

CPRI

TEST REPORT



Central Power Research Institute

(A Govt. of India Society)

**P.B.No. 8066, Sadashivanagar Post Office,
Sir C.V. Raman Road,
Bengaluru - 560 080 (INDIA)**

CENTRAL POWER RESEARCH INSTITUTE
(Member of STL)



TEST REPORT

Test Report Number : CPRI BLRSCL22T0982 **Date:** 7 December 2022

Name and Address of the Customer : M/s. CG Power and Industrial Solutions Limited,
D-2 & D-1/2, MIDC, Waluj, Aurangabad – 431 136,
Maharashtra, India.

Name and Address of the Manufacturer : M/s. CG Power and Industrial Solutions Limited,
D-2 & D-1/2, MIDC, Waluj, Aurangabad – 431 136,
Maharashtra, India.

Particulars of sample tested : 145 kV, 300-600-1200/1 A, 600-1200/1 A & 3000/1 A
Current Transformer

Type : Outdoor, oil immersed, live tank
Description of the test sample : Refer Sheet 2 of 9
Serial Number : 220643
Number of samples tested : One

Date(s) of test (s) : 16 September, 2022

CPRI Sample code Number (s) : HVD22S0707

Particulars of tests conducted : Refer Sheet 3 of 9
Test in accordance with
Standard / specification : IEC 61869-2: 2012 & IEC 61869-1: 2007

Sampling plan : Not applicable

Customer's requirement : Nil
Deviations if any : Nil

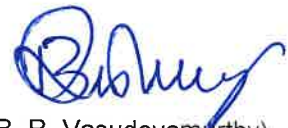
Name of the witnessing persons
Customer's representative : Mr. Yogesh Warghade, Design- Executive
Other than customer's representative : None

Test subcontracted with address
of the laboratory : None

Documents constituting this report (In words)
Number of Sheet(s) : Nine
Number of Oscillogram(s) : Nil
Number of Graph(s) : Nil
Number of Photograph(s) : Nil
Number of Test Circuit Diagram(s) : Nil
Number of Drawing(s) : Three


(S. Shenbagarajan)
Test Engineer




(B. R. Vasudevamurthy)
Joint Director
Reviewed and Authorized by

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DESCRIPTION OF SAMPLE TESTED
(As assigned by the manufacturer)

Test sample	Current Transformer		
Type	Outdoor, oil immersed, live tank		
Designation	IOSK:145/275/650		
Serial number	220643		
Highest voltage for Equipment (U_m)	145 kV		
Rated insulation level	275 / 650 kV		
Frequency	50 Hz		
Number of cores	I	II	III
Accuracy class	0.2S	5P	PX
Instrument security factor	FS 10	---	---
Accuracy limit factor	---	20	---
Rated Output (VA)	15	30	---
Minimum knee point Voltage (E_k) - V	---	---	600
Maximum secondary winding resistance at 75° C (R_{ct}) - Ω	---	---	12
Maximum exciting current at $E_{k/2}$ (mA)	---	---	10
Rated transformation ratio	300-600-1200/1 A	600-1200/1 A	3000/1 A


(S. Shenbagarajan)
Test Engineer

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SUMMARY OF TESTS CONDUCTED

1. Tests conducted : Refer the table below
2. Rating for which tested : Refer Sheet 5 of 9 to Sheet 8 of 9
3. Schedule of tests :

Sl. No	Tests Conducted	Clause Numbers	Sheet
1	Tests for ratio error and phase displacement of measuring current transformer	7.2.6.201 of IEC 61869-2 : 2012	5 of 9 & 6 of 9
2	Determination of the instrument security factor (FS) of measuring current transformer	7.2.6.202 of IEC 61869-2 : 2012	6 of 9
3	Tests for ratio error and phase displacement of class P protective current transformer	7.3.5.202 of IEC 61869-2 : 2012	7 of 9
4	Test for composite error of class P protective current transformer	7.2.6.203 b) of IEC 61869-2 : 2012	7 of 9
5	Test for turns ratio error for class PX protective current transformer	7.3.5.206 of IEC 61869-2 : 2012	8 of 9
6	Test of low-leakage reactance type for class PX protective current transformer	7.2.6.205 of IEC 61869-2 : 2012	8 of 9
7	Determination of the secondary winding resistance (R_{ct})	7.3.201 of IEC 61869-2 : 2012	8 of 9
8	Test for rated knee point e.m.f. (E_k) and exciting current at E_k	7.3.203 of IEC 61869-2 : 2012	8 of 9

4. Drawing Number(s) : Refer Sheet 4 of 9


(S. Shenbagarajan)
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LIST OF DRAWINGS

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 CT42 RS	---	R0
2	413695829 CT42 GA/R0	---	---
3	413695829 CT 42 CD/R0	---	---

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


(S. Shenbagarajan)
Test Engineer

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TEST RESULTS

1) TESTS FOR RATIO ERROR AND PHASE DISPLACEMENT OF MEASURING CURRENT TRANSFORMER

Current ratio : 300/1
Accuracy class : 0.2S

Primary connection : P1 - P2
Secondary connection : 1S1-1S2 & (short 1-1S2)

Burden (VA) & Power factor	Type of error	Error at percentage of rated current				
		120	100	20	5	1
15 & 0.8 lag	% Current error	0.0762	0.0719	0.0444	0.0259	0.0250
	Phase displacement (min)	1.63	1.68	4.10	5.47	7.88
3.75 & UPF	% Current error	0.154	0.155	0.159	0.154	0.120
	Phase displacement (min)	1.62	1.58	1.97	1.99	2.35

Current ratio : 600/1
Accuracy class : 0.2S

Primary connection : P1 - P2
Secondary connection : 1S1-1S3 & (short 1-1S3)

Burden (VA) & Power factor	Type of error	Error at percentage of rated current				
		120	100	20	5	1
15 & 0.8 lag	% Current error	0.0345	0.0373	0.0308	0.0211	-0.0108
	Phase displacement (min)	1.30	1.13	1.92	2.18	1.48
3.75 & UPF	% Current error	0.0755	0.0760	0.0771	0.0712	0.0435
	Phase displacement (min)	0.89	0.89	0.90	0.79	-0.26


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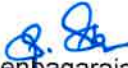
TESTS FOR RATIO ERROR AND PHASE DISPLACEMENT OF MEASURING CURRENT TRANSFORMER (contd.,)

Current ratio : 1200/1 Primary connection : P1 - P2
Accuracy class : 0.2S Secondary connection : 1S1-1S4 & (short 1-1S4)

Burden (VA) & Power factor	Type of error	Error at percentage of rated current				
		120	100	20	5	1
15 & 0.8 lag	% Current error	0.0216	0.0204	0.0145	0.0229	0.0764
	Phase displacement (min)	0.11	0.18	1.03	1.60	3.14
3.75 & UPF	% Current error	0.0374	0.0379	0.0428	0.0549	0.102
	Phase displacement (min)	0.42	0.43	0.54	0.78	2.08

2) DETERMINATION OF THE INSTRUMENT SECURITY FACTOR (FS) OF MEASURING CURRENT TRANSFORMER

Secondary connection	Ratio	Rated Output (VA)	Secondary winding resistance Corrected to 75 °C (Ω)	Secondary limiting E.M.F (calculated) (V)	Voltage applied at secondary to get 1 A (V)	Composite Error (%)
1S1-1S2 & (short 1-1S2)	300/1	15	0.949	157.7	66.3	> 10
1S1-1S3 & (short 1-1S3)	600/1	15	1.9500	166.01	66.2	> 10
1S1-1S4 & (short 1-1S4)	1200/1	15	3.081	175.6	66.3	> 10


(S. Shenbagarajan)
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3) TESTS FOR RATIO ERROR AND PHASE DISPLACEMENT OF CLASS P PROTECTIVE CURRENT TRANSFORMER

Current ratio : 600/1
Accuracy class : 5P

Primary connection : P1 – P2
Secondary connection : 2S1 – 2S2

Burden (VA)& Power factor	Type of error	Percentage primary voltage
		100
30 VA & 0.8 lag	% Voltage error	-0.247
	Phase displacement (min)	2.44

Current ratio : 1200/1
Accuracy class : 5P

Primary connection : P1 – P2
Secondary connection : 2S1 – 2S3

Burden (VA)& Power factor	Type of error	Percentage primary voltage
		100
30 VA & 0.8 lag	% Voltage error	-0.0913
	Phase displacement (min)	0.90

4) TEST FOR COMPOSITE ERROR OF CLASS P PROTECTIVE CURRENT TRANSFORMER

Secondary connection	Accuracy class	Ratio	Secondary winding resistance corrected to 75 °C (Ω)	Secondary limiting E.M.F applied (V)	Excitation current measured (mA)	% Composite error
2S1-2S2	30	600/1	3.382	655.37	25.23	0.13
2S1-2S3	30	1200/1	9.181	754.98	5.31	0.026


(S. Shenbagarajan)
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5) TEST FOR TURNS RATIO ERROR FOR CLASS PX PROTECTIVE CURRENT TRANSFORMER

Primary	Secondary connection	Ratio	Accuracy Class	% Ratio error
P1-P2	3S1-3S2	3000/1	PX	0.0045

6) TEST OF LOW LEAKAGE REACTANCE TYPE FOR CLASS PX PROTECTIVE CURRENT TRANSFORM

It was verified by the drawing that tested current transformer has substantially continuous ring-core and secondary winding uniformly distributed. The current transformer has a primary conductor symmetrical with respect to rotation. Hence it was proved that tested CT is a low leakage reactance type.

7) DETERMINATION OF THE SECONDARY WINDING RESISTANCE (R_{ct})

Secondary connection	Ratio	Secondary winding resistance 24 °C (Ω)	Secondary winding resistance corrected to 75 °C (Ω)
3S1-3S2	3000/1	7.9595	9.529

8) TEST FOR RATED KNEE POINT E.M.F (E_k) AND EXCITING CURRENT AT (E_k)

Secondary connection	Exciting current – I_e (measured) at Knee-point e.m.f. – E_k (applied)	
	E_k (V)	I_e (mA)
3S1-3S2	(1.1 V_k) 660	3.32
	(V_k) 600	2.58
	(0.75 V_k) 450	1.95
	(0.5 V_k) 300	1.48
	(0.25 V_k) 150	0.94
	(0.1 V_k) 60	0.51

Conclusion: The sample tested complies with the sub-clause(s) of the standards referred for the tests conducted.


(S. Shenbagarajan)
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NOTE

- a) The Test results relate only to the sample(s) tested.
- b) Publication or reproduction of this Test Report in any form other than by complete set of the whole Test Report and in the language written is not permitted without the written consent of CPRI.
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- d) Any anomaly / discrepancy in the Test Report should be brought to notice of CPRI within 45 days from the date of issue.
- e) All documents constituting the Test Report are stitched together with a continuous silk thread, the two ends of which have been brought over the front sheet of the Test Report and sealed with a CPRI logo printed paper sticker
- f) NABL has Accredited this laboratory as per ISO/IEC 17025-2017 vide Certificate no.TC-5452 for the tests carried out.



TC-5452


(S. Sheribagarajan)
Test Engineer

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

THE VERIFICATION OF THIS DRAWING
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CHECKS ONLY WHEREVER POSSIBLE

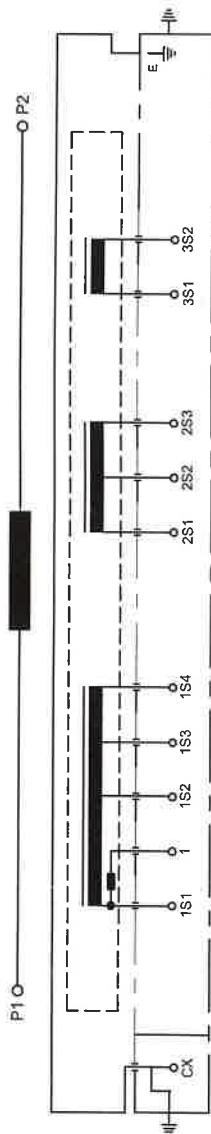
TRATING & SCHEMATIC DIAGRAM

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

MADE IN INDIA

CUSTOMER : CG Power and Industrial Solutions Limited, Aurangabad

TYPE	IOSK : 145 / 275 / 650	INSULATION LEVEL	275 kV / 650 kVp	FREQUENCY	50 Hz	W.O. NO.	413695829	SPECIFICATION	IEC-61869-1&2	YEAR
SHORT TIME CURRENT RATING 50 kA / 3 SEC. 125 kAp RATED CONTINUOUS THERMAL CURRENT 1440 AMP TOTAL & NOMINAL SPECIFIC CREEPAGE DISTANCE (MM) 3525 mm/25mm kV SR NO 270402										



CORE NO.	I		II		III
	3000/1 P1-P2	6000/1 P1-P2	1200/1 P1-P2	6000/1 P1-P2	
RATIO					3000/1
PR. TERMINAL					P1-P2
SEC. TERMINAL	1S1-1S2 & (SHORT 1-1S2)	1S1-1S3 & (SHORT 1-1S3)	1S1-1S4 & (SHORT 1-1S4)	2S1-2S2	3S1-3S2
BURDEN (VA)	15	15	15	30	—
CLASS	0.2S	0.2S	0.2S	5P	PX
ISF / ALF	≤ 10	≤ 10	≤ 10	20	—
kPV (MIN) V	—	—	—	—	600 V
lex(max.) AT VK/2	—	—	—	—	10 mA
tdt @ 75°C	—	—	—	—	≤ 12 s

CAUTION : 1. SHORT ALL SEC. TERMINALS WHEN NOT IN USE OR BEFORE DISCONNECTING BURDENS.
2. CONNECT Cx TERMINAL TO EARTH WHEN CT IS IN OPERATION.

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2. CONNECT Cx TERMINAL TO EARTH WHEN CT IS IN OPERATION.

Ø4.5 Holes, 4Nos.

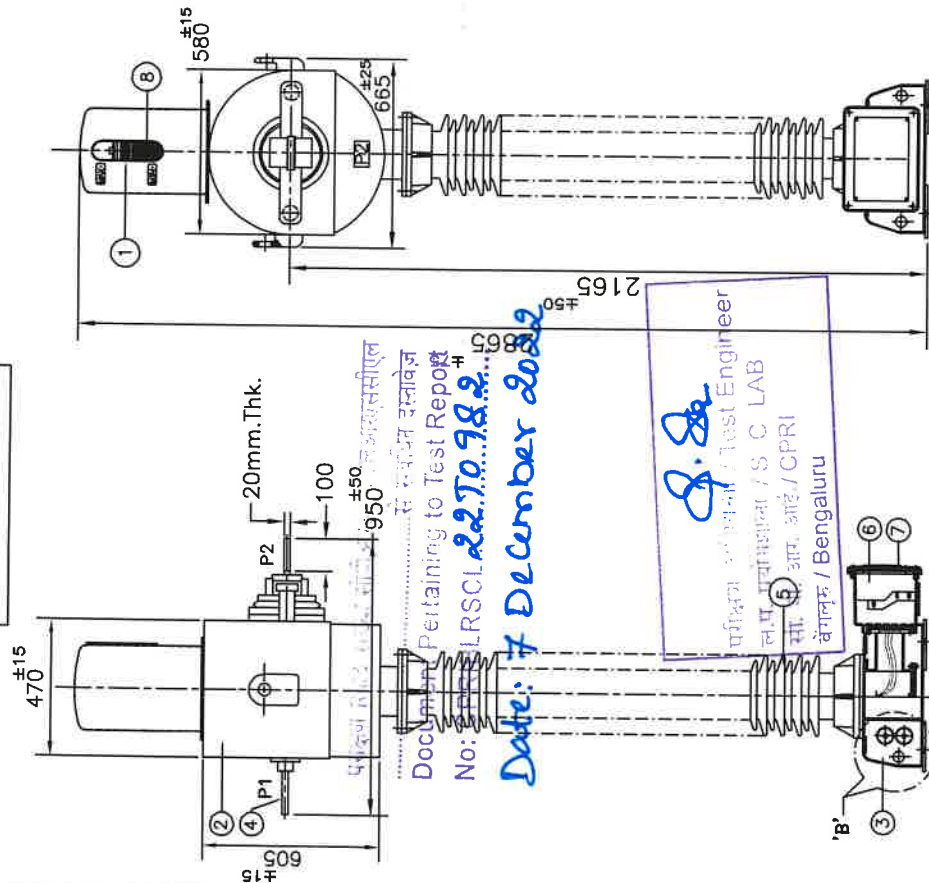
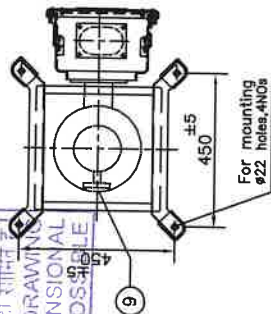
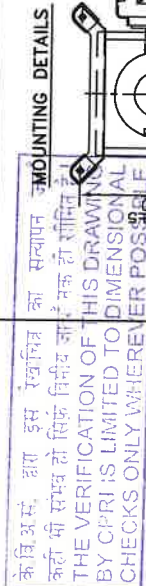
MATERIAL : ALUMINIUM ANODISED


 परीक्षक अभियन्ता / Test Engineer
 ल.प. प्रयोगशाला / S C LAB
 सी. पी. डी. बंग. अर्द्ध. CPRI
 बंगलूरु / Bengaluru

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TECHNICAL SPECIFICATIONS

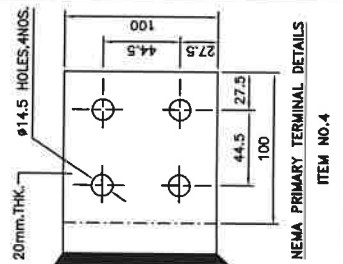
SPECIFICATION	UNIT	RATING
HIGHEST SYSTEM VOLTAGE (Ph-Ph)	Kilo Volts	145
HIGHEST SYSTEM VOLTAGE (Ph-E)	Kilo Volts	145/ $\sqrt{3}$
POWER FREQUENCY WITHSTAND VOLTAGE FOR 1 MIN. (DRY & WET)	Kilo Volts	275
LIGHTNING IMPULSE WITHSTAND VOLTAGE	Kilo Volts(Peak)	650
FREQUENCY	Hz	50
TOTAL & NOMINAL	mm	3625
SPECIFIC CREEPAGE DISTANCE	mm/kV	25
TOTAL WEIGHT ($\pm 10\%$)	Kilogram	450
OIL VOLUME ($\pm 10\%$)	Litre	120
APPLICABLE STANDARDS	-	IEC 61869-1&2

DETAILS OF PRIMARY WINDING :

PRIMARY CONDUCTOR SIZE/CROSS SECTION : ROD=#50, CROSS SECTION = 19.62 SQ.CM.
TUBE=#73/89(I/D & OD), CROSS SECTION=20.34 SQ.CM.
PRIMARY TERMINAL = 100X100X20 THK.

DETAILS OF SECONDARY WINDING :

	TOTAL NO OF SECONDARY TURNS (NO)	SECONDARY WINDING		CORE DETAILS
		CONDUCTOR SIZE (SWG/SQ.MM.)	MATERIAL OF SECONDARY WINDING	
CORE I	2400(600+600+1200)	21X4,21X2,19X1/ 2.072,1.036,0.810	COPPER	YES
CORE II	2400(1200+1200)	19X2,19X1/ 1.652,0.810	COPPER	YES
CORE III	6000	15X1/2,827	COPPER	—



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

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295/335/20

NO. Of Turns : 6000

A diagram of a 3x3 grid. The top row is labeled 'H' with a double-headed arrow. The middle row is labeled 'ID.' with a double-headed arrow. The bottom row is labeled 'OD.' with a double-headed arrow. The grid is composed of 9 squares. A dashed line runs vertically through the center of the grid.

ID = Internal Diameter.

OD = Outer Diameter.

H = Height.

a) Ring Core, Material : CRGO M4

Note

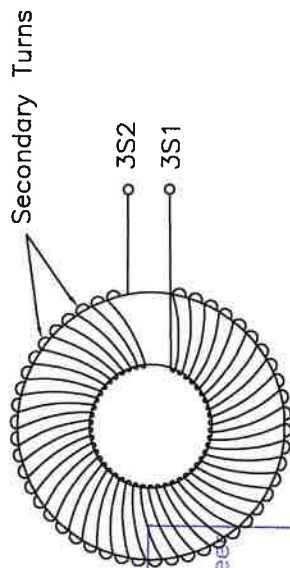
- 1) The current transformer has a substantially continuous ring core.
- 2) The current transformer has uniformly distributed secondary winding.
- 3) The current transformer has a primary conductor symmetrical with respect to rotation.
- 4) The influences of conductors of the adjacent phase outside of the current transformer housing and of the neighbouring phases are negligible.

पराशर १५७३ अ. २४ श्रुति ८

Document Pertaining to Test Report

No: CPRI LRSL 2270982

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b) Core having uniformly distributed Secondary winding.

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