# CPRI

# TEST REPORT

Central Power Research Institute
(A Govt. of India Society)
Medipally P.O., Warangal Road,
Hyderabad – 500 098 (INDIA)

# CENTRAL POWER RESEARCH INSTITUTE

CPRI

## TEST REPORT

| | | |
|---|---|---|
| **Test Report Number** | : | **CPRIHYDUHVMISC24T0079** **Date: 01 April 2024** |
| **Name and Address of the Customer** | : | M/s. CG Power and Industrial Solutions Limited, D-2, MIDC, Waluj, Aurangabad-431136, Maharashtra State, India |
| **Name and Address of the Manufacturer** | : | M/s. CG Power and Industrial Solutions Limited, D-2, MIDC, Waluj, Aurangabad-431136, Maharashtra State, India |
| **Particulars of sample tested** | : | 132 kV Inductive Voltage Transformer |
| **Type** | : | VEOT:145/650/50 |
| **Description of test sample** | : | 132 kV Inductive Voltage Transformer |
| **Serial Number** | : | 234656 |
| **Number of samples tested** | : | One |
| **Date(s) of test(s)** | : | 22 March 2024 to 23 March 2024 |
| **CPRI Sample Code number(s)** | : | UHV24S0073 |
| **Particulars of test conducted** | : | Refer sheet 3 of 7 |
| **Test in accordance with Standard/ Specification** | : | IEC 61869-1: 2007 and IEC 61869-3: 2011 |
| **Sampling plan** | : | Not applicable |
| **Customer's requirement** | : | Short circuit withstand capability test to be performed on 3a-3n secondary winding |
| **Deviations, if any** | : | Nil |
| **Name of the witnessing persons Customer representatives** | : | Mr. Gajanan Khadke |
| **Other than customer's representatives** | : | Nil |
| **Test subcontracted with address of the laboratory** | : | None |
| **Documents constituting this report (in words)** | | |
| **Number of Sheets(s)** | : | Seven |
| **Number of Oscillogram(s)** | : | One |
| **Number of Graph(s)** | : | Nil |
| **Number of Photograph(s)** | : | Nil |
| **Number of Test circuit diagram(s)** | : | Two |
| **Number of Drawing(s)** | : | Two |

(B. Krishna)
Test Engineer

(K. Devender Rao)
Joint Director
Reviewed and Authorized by



UHV RESEARCH LABORATORY
MEDIPALLY P.O., WARANGAL HIGHWAY, HYDERABAD – 500098
PHONE: 080-2207 2051, 080-2207 2052, e-mail: uhvrl@cpri.in

# CENTRAL POWER RESEARCH INSTITUTE

CPRI

## TEST REPORT

**Test Report Number: CPRIHYDUHVMISC24T0079** **Dated: 01 April 2024**

### DESCRIPTION OF SAMPLE TESTED
(As assigned by the manufacturer)

145 kV Inductive Voltage Transformer

| | | |
|---|---|---|
| Rated primary voltage ($U_{pr}$) | : | 132 / √3 $kV_{rms}$ |
| Highest system voltage (HSV) | : | 145 $kV_{rms}$ |
| Frequency | : | 50 Hz |
| Insulation Level | : | 275 $kV_{rms}$ / 650 $kV_p$ |
| Voltage factor | : | 1.2 continuous and 1.5 for 30 seconds |

| Rated secondary voltage (V) | Terminal marking | Burden (VA) | Accuracy class |
|---|---|---|---|
| 110 / √3 | 1a – 1n | 200 | 3P |
| 110 / √3 | 2a – 2n | 50 | 3P |
| 110 / √3 | 3a – 3n | 50 | 0.5 |

(B. Krishna)
Test Engineer



UHV RESEARCH LABORATORY
MEDIPALLY P.O., WARANGAL HIGHWAY, HYDERABAD – 500098
PHONE: 080-2207 2051, 080-2207 2052, e-mail: uhvrl@cpri.in

## CENTRAL POWER RESEARCH INSTITUTE

CPRI

### TEST REPORT

**Test Report Number : CPRIHYDUHVMISC24T0079** **Date: 01 April 2024**

### SUMMARY OF TEST CONDUCTED

1. Tests conducted : Routine, type and special tests
2. Rating for which tested : 132 $kV_{rms}$
3. Schedule of test results

| Tests conducted | Clause Number and Standard | Sheet Number |
|---|---|---|
| Short circuit withstand capability test | 7.2.301 of IEC 61869-3:2011 | 4 of 7 |
| Test for Accuracy after short circuit withstand capability test | 7.2.6 of IEC: 61869-5:2011 | 5 & 6 of 7 |

4. Oscillogram Numbers : CPRIHYDUHVMISC24T0079S001
5. Graph Numbers : Nil
6. Photograph Numbers : Nil
7. Test Circuit Diagram Numbers : CPRIHYDUHVMISC24T0079TCD01 and CPRIHYDUHVMISC24T0079TCD02

**Drawing Numbers**

The manufacturer has guaranteed that the sample submitted for the test(s) has been manufactured in accordance with the following drawings:

| Sl. No. | Drawing Number | Sheet Number | Revision Number |
|---|---|---|---|
| 1 | 413695829 IVT4900 GA/R0 | --- | --- |
| 2 | 413695829 IVT4900 RS_R0 | --- | --- |

It is verified that these drawings adequately represent the sample tested. Verification of these drawings by CPRI is limited to dimensional check only wherever possible.

(B. Krishna)
Test Engineer



UHV RESEARCH LABORATORY
MEDIPALLY P.O., WARANGAL HIGHWAY, HYDERABAD – 500098
PHONE: 080-2207 2051, 080-2207 2052, e-mail: uhvrl@cpri.in

# CENTRAL POWER RESEARCH INSTITUTE

CPRI

## TEST REPORT

**Test Report Number : CPRIHYDUHVMISC24T0079** **Date: 01 April 2024**

## TEST RESULTS

**Test: Short circuit withstand capability test** (As per clause 7.2.301 of IEC 61869-3:2011)

| | | |
|---|---|---|
| **Test condition** | : | Under dry condition |
| **Test frequency** | : | 50 Hz |
| **Ambient conditions** | : | |
| Dry bulb temperature | : | 30 °C |
| Wet bulb temperature | : | 25 °C |
| Atmospheric pressure | : | 95.06 kPa |

**Test procedure:** The power frequency AC voltage applied on the primary terminal of the IVT. Terminals N, 1n and 2n were connected to earth along with the tank. The secondary winding terminals 3a – 3n were shorted for duration of 1 s at rated primary voltage ($U_{pr}$) i.e., 76.2 $kV_{rms}$ using contactor. The secondary current was measured using a CT of 150 / 5 A ratio along with a burden of 10 Ω connected across CT secondary. The primary voltage, secondary voltage and the secondary current through 3a – 3n were recorded using a four channel PicoScope. It is indicated as upper, middle and lower traces, respectively in the oscillogram no. CPRIHYDUHVMISC24T0079S001

**Observations:**

1. No physical damage was observed to the IVT after the test
2. No examination of insulation next to surfaces of primary and secondary windings was conducted, as the current density in the secondary winding calculated from the measured symmetrical short-circuit current in the secondary winding was less than 180 A / $mm^2$

**(B. Krishna)**
**Test Engineer**



UHV RESEARCH LABORATORY
MEDIPALLY P.O., WARANGAL HIGHWAY, HYDERABAD – 500098
PHONE: 080-2207 2051, 080-2207 2052, e-mail: uhvrl@cpri.in

# CENTRAL POWER RESEARCH INSTITUTE

CPRI

## TEST REPORT

**Test Report Number** : **CPRIHYDUHVMISC24T0079** **Date: 01 April 2024**

## TEST RESULTS

**Test: Test for Accuracy after short circuit withstand capability test** (7.2.6 of IEC 61869-3: 2011)

**Test condition** : Under dry condition
**Test frequency** : 50 Hz

**Ambient conditions** :
Dry bulb temperature : 29°C
Wet bulb temperature : 24°C
Atmospheric pressure : 94.92 kPa
1. Primary voltage : 132 / √3 $kV_{rms}$
2. Secondary voltage : 110 / √3 $V_{rms}$

| Secondary winding under test | Burden (VA) | Test Voltage in percentage of primary voltage (%) | Voltage (Ratio) Error (%) | Phase Displacement (Minutes) | Remarks |
|---|---|---|---|---|---|
| 1a – 1n<br>Accuracy class: 3P<br>PF: 0.8 (lag) | 200 | 150 | -0.446 | 11.06 | The winding is within limits of voltage ratio error (±3%) and phase displacement (± 120 minutes) as specified in the standard |
| | | 120 | -0.266 | 4.77 | |
| | | 100 | -0.217 | 3.01 | |
| | | 5 | -0.235 | 3.18 | |
| | | 2 | -0.242 | 3.42 | |
| | 50 | 150 | -0.0907 | 8.55 | |
| | | 120 | 0.0748 | 3.11 | |
| | | 100 | 0.1362 | 0.763 | |
| | | 5 | 0.1206 | 0.633 | |
| | | 2 | 0.1187 | 0.723 | |

| Secondary winding under test | Burden (VA) | Test Voltage in percentage of primary voltage (%) | Voltage (Ratio) Error (%) | Phase Displacement (Minutes) | Remarks |
|---|---|---|---|---|---|
| 2a – 2n<br>Accuracy class: 3P<br>PF: 0.8 (lag) | 50 | 150 | -0.0649 | 9.52 | The winding is within limits of voltage ratio error (±3%) and phase displacement (± 120 minutes) as specified in the standard |
| | | 120 | 0.0873 | 3.38 | |
| | | 100 | 0.1368 | 1.349 | |
| | | 5 | 0.1219 | 1.046 | |
| | | 2 | 0.1193 | 1.526 | |
| | 12.5 | 150 | 0.0202 | 9.02 | |
| | | 120 | 0.1769 | 2.71 | |
| | | 100 | 0.226 | 0.670 | |
| | | 5 | 0.217 | 0.069 | |
| | | 2 | 0.219 | 0.012 | |

(B. Krishna)
**Test Engineer**



UHV RESEARCH LABORATORY
MEDIPALLY P.O., WARANGAL HIGHWAY, HYDERABAD – 500098
PHONE: 080-2207 2051, 080-2207 2052, e-mail: uhvrl@cpri.in

# CENTRAL POWER RESEARCH INSTITUTE

## TEST REPORT

**Test Report Number : CPRIHYDUHVMISC24T0079** **Date: 01 April 2024**

### TEST RESULTS

1. Primary voltage : $132 / \sqrt{3}$ $kV_{rms}$
2. Secondary voltage : $110 / \sqrt{3}$ $V_{rms}$

| Secondary winding under test | Burden (VA) | Test Voltage in percentage of primary voltage (%) | Voltage (Ratio) Error (%) | Phase Displacement (Minutes) | Remarks |
|---|---|---|---|---|---|
| 3a – 3n<br>Accuracy class: 0.5<br>PF: 0.8 (lag) | 60 | 120 | 0.1317 | 2.93 | The winding is within limits of voltage ratio error (±0.5%) and phase displacement (± 20 minutes) as specified in the standard |
| | | 100 | 0.1748 | 0.055 | |
| | | 80 | 0.1823 | 0.486 | |
| | 12.5 | 120 | 0.203 | 2.57 | |
| | | 100 | 0.244 | 0.557 | |
| | | 80 | 0.252 | 0.152 | |

**Conclusion:** Test sample tested complies with the requirement of clause no. 7.2.301 & 7.2.6 of 61869-3: 2011 and customer request for the tests conducted.

(B. Krishna)
Test Engineer



UHV RESEARCH LABORATORY
MEDIPALLY P.O., WARANGAL HIGHWAY, HYDERABAD – 500098
PHONE: 080-2207 2051, 080-2207 2052, e-mail: uhvrl@cpri.in

## CENTRAL POWER RESEARCH INSTITUTE

CPRI

### TEST REPORT

**Test Report Number. CPRIHYDUHVMISC24T0079** **Date: 01 April 2024**

### NOTE

a) The Test results relate only to the sample(s) tested.

b) Publication or reproduction of this Test Report /Test Certificate in any form other than by complete set of the whole Test Report /Test Certificate and in the language written is not permitted without the written consent of CPRI.

c) Any Corrections/erasure invalidates the Test Report/Test Certificate

d) NABL has Accredited this laboratory as per ISO/IEC17025:2017, vide certificate no.TC-6198 for the tests carried out.

(B. Krishna)
Test Engineer

----------End of Test Report----------



UHV RESEARCH LABORATORY
MEDIPALLY P.O., WARANGAL HIGHWAY, HYDERABAD – 500098
PHONE: 080-2207 2051, 080-2207 2052, e-mail: uhvrl@cpri.in

# CENTRAL POWER RESEARCH INSTITUTE

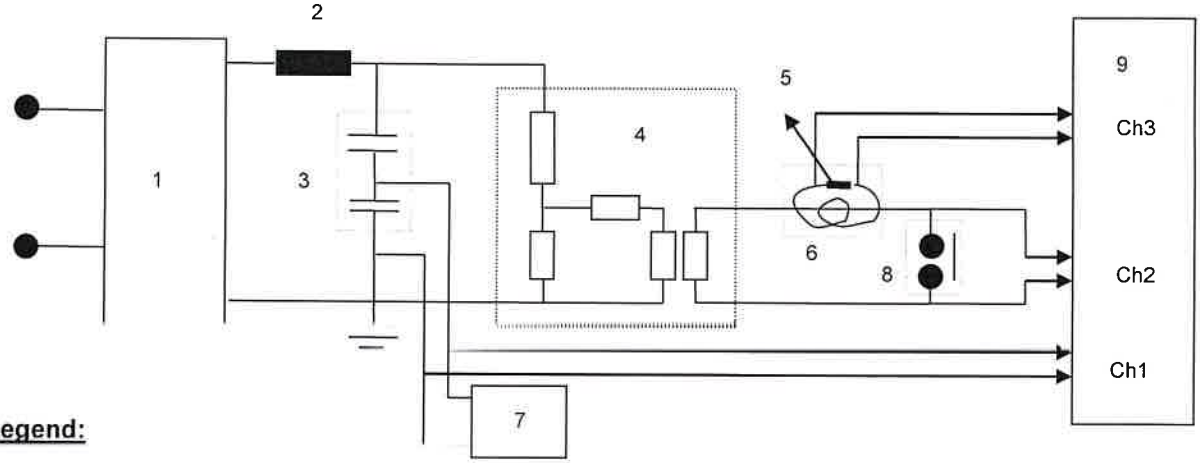
CPRI

## TEST REPORT

**Test Report Number. CPRIHYDUHVMISC24T0079** **Date: 01 April 2024**

## TEST CIRCUIT DIAGRAMS

### 1. Short-circuit withstand capability test & Ferro-resonance check

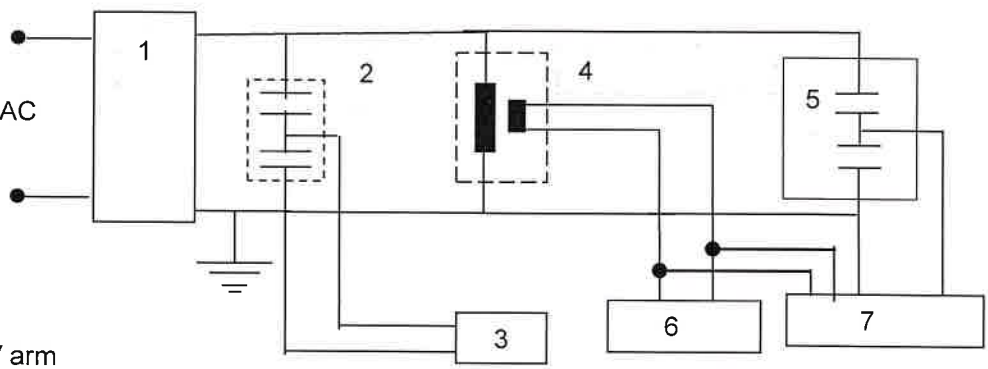



**Legend:**

1: HV AC source 2: Protective Resistor 3: Voltage divider 4: Test Sample
5: Burden (10 Ω) 6: 150 / 5 A CT 7: RMS voltmeter 8: Contactor
9: 4 Channel digital storage oscilloscope

**Test Circuit Diagram Number. CPRIHYDUHVMISC24T0079TCD01**

### 2. Test for accuracy




**Legend:**

1: HV AC Source
2: HV Divider
3: Voltmeter
4: IVT under test
5. Standard Capacitor with LV arm
6. Burden
7. Automatic instrument transformer test set with electronic potential divider

**Test Circuit Diagram Number: CPRIHYDUHVMISC24T0079TCD02**

**(B. Krishna)**
**Test Engineer**


UHV RESEARCH LABORATORY
MEDIPALLY P.O., WARANGAL HIGH WAY, HYDERABAD – 500098.
Phone: 080-22072051, 080-22072052, E-mail: uhvrl@cpri.in

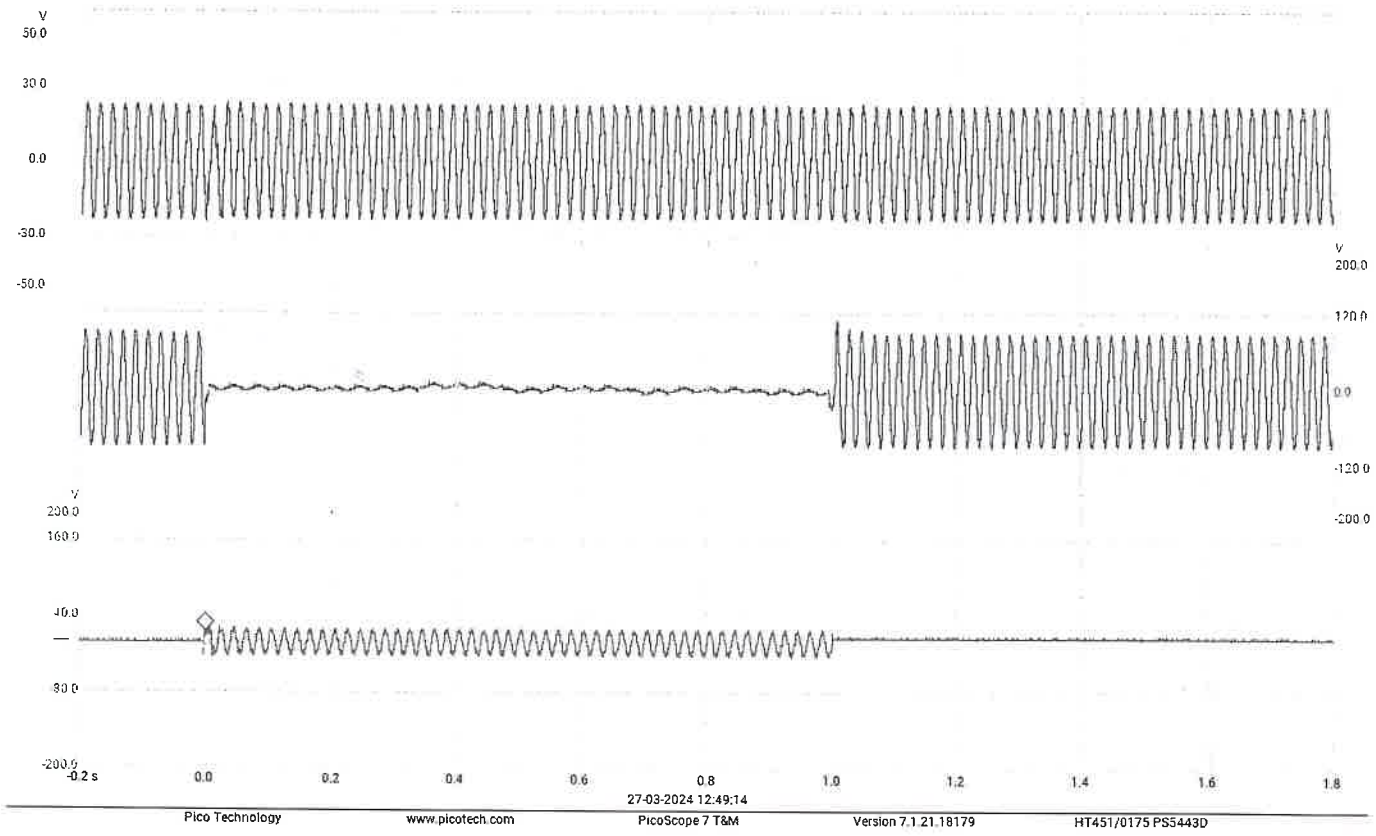
# CENTRAL POWER RESEARCH INSTITUTE

CPRI

## TEST REPORT

**Test Report Number. CPRIHYDUHVMISC24T0079** **Date: 01 April 2024**

### OSCILLOGRAM

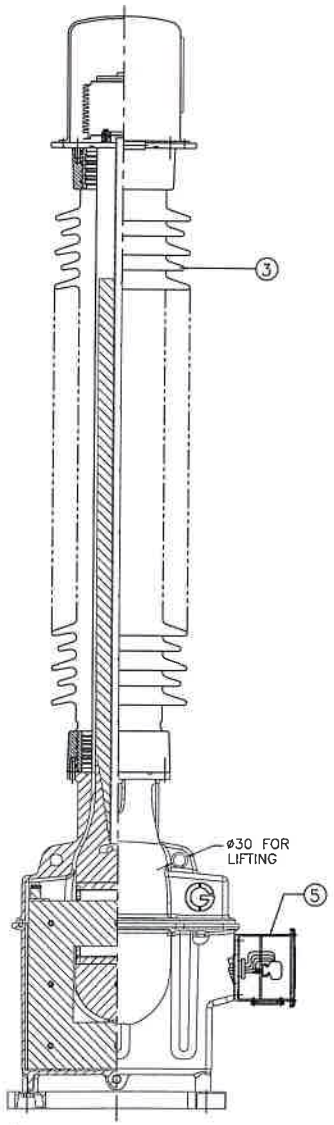



**Oscillogram Number**: CPRIHYDUHVMISC24T0079S001

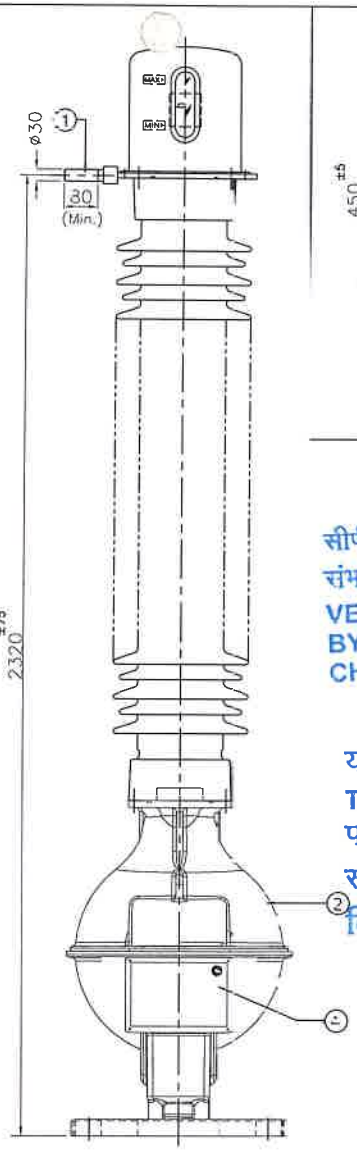
(R Krishna)
Test Engineer


UHV RESEARCH LABORATORY
MEDIPALLY P.O., WARANGAL HIGH WAY, HYDERABAD – 500098.
Phone: 080-22072051, 080-22072052, E-mail: uhvrl@cpri.in

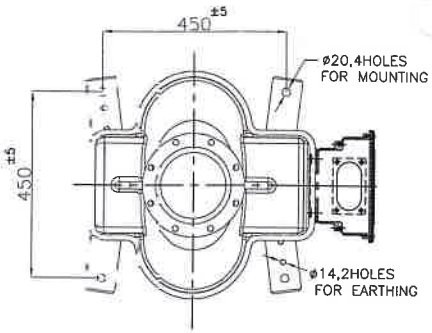
IF IN DOUBT ASK




SECTIONAL SIDE VIEW




FRONT VIEW




MOUNTING DETAILS

TOP VIEW

| ITEM NO. | QTY. | DESCRIPTION | MATERIAL |
|---|---|---|---|
| 1 | 1 | PRIMARY TERMINAL–ø30x80L(Min.) | COPPER |
| 2 | 1 | TANK | ALUMINIUM CAST |
| 3 | 1 | PORCELAIN INSULATOR | PORCELAIN BROWN COLOUR |
| 4 | 1 | RATING & SCHEMATIC DIAGRAM | ALUMINIUM |
| 5 | 1 | SECONDARY TERMINAL BOX | ALUMINIUM CAST |

## TECHNICAL SPECIFICATIONS
## 132 kV INDUCTIVE VOLTAGE TRANSFORMER

| SPECIFICATION | UNIT | RATING |
|---|---|---|
| HIGHEST SYSTEM VOLTAGE (Ph–Ph) | Kilo Volts | 145 |
| HIGHEST SYSTEM VOLTAGE (Ph–E) | Kilo Volts | 145/√3 |
| 1 MIN. AC WITHSTAND VOLTAGE | Kilo Volts | 275 |
| LIGHTNING IMPULSE WITHSTAND VOLTAGE | Kilo Volts(Peak) | 650 |
| TOTAL CREEPAGE DISTANCE(MINIMUM) | Milimeter | 3625 |
| TOTAL WEIGHT (±10%) | Kilogram | 400 |
| OIL VOLUME (±10%) | Litre | 90 |
| APPLICABLE STANDARDS | – | IEC:61869–1&3 |
| VOLTAGE FACTOR | = 1.2 CONTINUOUS/1.5–30SEC. | |
| INSULATION CLASS | A | |

सीपीआरआई के इस आरेख का सत्यापन जहाँ तक संभव हो, केवल आयाम जाँच तक ही सीमित है

VERIFICATION OF THIS DRAWING BY CPRI IS LIMITED TO DIMENSIONAL CHECK ONLY WHEREVER POSSIBLE

यह आरेख सीपीआरआई से संबंधित है।

THIS DRAWING PERTAINS TO CPRI

परीक्षण रिपोर्ट / TEST REPORT सं / NUMBER : CPRIHYDUHVMISC-24T0079

दिनांक / Date : 01.04.2024

परीक्षण इंजीनियर
यूएचवीआरएल, सीपीआरआई
हैदराबाद
Test Engineer
UHVRL, CPRI,
HYDERABAD

NOTE :

1) PRIMARY WINDING NO OF TURNS : 37120
2) CROSS SECTION AREA OF PRIMARY WIDING : 38 SWG. (0.01824 Sq.mm)
3) SECONDARY WINDING :

| NO.OF WINDING | NUMBER OF TURNS | SWG/Sq.mm |
|---|---|---|
| WINDING–I | 31 | (14x2)/6.48 |
| WINDING–II | 31 | (14x2)/6.48 |
| WINDING–III | 31 | (14x4)/12.97 |

4) CORE MATERIAL : CRGO M4

NOTE : PLEASE REFER INSTRUCTION MANUAL FOR HANDLING & TRANSPORTATION OF PT.

Dimensions shown are tentative and may change during detailed design/engineering.

| NO | REVISION | SIGN | DATE |
|---|---|---|---|
| R6 | | | |
| R5 | | | |
| R4 | | | |
| R3 | | | |
| R2 | | | |
| R1 | | | |

| | SIGN | NAME |
|---|---|---|
| DRN | | STJ |
| CHD | | SDS |
| APPD | | SDS |

GENERAL ARRANGEMENT DRAWING FOR 132 kV INDUCTIVE VOLTAGE TRANSFORMER

SCALE N.T.S. DATE : 14.12.2023 ALL DIMENSIONS ARE IN mm

CG Power and Industrial Solutions Limited. Autogenous

DRG.NO:–413695829 IVT4900 GA/E0

सीपीआरआई के इस आरेख का सत्यापन जहाँ भी संभव हो, केवल आयाम जाँच तक ही सीमित है ।
VERIFICATION OF THIS DRAWING BY CPRI IS LIMITED TO DIMENSIONAL CHECK ONLY WHEREVER POSSIBLE

यह आरेख सीपीआरआई से संबंधित है ।
THIS DRAWING PERTAINS TO CPRI
परीक्षण रिपोर्ट / TEST REPORT सं / NUMBER : CPRI/HVD/UHVMIS:2470079
दिनांक / Date : 01.04.2024

परीक्षण इंजीनियर
यूएचवीआरएल, सीपीआरआई
हैदराबाद
Test Engineer
UHVRL, CPRI,
HYDERABAD

IN DOUBT ASK

±1
175
±0.2
160

# 132 kV INDUCTIVE VOLTAGE TRANSFORMER

RATING & SCHEMATIC DIAGRAM

MFG. BY :- CG Power and Industrial Solutions Limited, D2 MIDC Waluj, Aurangabad

MADE IN INDIA

Customer : CG Power and Industrial Solutions Limited, Aurangabad (MSETCL)

PO NO. : -

| | | | | | |
|---|---|---|---|---|---|
| TYPE | VECT- 45/650/50 | S.O.NO. | 413695829 | YEAR | 2024 |
| SPEC. | IS : 16527-1&3/ IEC : 61869-1&3 | RATED FREQ. | 50 Hz | IVT SR.NO | [redacted] |

| | WINDING-I | WINDING-II | WINDING-III |
|---|---|---|---|
| | A - N | 1a - 1n | 2a - 2n | 3a - 3n |
| VOLTS | 132000 /√3 | 110/ √3 | 110/ √3 | 110/ √3 |
| BURDEN (VA) | -- | 200 | 50 | 50 |
| ACCURACY CLASS | -- | 3P | 3P | 0.5 |

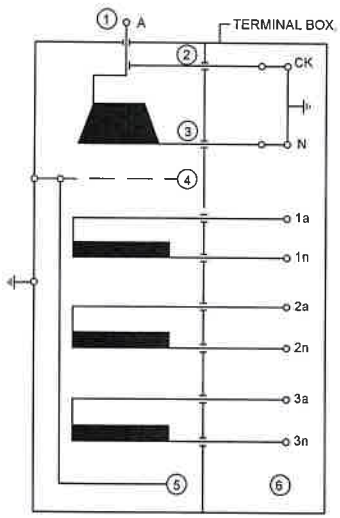
| | | | |
|---|---|---|---|
| HIGHEST SYSTEM VOLTAGE | 145 KV | INSULATION LEVEL | 275 kV/ 650 kVp |
| VOLTAGE FACTOR | 1.2 CONT./1.5-30SEC | CREEPAGE DISTANCE | 3625 mm |
| TOTAL WEIGHT | 1100 ±10% Kg | OIL VOLUME | 90 ±10% Litre |

1. PRIMARY TERMINAL (H.V.)
2. CAPACITANCE TAN DELTA LEADOUT FROM BUSHING ACTIVE PART.
3. NEUTRAL END OF HV WINDING.
4. EARTH SHIELD BETWEEN HV & LV. (CONNECTED TO EARTH INSIDE HOUSING.)
5. CORE EARTHING LEAD (CONNECTED TO EARTH INSIDE HOUSING)
6. SECONDARY LEADOUT.

CAUTION:

-ENSURE LV TERMINALS ARE NOT SHORTED IN OPERATION.

-ENSURE Ck AND N ARE CONNECTED TO EARTH BEFORE CHARGING IVT.




R0

80 ±0.2
95 ±1

4 HOLES OF ø4.5 mm

MATERIAL : AL.(PHOTO METALLIC)

IVT SR.NOs. : 234656

| NO | REVISION | SIGN | DATE |
|---|---|---|---|
| R6 | | | |
| R5 | | | |
| R4 | | | |
| R3 | | | |
| R2 | | | |
| R1 | | | |

| | SIGN | NAME |
|---|---|---|
| DRN | | KSH |
| CHD | | STJ |
| APPD | | SDS |

RATING & SCHEMATIC DIAGRAM
132 KV INDUCTIVE VOLTAGE TRANSFORMER

SCALE 1:1 DATE : 15.12.2023 ALL DIMENSIONS ARE IN mm

CG Power and Industrial Solutions Limited, Aurangabad

DRG.NO:-413695829 IVT4900 RS_R0