calculated z%** | **Factory z%** | **% error** |
| **V0** | **I0** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Applied voltage =

\*measured current =

\*rated tap current =

\*rated tap voltage =

Used calculation

3 V0 / I**0**

% Z = ----------------------------------------------- × 100

(VRATED / √3) /I **RATED**

Note:

Factory test = **%**

Error = **%**

1. **CALIBRATION OF OIL AND WINDING TEMPERATURE SENSORS**

Instrument: Broman- model

|  |  |  |
| --- | --- | --- |
| Reference Temp. | Oil Temp. Indicator | HV winding Temp Indicator |
| Starting Temp |  |  |
| 40 |  |  |
| 60 |  |  |
| 80 |  |  |
| 100 |  |  |
| 120 |  |  |
| 140 |  |  |

Limit: ± 3



* 1. **Winding Temperature Calibration By Secondary Current Injection**

High voltage winding temperature indicator:

CT Ratio :

Full load current: Amps

Current injection: Amps

|  |  |
| --- | --- |
| Reading | |
| Time (min.) | Temp. Reading |
| 0 |  |
| 5 |  |
| 10 |  |
| 15 |  |
| 20 |  |
| 25 |  |
| 30 |  |
| 35 |  |
| 40 |  |
| 45 |  |

|  |  |
| --- | --- |
| Oil Temp. at start (A) | ˚C |
| Oil Temp. at end (B) | ˚C |
| Winding Temp. Before current injection (C) | ˚C |
| Winding Temp. After 45 mins (D) | ˚C |
| Simulated Temp. Rise Measured: [(D-C)-(B-A)] | ˚C |

1. **OIL DIELECTRIC STRENGTH:**

Electrode form : IEC 156 1995

Distance : 2.5 mm

Minimum strength : 50 KV

|  |  |  |  |
| --- | --- | --- | --- |
| Sample location | Test # | Break down voltage (kv) | Avg.bd.Voltage (kv) |
| H.V. tank | 1 |  |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| Conservator | 1 |  |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |

1. **LOSS MEASUREMENT CALCULATION**

For R phase :

Measured voltage : in volts

Measured current : in amps

Formula used : R=V/I

Calculated Ω/ph :

Calculation of inductance:

Formula used **:** Z=R+XL

**:** L= (Z-R) / 2\*3.14\*60

Factory Test :

Calculated Value :

Error% :

For Y phase:

Measured line voltage : in volts

Measured current : in amps

Formula used : R=V/I

Calculated Ω/PH :

Calculation of inductance

Formula used **:** Z=R+XL

**:** L= (Z-R)/2\*3.14\*60

Factory test :

Calculated value :

Error% :

For B phase :

Measured line voltage : in volts

Measured current : in amps

Formula used : R=V/I

Calculated Ω/PH :

Calculation of inductance

Formula used **:** Z=R+XL

**:** L= (Z-R)/2\*3.14\*60

Factory test :

Calculated value :

Error% :

1. **TESTING OF FANS:**

Instrument : Digital Multimeter with Clamp Meter & Megger

Group # 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Fan no. | IR with 1000 v  ( GΩ ) | Starting current(amp) | | | Running current (amp) | | | Direction |
| IR | IY | IB | IR | IY | IB |
| 1 |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |  |  |

Total current consumption by group # 1 cooling fans

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | STARTING | | | RUNNING | | |
| IR | IY | IB | IR | IY | IB |
| GROUP # 1 |  |  |  |  |  |  |

As per approved drawing:

1. Verified group # 1 starts at : ° c

2. Verified group # 1 stops at : ° c

1. **FUNCTIONAL TEST ON THE CONTROL AND SUPERVISORY EQUIPMENT:**

Instrument: digital multimeter

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Devices | Alarm | Trip |
| 1 | Buchholz relay for main tank |  |  |
| 2 | Pressure relief valve |  |  |
| 3 | High voltage & winding gauges |  |  |
| 4 | Oil temperature |  |  |
| 5 | Thermostat for tank |  |  |
| 6 | Oil level Gauge for T/F |  |  |
| 7 | Mcb |  |  |

1. **INSULATION TEST ON CONTROL WIRES:**

All wiring were checked for continuity between individual devices, terminals and terminal box and insulation resistance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cable no. | Wires no. | Description | Voltage 500 v | Measured ohms |
|  |  | Buchholz T/F | 500 |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  | P.R.V - TF | 500 |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No. | Name of device | Terminal Marks | Insulation resistance at 1000 V (KΩ) | Result |
| 1 | Buchholz relay for transformer |  | > 150000 |  |
| 2 | Buchholz relay for conservator |  | > 150000 |  |
| 3 | Thermometer for oil temperature |  | > 150000 |  |
| 4 | Thermometer for winding temp |  | > 150000 |  |
| 5 | Oil level indicator |  | > 150000 |  |
| 6 | Pressure relief device |  | > 150000 |  |
| 7 | Temperature monitor for oil temp |  | > 150000 |  |
| 8 | Source cabling |  | > 150000 |  |
| 9 | Others |  | > 150000 |  |