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TEST REPORT

NAME & ADDRESS OF CUSTOMER M/s. RAJASTHAN POWERGEN TRANSFORMER PVT. LTD. Karola-Bhinmal Road, Karola, Sanchore, Dist.- Jalore, Rajasthan-343041	**REPORT NO.:** RP-1718-050430 **DATE:** 10.01.2018	
	CUSTOMER REF. NO.: NP/ERDA/TT/41/ 2017-18	**DATED:** 29.11.2017
	DATE OF SAMPLE RECEIPT:	**DATE OF TESTING:**
	30.11.2017	04.12.2017 to 26.12.2017
SAMPLE DESCRIPTION **16 kVA Single Phase Distribution Transformer** 6351/240 Volts, 2.52/66.67Amps., Oil filled, **ENERGY EFFICIENCY LEVEL:** 2 Further details as per sheet No. 3 of 27	**SAMPLE IDENTIFICATION** **ERDA SAMPLE CODE NO.:** ERDA-00228924 **SERIAL NO.:** RPTPL/16KVA/2017/18/001 **YEAR OF MFG.:** 2017 **CUSTOMER :** AVVNL	
TEST DETAILS As per sheet 4 OF 27. **ENCLOSURES:** As per sheet 2 OF 27. **REMARKS:** On respective sheets from 5 OF 27 to 27 OF 27.	**TEST SPECIFICATIONS** As per sheet 4 OF 27.	
PREPARED BY	**CHECKED BY**	**APPROVED BY** **Kapil J. Sharma**

NOTE:
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Enclosures	
1. Oscillogram No.	1352/01 to 1352/05
2. Photograph No.	1718-014127/1261
3. Test circuit diagram No.	OLSC/DTC/05
4. Drawing No.	RPTPL/RP/02 Rev.:00 Sheet No. 00 RPTPL/OGA/02 Rev.:00 Sheet No. 01 RPTPL/IC/02 Rev..00 Sheet No. 01 RPTPL/CD/02 Rev.:00 Sheet No. 00

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TECHNICAL SPECIFICATIONS OF TEST OBJECT ASSIGNED BY CUSTOMER

1. Name of manufacturer	: **RAJASTHAN POWERGEN TRANSFORMER PVT. LTD.**
2. Equipment	: **16 kVA Single Phase Distribution Transformer**
3. Standard No.	: IS 1180 (Part 1): 2014 [Amendment No. 1& 2], IS 2026, as per customer request
4. Serial No.	: RPTPL/16KVA/2017/18/001
5. Energy efficiency level	: 2
6. Type	: Outdoor, Oil cooled
7. kVA rating	: 16
8. Rated voltage H.V.(volts)	: 6351
L.V. (volts)	: 240
9. Rated current H.V. (Amp.)	: 2.52
L.V.(Amp.)	: 66.67
10. Number of phases	: 1
11. Frequency (Hz.)	: 50
12. Type of cooling	: ONAN
13. Temperature rise of oil/winding	: 35°C/40°C
14. Percentage Impedance	: 4.0%
15. Primary winding conductor	: Polysterimide enamel class H Aluminium wire, bare dia.2.50mm
16. Secondary winding conductor	: DPC Aluminium strip, bare size (14.0mm x 3.0mm) x 2 Nos. in parallel
17. Quantity of oil (Litre)	: 54
18. Weight of oil (kg.)	: 47
19. Weight of core and winding assly. (kg.)	: 119
20. Total weight (kg.)	: 208
21. Polarity	: Subtractive
22. Vector group	: 1-Phase
23. Year of manufacture	: 2017
24. Insulation Level L.V.	: 03kVrms
25. Total losses at 75°C (Watts)	: 82Max. (at 50 % load)
26. Total losses at 75°C (Watts)	: 224Max. (at 100 % load)

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REPORT NO.: RP-1718-050430 Date: 10 Jan 2018

Sr. No.	TEST DETAILS	TEST SPECIFICATION
1	Measurement of winding resistance	As per cl.no.21.2.a of IS: 1180 PART 1-2014
2	Measurement of voltage ratio and check of phase displacement	As per cl.no.21.2.b of IS: 1180 PART 1-2014
3	Measurement of short-circuit impedance and load loss at 50 percent and 100 percent load	As per cl.no.21.2.c of IS: 1180 PART 1-2014
4	Measurement of no-load loss and current	As per cl.no.21.2.d of IS: 1180 PART 1-2014
5	Total losses at 50% load	As per cl.no. 8.8 of IS: 1180 PART 1-2014
6	Total losses at 100% load	As per cl.no. 8.8 of IS: 1180 PART 1-2014
7	Measurement of no-load loss and current at 90%,110% and 112.5 % of rated voltage	As per customer`s requirement
8	No load current at 112.5 percent voltage:	As per cl.no.21.4.c of IS: 1180 PART 1-2014
9	Measurement of insulation resistance	As per cl.no.21.2.e of IS: 1180 PART 1-2014
10	Separate-source voltage withstand test	As per cl.no.21.2.g of IS: 1180 PART 1-2014
11	Induced over-voltage withstand test	As per cl.no.21.2.f of IS: 1180 PART 1-2014
12	Temperature-rise test	As per customer`s requirement testing procedure followed as per cl.no.21.3.b of IS: 1180 PART 1-2014
13	Oil leakage test	As per cl.no.21.2.j of IS: 1180 PART 1-2014
14	Pressure test (routine test)	As per cl.no.21.2.h of IS: 1180 PART 1-2014
15	Pressure test (type test)	As per cl.no.21.3.d of IS: 1180 PART 1-2014
16	Permissible flux density and over fluxing	As per cl.no. 8.9 of IS: 1180 PART 1-2014
17	Measurement of the Harmonics of the No load current	As per customer's requirement, testing procedure followed as per cl. no. 10.6 of IS 2026 (Part 1):2011
18	Lightning Impulse test	As per cl.no.21.3.a of IS: 1180 PART 1-2014
19	Short circuit withstand test	As per cl.no.21.3.c of IS: 1180 PART 1-2014
20	Determination of sound levels	As per cl.no.21.4.a of IS: 1180 PART 1-2014
21	Paint adhesion tests	As per cl.no.21.4.d of IS: 1180 PART 1-2014

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REPORT NO.: RP-1718-050430 Date: 10 Jan 2018

Sr. No.	Particular of Tests & Cl.No.	Requirement as per Specification	Obtained Value	Remarks
1	**Measurement of winding resistance** (As per cl.no.21.2.a of IS: 1180 PART 1-2014) Top oil temperature: 24.9 °C			---
	HV winding 1.1 – 1.2(N):	--	7.9755 Ω	
	LV winding 2.1 – 2.2(n):	--	12.446 mΩ	
2	**Measurement of voltage ratio and check of phase displacement** (As per cl.no.21.2.b of IS: 1180 PART 1-2014)			**Conforms**
	Measurement of voltage ratio 1.1-1.2(N) and 2.1-2.2(n):	26.463(± 0.5%)	26.470	
	Polarity :	Subtractive	Subtractive	
3	**Measurement of short-circuit impedance and load loss at 50 percent and 100 percent load** (As per cl.no.21.2.c of IS: 1180 PART 1-2014)			---
	At 50% load:			
	Tested with **1.2601** Amps (on HV side)			
	Frequency: **50.061** Hz			
	Top oil temperature: **22.9**°C			
	Test current (Amps)		1.2601	
	Impedance voltage (Volts)		126.090	
	Measured load loss (Watts)		29.18	
	Impedance voltage (%) (Computed to 50% load)			
	At 22.9°C		1.985	
	At 75°C	--	1.987	
	Load loss (Watts) (Computed to 50% load)			
	At 22.9°C		29.175	
	At 75°C	--	34.195	

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REPORT NO.: RP-1718-050430 Date: 10 Jan 2018

Sr. No.	Particular of Tests & Cl.No.	Requirement as per Specification	Obtained Value	Remarks
	At 100% load:			
	Tested with **2.5212** Amps (on HV side)			
	Frequency: **50.028** Hz			
	Top oil temperature: **22.9**°C			
	Test current (Amps)		2.5212	
	Impedance voltage (Volts)		252.380	
	Measured load loss (Watts)		117	
	Impedance voltage (%)			
	(Computed to 100% load)			
	At 22.9°C		3.972	
	At 75°C	4 (IS Tol.)	3.995	**Conforms**
	Load loss (Watts)			
	(Computed to 100% load)			
	At 22.9°C		116.889	
	At 75°C	--	136.938	---
4	**Measurement of no-load loss and current** (As per cl.no.21.2.d of IS: 1180 PART 1-2014)			---
	Tested with mean value of voltage **240.580** volts (On LV side)			
	Frequency : **50.051** Hz			
	RMS Voltage (Volts)		240.320	
	No-load current (Amps)		0.19793	
	Measured no-load loss (Watts)		40.71	
	Corrected no-load loss (Watts)	--	40.754	
5	**Total losses at 50% load** (As per cl.no. 8.8 of IS: 1180 PART 1-2014)	Max. 82	74.949	**Conforms**
6	**Total losses at 100% load** (As per cl.no. 8.8 of IS: 1180 PART 1-2014)	Max. 224	177.692	**Conforms**

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REPORT NO.: RP-1718-050430 Date: 10 Jan 2018

Sr. No.	Particular of Tests & Cl.No.	Requirement as per Specification	Obtained Value	Remarks
7	**Measurement of no-load loss and current at 90%,110% and 112.5 % of rated voltage** (As per customer`s requirement) **At 90% of rated voltage** Tested with average **216.4** volts (On LV side) Frequency : **49.964** Hz			---
	RMS Voltage (Volts)		216.010	
	No-load current (Amps)		0.17169	
	Measured no-load loss (Watts)		32.61	
	Corrected no-load loss (Watts)	--	32.669	
	At 110% of rated voltage Tested with average **264.4** volts (On LV side) Frequency : **49.95** Hz			
	RMS Voltage (Volts)		264.020	
	No-load current (Amps)		0.24341	
	Measured no-load loss (Watts)		50.27	
	Corrected no-load loss (Watts)	--	50.342	
	At 112.5% of rated voltage Tested with average **270.41** volts (On LV side) Frequency : **49.963** Hz			
	RMS Voltage (Volts)		270.200	
	No-load current (Amps)		0.26195	
	Measured no-load loss (Watts)		53.04	
	Corrected no-load loss (Watts)	--	53.081	
8	**No load current at 112.5 percent voltage:** (As per cl.no.21.4.c of IS: 1180 PART 1-2014) Test voltage of 112.5 percent of rated voltage at rated frequency was applied to the L.V. winding terminals and H.V. winding terminals were kept open circuited. No load current was recorded.			**Conforms**

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REPORT NO.: RP-1718-050430 Date: 10 Jan 2018

Sr. No.	Particular of Tests & Cl.No.	Requirement as per Specification	Obtained Value	Remarks
	Test voltage (Volts)		270.020	
	No load current (Amps)		0.25956	
	No Load Current (%)	Max. 6.0	0.389	
9	**Measurement of insulation resistance** (As per cl.no.21.2.e of IS: 1180 PART 1-2014) Top oil temperature: 25.8 °C			---
	IR value measured between			
	HV winding to Earth at 1000 V DC	--	151.8 GΩ	
	LV winding to Earth at 1000 V DC	--	96.0 GΩ	
	HV winding to LV winding at 1000 V DC	--	181.2 GΩ	
10	**Separate-source voltage withstand test** (As per cl.no.21.2.g of IS: 1180 PART 1-2014)			**Conforms**
	on HV winding:			
	The power frequency test voltage of 3 kV ac, rms was applied between the HV winding and earth. The tank and LV winding were shorted together and earthed. The test voltage was applied for 60 seconds.	Transformer shall withstand power frequency voltage of 3kV for 60 seconds.	Withstood	
	on LV winding:			
	The power frequency test voltage of 3 kV ac, rms was applied between the LV winding and earth. The tank and HV winding were shorted together and earthed. The test voltage was applied for 60 seconds.	Transformer shall withstand power frequency voltage of 3kV for 60 seconds.	Withstood	
11	**Induced over-voltage withstand test** (As per cl.no.21.2.f of IS: 1180 PART 1-2014)			**Conforms**
	The test voltage of 756 Volts, 1- phase was applied to the LV winding of the transformer. The supply frequency was maintained at 150 Hz. The test voltage was applied for 40 seconds.	Transformer shall withstand 756 volts at 150 Hz frequency for 40 seconds.	Withstood	

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REPORT NO.: RP-1718-050430 Date: 10 Jan 2018

Sr. No.	Particular of Tests & Cl.No.	Requirement as per Specification	Obtained Value	Remarks
12	**Temperature-rise test** (As per customer`s requirement testing procedure followed as per cl.no.21.3.b of IS: 1180 PART 1-2014) Before starting test, the dimensions of tank were measured & recorded. Size of tank: DIA-440 mm, H-635 mm **Losses fed for temperature-rise test were 224 Watts** (As specified by the customer) Specified losses were fed to the transformer (i.e. supply was connected to HV winding and LV winding kept short circuited) till steady state temperature rise was attained. Top oil temperature was recorded hourly. After steady state condition, the losses were brought down in reference to the rated current one hour prior to shut down. At the shut down, the hot winding resistances were measured and temperature rise calculated.			**Conforms**
	A) Top oil temperature-rise	Max. 35°C	22.6°C	
	B) Winding temperature-rise (Resistance method)			
	1) HV winding	Max. 40°C	28.5°C	
	2) LV winding	Max. 40°C	32.3°C	
	C) Ambient temperature at shutdown		21.2°C	
	D) Time of shutdown (Hrs)		09:00	
13	**Oil leakage test** (As per cl.no.21.2.j of IS: 1180 PART 1-2014)			**Conforms**

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REPORT NO.: RP-1718-050430 Date: 10 Jan 2018

Sr. No.	Particular of Tests & Cl.No.	Requirement as per Specification	Obtained Value	Remarks
	The assembled transformer with all fittings including bushings in position was tested at a pressure at the top equivalent to the head that was available at the base of the tank for 6 hours.	There should be no leakage at any point	No leakage observed	
14	**Pressure test (routine test)** (As per cl.no.21.2.h of IS: 1180 PART 1-2014) The transformer tank was tested at an air pressure of 35 kPa above atmosphere pressure maintained inside the tank for 10 min.	There should be no leakage at any point	No leakage observed	**Conforms**
15	**Pressure test (type test)** (As per cl.no.21.3.d of IS: 1180 PART 1-2014) The transformer tank was subjected to air pressure of 100 kPa above atmospheric pressure for 30 minutes.	There should be no leakage at any point and there is no deformation of tank.	No leakage observed and no deformation of tank observed.	**Conforms**
16	**Permissible flux density and over fluxing** (As per cl.no. 8.9 of IS: 1180 PART 1-2014) **(a) Overfluxing test:** Test voltage at rated frequency was applied to the L.V. winding terminals and H.V. winding terminals were kept open circuited and exciting current was recorded at 100% and 112.5% of rated voltage. Rated full load current of L.V. winding = 66.67 Amps			**Conforms**

% of rated voltage	Test voltage (Volts)	No load current (Amps)		
100%	240.32	0.19793	Max. 3.0%	0.297%

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REPORT NO.: RP-1718-050430 Date: 10 Jan 2018

Sr. No.	Particular of Tests & Cl.No.	Requirement as per Specification	Obtained Value	Remarks
	112.5% 270.02 0.25956	Max. 6.0%	0.389%	
	(b) Permissible flux density: Transformer was opened for the measurement of total area of the core. The core was dismantled and various dimensions of width and thickness were measured to calculate the total area of the core. Number of turns of L.V. winding were counted. Total measured area of the core: **13454.80** mm^2 Stacking factor: **0.96** (As specified by customer) Total no. of turns of L.V winding: **60** per phase Rated voltage of L.V winding: **240** V per phase Rated frequency: **50** Hz Flux density is calculated with +12.5 percent combined voltage and frequency variation from rated voltage and frequency. Flux density = 112.5 % of voltage/phase / (4.44 x Freq.(Hz) x Turns x Area of Core)	1.9 Tesla	1.57 Tesla	

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REPORT NO.: RP-1718-050430 Date: 10.01.2018

Sr. No.	Particulars of test and clause no.	Requirement as per specification.	Obtained value	Remarks
17	**Measurement of the Harmonics of the No-load current** (As per customer's request testing procedure followed as per cl. no. 10.6 of IS 2026 (Part 1):2011)	The harmonics of the no-load current in the three phases shall be measured and magnitude of the harmonics shall be expressed as a percentage of the fundamental component.	Refer table 1 for individual current harmonics components & individual voltage harmonics components measured at LV side at rated voltage i.e. 240 V Current THD: 29.84% Voltage THD: 1.51%	---

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TABLE-1 : Harmonics in voltage and current (as a percentage of fundamental)

Harmonic order	Current I_R in %	Current I_R in Amps	Voltage V_{RY} in %
1	100.00	0.19	100.00
2	14.89	0.03	0.04
3	21.61	0.04	0.27
4	9.26	0.02	0.06
5	8.68	0.02	1.42
6	4.46	0.01	0.05
7	3.69	0.01	0.30
8	1.88	0.00	0.02
9	1.44	0.00	0.10
10	0.82	0.00	0.02
11	0.23	0.00	0.21
12	0.39	0.00	0.01
13	0.31	0.00	0.10
14	0.19	0.00	0.01
15	0.36	0.00	0.12
16	0.09	0.00	0.00
17	0.53	0.00	0.12
18	0.11	0.00	0.01
19	0.48	0.00	0.10
20	0.07	0.00	0.00
21	0.15	0.00	0.03
22	0.10	0.00	0.01
23	0.05	0.00	0.02
24	0.08	0.00	0.01
25	0.12	0.00	0.02
THD %	29.84		1.51
Parameter measured	0.20 A		240.32 V

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TEST REPORT NO.: RP-1718-050430 **SHEET NO.:** 14 of 27
DATE : 10/01/2018

18.Lightning Impulse Test (As per Cl. No.21.3.a of IS 1180 (part 1) : 2014 Amendment 1 & 2 & Test voltage was specified by the customer & Test procedure was followed as per IS : 2026- (part- III),2009, Cl. No. 14

Waveform	Comment	Ut / kVp	T1 / µs	T2 / µs	Tc / µs
		1.1-POLE			
1	60% LI RW	-44.734	1.292	53.765	
2	100% LI FW	-75.119	1.287	54.060	
3	60% LI CRW	-50.357	1.303		2.561
4	110% LI CFW	-83.811	1.308		2.723
5	110% LI CFW	-83.766	1.308		3.247
6	100% LI FW	-74.265	1.298	53.969	
7	100% LI FW	-74.759	1.290	54.096	

REMARKS: From the observation of enclosed oscillographic records , it is concluded that the transformer **conforms** to the requirements of the above mentioned standard with respect to the test carried out.

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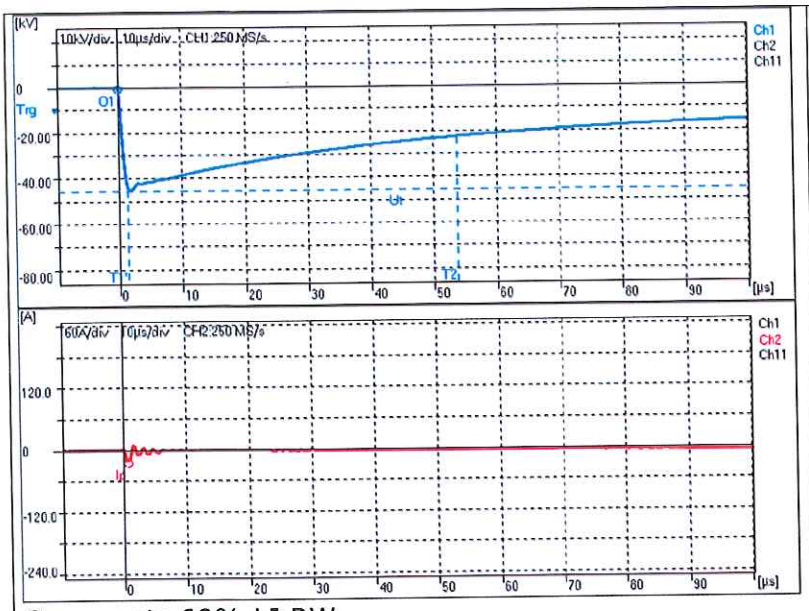
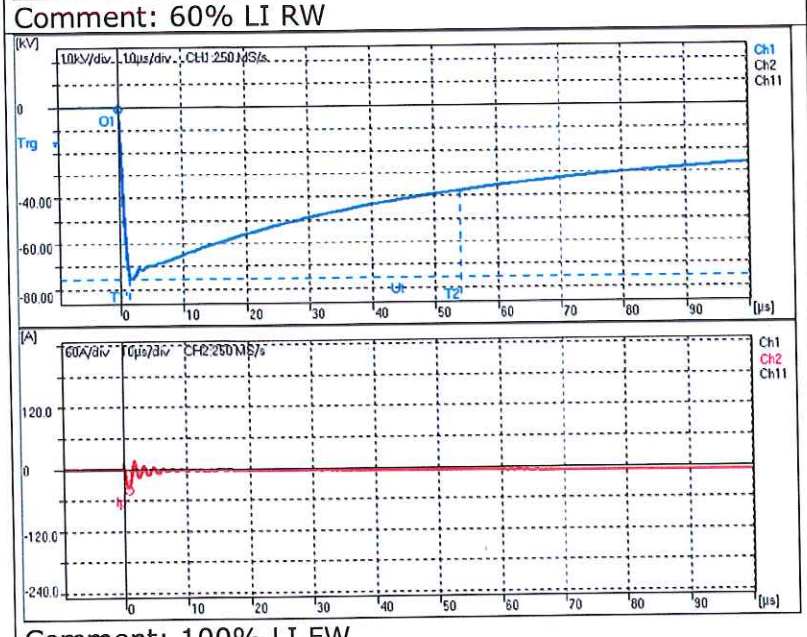
TEST REPORT NO.: RP-1718-050430
DATE : 10/01/2018



Comment: 60% LI RW

Fig.: 1
U_p = -44.73 kV
T_1 = 1.29 µs
T_2 = 53.76 µs
T_c = µs



Comment: 100% LI FW

Fig.: 2
U_p = -75.12 kV
T_1 = 1.29 µs
T_2 = 54.06 µs
T_c = µs

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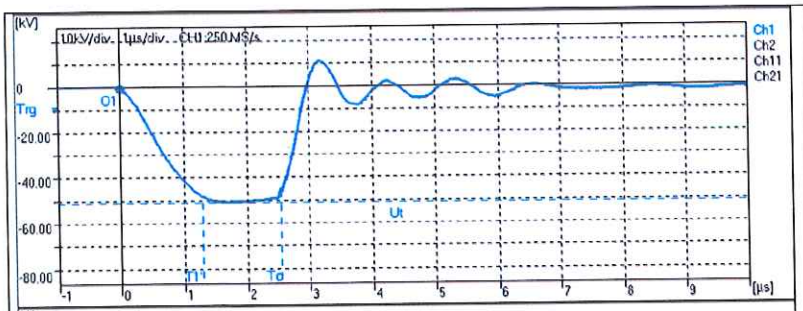
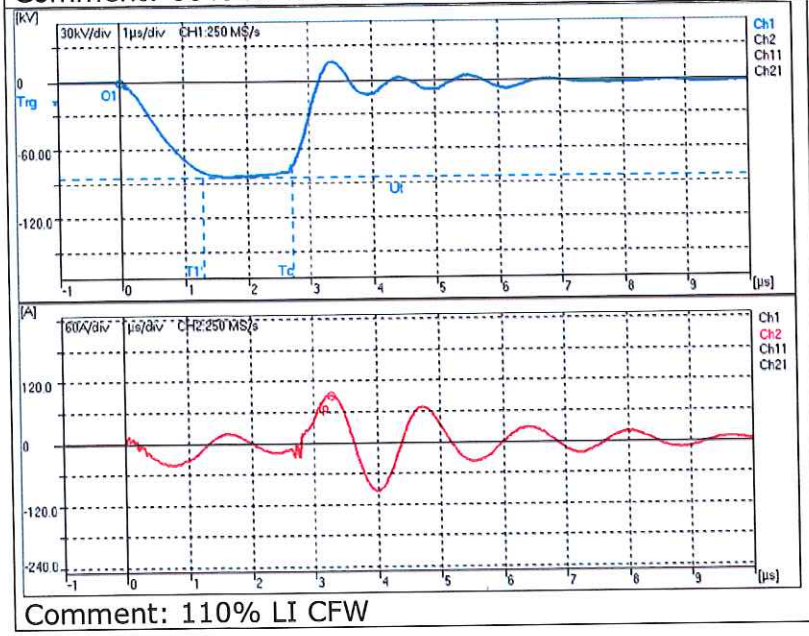


Comment: 60% LI CRW

Fig.: 3
U_p = -50.36 kV
T_1 = 1.30 µs
T_2 = µs
T_c = 2.56 µs



Comment: 110% LI CFW

Fig.: 4
U_p = -83.81 kV
T_1 = 1.31 µs
T_2 = µs
T_c = 2.72 µs

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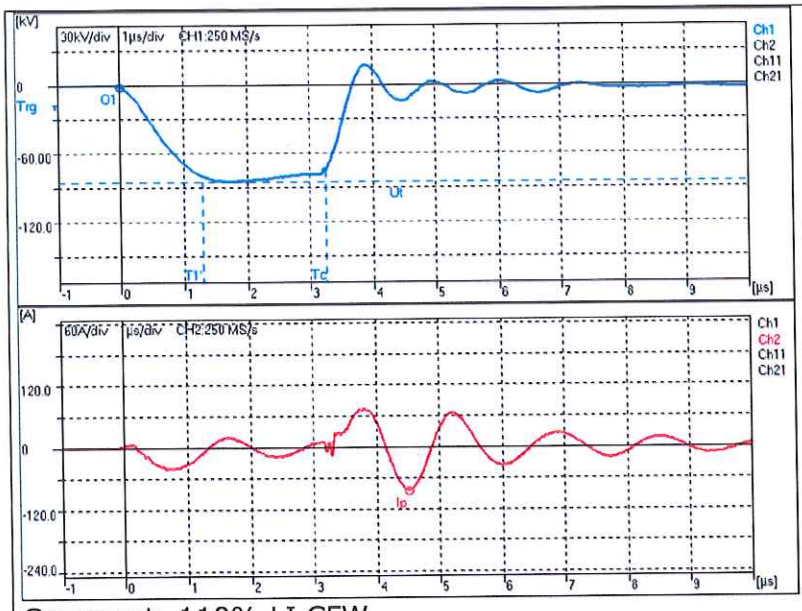
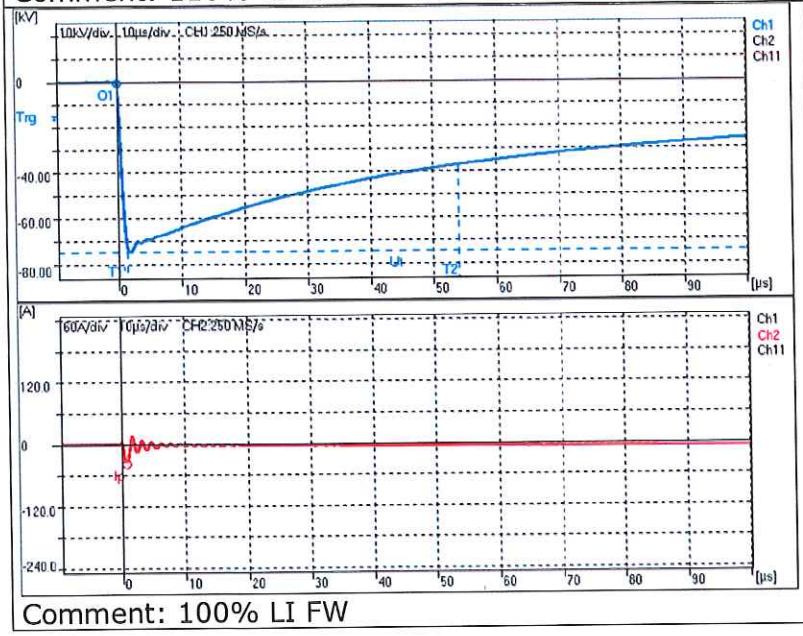
TEST REPORT NO.: RP-1718-050430 **SHEET NO.:** 17 of 27
DATE : 10/01/2018



Comment: 110% LI CFW

Fig.: 5
U_p = -83.77 kV
T_1 = 1.31 µs
T_2 = µs
T_c = 3.25 µs



Comment: 100% LI FW

Fig.: 6
U_p = -74.27 kV
T_1 = 1.30 µs
T_2 = 53.97 µs
T_c = µs

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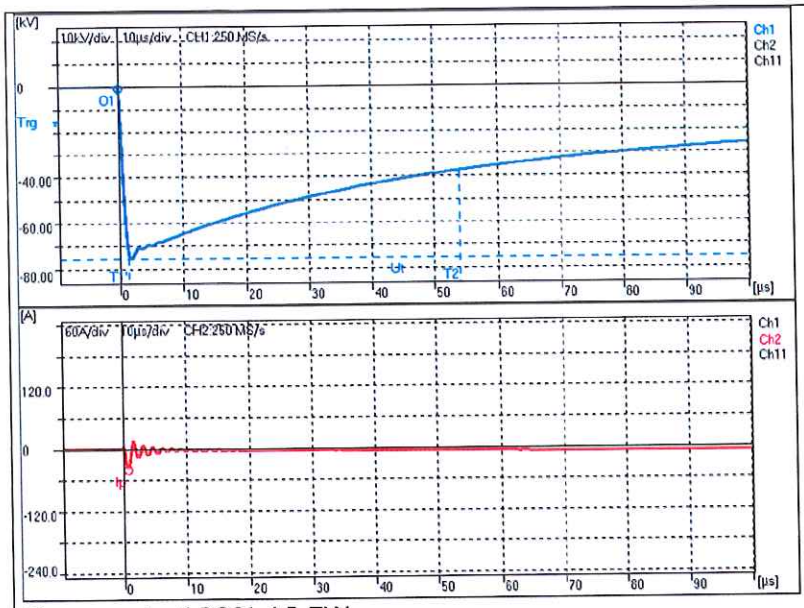

Comment: 100% LI FW

Fig.: 7
U_p = -74.76 kV
T_1 = 1.29 µs
T_2 = 54.10 µs
T_c = µs

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19. Short-circuit withstand test
(As per Cl. No. 17 & 21.3 c of IS 1180 (Part 1): 2014)

ROUTINE TEST RESULTS BEFORE SHORT CIRCUIT

a) MEASUREMENT OF WINDING RESISTANCE

Measurement at oil temperature: 20.0°C	
LV Winding resistance (mΩ)	HV Winding resistance (Ω)
2.1-2.2n	1.1-1.2N
12.413	7.8525

b) MEASUREMENT OF VOLTAGE RATIO AND CHECK OF POLARITY

Polarity: Subtractive was verified

Measured turns ratio between Terminals	Rated turns Ratio	Difference (%)
1.1-1.2N/2.1-2.2n		
26.491	26.463	0.106

c) MEASUREMENT OF SHORT-CIRCUIT IMPEDANCE AND LOAD LOSS **(at 100 % load)**

Oil temperature: 19.9°C

Test current (Amp.)	Impedance voltage (V)	Frequency (Hz.)	Load loss measured (Watts)	Impedance Voltage (%Z) at 50 Hz.	Load loss computed at 75°C (Watts)	%Z at 75°C
2.517	252.118	50.047	117.060	3.970	139	3.997

d) MEASUREMENT OF LOAD LOSS **(at 50 % load)**

Oil temperature: 19.9°C

Test current (Amp.)	Impedance voltage (V)	Frequency (Hz.)	Load loss measured (Watts)	Load loss computed at 75°C (Watts)
1.253	125.401	50.054	28.993	35

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e) MEASUREMENT OF NO-LOAD LOSS AND CURRENT

Oil temperature: 19.9°C

Applied Voltage (V)	Current (Amp.)	Frequency (Hz.)	Losses Measured (Watts)
240.020	0.201	50.083	41

- Total losses at 75°C: 76 Watts (at 50 % load)
- Total losses at 75°C:180 Watts (at 100% load)

f) MEASUREMENT OF INSULATION RESISTANCE

Oil temperature: 20.0°C, Measured at Voltage: 1000 V DC

	IR value (MΩ)
HV to LV winding	> 2000
HV winding to LV + EARTH	> 2000
LV winding to HV + EARTH	> 2000

g) INDUCED OVER-VOLTAGE WITHSTAND TEST

Sr. No.	Test	Applied voltage (V)	Applied Freq. (Hz.)	Duration (sec.)	Remarks
1.	Between LV windings with HV terminal open & neutral terminal earthed.	756	150	40	Withstood

h) SEPARATE-SOURCE VOLTAGE WITHSTAND TEST

Sr. no.	Test	Applied voltage (kV)	Duration (sec.)	Remarks
1.	Between HV winding and LV winding connected to the tank and earth	03	60	Withstood
2.	Between LV winding and HV winding connected to the tank and earth	03	60	Withstood

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SHORT-CIRCUIT WITHSTAND TEST:

The verification of short-circuit withstand test was performed on the transformer by connecting the secondary winding to single phase of the source and primary winding short circuited using synchronization switch. The test conducted with short circuiting of primary winding; follow the application of the voltage to the secondary winding of transformer as per schematic circuit diagram No. OLSC/DTC/05.

Condition of the equipment under test: As after routine tests.

Supply Frequency: 50 Hz.

Test No.	Oscillo-gram No.	Applied voltage (Vrms)	Short circuit current on LV (A)		Duration (sec.)	Remarks
			Peak	RMS		
1.	1352/01	-	2956	1316	0.1	Calibration Shot
2.	1352/02	240	3702	1791	0.5	No Abnormality
3.	1352/03	240	3734	1835	0.5	No Abnormality
4.	1352/04	240	3525	1790	0.5	No Abnormality
5.	1352/05	240	3668	1715	2.0	Thermal shot No Abnormality

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Measurement of the % reactance during the short circuit test

LV winding was short circuited. AC supply was connected to HV winding to pass test current. Before the short circuit test and after each shot, the percentage reactance was measured.

Sr. No.	Measurement performed		Measured value of % reactance at 50 Hz.	%Change in % reactance
1.	Before test		3.90	-
2.	After the test no.	2.	3.91	0.26
3.	After the test no.	3.	3.91	0.26
4.	After the test no.	4.	3.91	0.26
5.	After the test no.	5.	3.91	0.26

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ROUTINE TEST RESULTS AFTER SHORT CIRCUIT

a) MEASUREMENT OF WINDING RESISTANCE

Measurement at oil temperature:25.2°C	
LV Winding resistance (mΩ)	HV Winding resistance (Ω)
2.1u-2.2n	1.1U-1.2N
12.693	8.0125

b) MEASUREMENT OF VOLTAGE RATIO AND CHECK OF POLARITY

Polarity: Subtractive was verified

Measured turns ratio between Terminals	Rated turns Ratio	Difference (%)
1.1U-1.2N/2.1u-2.2n		
26.478	26.463	0.057

c) MEASUREMENT OF SHORT-CIRCUIT IMPEDANCE AND LOAD LOSS**(at 100 % load)**

Oil temperature: 26.2°C

Test current (Amp.)	Impedance voltage (V)	Frequency (Hz.)	Load loss measured (Watts)	Impedance Voltage (%Z) at 50 Hz.	Load loss computed at 75°C (Watts)	%Z at 75°C
2.512	251.512	49.769	125.410	3.991	144	4.014

d) MEASUREMENT OF LOAD LOSS**(at 50 % load)**

Oil temperature: 26.2°C

Test current (Amp.)	Impedance voltage (V)	Frequency (Hz.)	Load loss measured (Watts)	Load loss computed at 75°C (Watts)
1.248	124.858	49.774	30.909	36

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e) MEASUREMENT OF NO-LOAD LOSS AND CURRENT

Oil temperature: 26.2°C

Applied Voltage (V)	Current (Amp.)	Frequency (Hz.)	Losses Measured (Watts)
240.010	0.201	50.004	41

- Total losses at 75°C: 77 Watts (at 50 % load)
- Total losses at 75°C: 185 Watts (at 100% load)

f) MEASUREMENT OF INSULATION RESISTANCE

Oil temperature: 25.2°C, Measured at Voltage: 1000 V DC

	IR value (MΩ)
HV to LV winding	> 2000
HV winding to LV + EARTH	> 2000
LV winding to HV + EARTH	> 2000

g) INDUCED OVER-VOLTAGE WITHSTAND TEST

Sr. No.	Test	Applied voltage (V)	Applied Freq. (Hz.)	Duration (sec.)	Remarks
1.	Between LV windings with HV terminal open & neutral terminal earthed.	756	150	40	Withstood

h) SEPARATE-SOURCE VOLTAGE WITHSTAND TEST

Sr. no.	Test	Applied voltage (kV)	Duration (sec.)	Remarks
1.	Between HV winding and LV winding connected to the tank and earth	03	60	Withstood
2.	Between LV winding and HV winding connected to the tank and earth	03	60	Withstood

Observation after test: The transformer was untanked and inspected.
1) Condition of conductor, core and clamping:
- No visible damage, deformation or displacement.
2) Condition of oil : Clear

Results: 1) % Change in % reactance is within tolerance limits as per standard.
2) The results of routine tests carried out before and after the short-circuit withstand test found within limits as per standard.ksp

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TEST REPORT NO: RP-1718-050430
DATE: 10/01/2018

Particulars of Tests & Cl. No.:
20. Determinations of sound levels [Cl. No. 21.4.a of IS 1180 (Part 1): 2014 with 2 amendments & Cl. No. 13 of IS 2026 (Part 10): 2009]

Condition of transformer	Transformer was energized at no load condition & excited at the rated voltage of sinusoidal waveform & rated frequency.
Details of equipment used:	**Name:** Sound level meter **Make:** Lutron **Meter Type:** Type 1 **Serial No.:** I.62852 **Calibration Report No. & Date:** NCQC-M/141117/01, Dt. 27/11/2017

TEST RESULTS:

A-Weighted sound pressure levels of the background noise

Sr. No.	Measurement Locations (Refer Sketch Below)	At the start of test dB(A)	At the end of test dB(A)
1	A	44.8	44.6
2	B	45.1	44.8
3	C	44.3	44.3
4	D	44.6	44.5
5	E	44.7	44.6
6	F	44.4	44.7
7	G	43.9	44.4
8	H	44.2	44.3
9	I	44.1	44.2
10	J	44.3	44.5
	Arithmetic Average $\overline{L_{bgA}}$	**44.5**	**44.5**

A-Weighted sound pressure levels at energized condition L_{pAi}

Sr. No.	Measurement Locations (Refer Sketch Below) dB(A)	L_{pAi} dB(A)
1	A	46.4
2	B	46.1
3	C	46.9
4	D	46.8
5	E	47.1
6	F	47.3
7	G	47.6
8	H	47.9
9	I	47.5
10	J	47.8
	Arithmetic Average $\overline{L_{pA0}}$	**47.2**

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TEST REPORT NO: RP-1718-050430
DATE: 10/01/2018

TEST PARAMETERS:

Measurement distance : 1 m,

Microphone Spacing: 1 m

Measurement made : Half of the height of the transformer tank

Method followed: Sound pressure measurement as per Cl. No. 11, 11.3 & Table 2 of IS 2026 (Part 10): 2009.

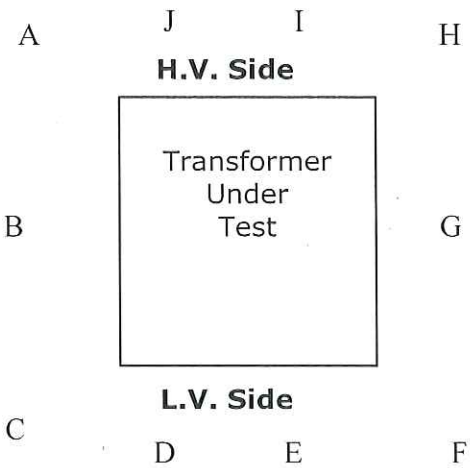
Length of prescribed contour: 10.4 m

Transformer Tank Height: 0.635 m

A-Weighted sound pressure level ($\overline{L_{pA0}}$):	47.2 dB(A)
Corrected average A-weighted sound pressure level ($\overline{L_{pA}}$):	41.3 dB(A)
Calculated A- weighted sound power level (L_{WA}) :	50.4 dB(A)

Requirement: Guaranteed value of sound pressure level is considered as 48 dB(A) as mentioned in customer's letter.

REMARKS: Transformer conforms to the requirement of guaranteed value of Sound pressure level.



Sketch showing the locations of sound measurement

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TEST REPORT No.: RP-1718-050430 DATE: 10-01-2018 SHEET 27 OF 27

Sr. No.	Particular of Tests and Cl. No.	Requirements as per specification	Obtained value	Remarks
21.	Paint Adhesion Test at 29°C & 25 % RH Test Method A – X-cut tape test (Test procedure followed as per ASTM D 3359-2017, Cl. No. 8) Cl. No. 21.4.d of IS 1180 (Part 1): 2014 - Adhesion strength of pressure sensitive tape 6.7 N/cm.	--	Observation 1- 5A – No peeling or removal was observed at the location. Observation 2- 5A – No peeling or removal was observed at the location. Observation 3- 5A – No peeling or removal was observed at the location.	--

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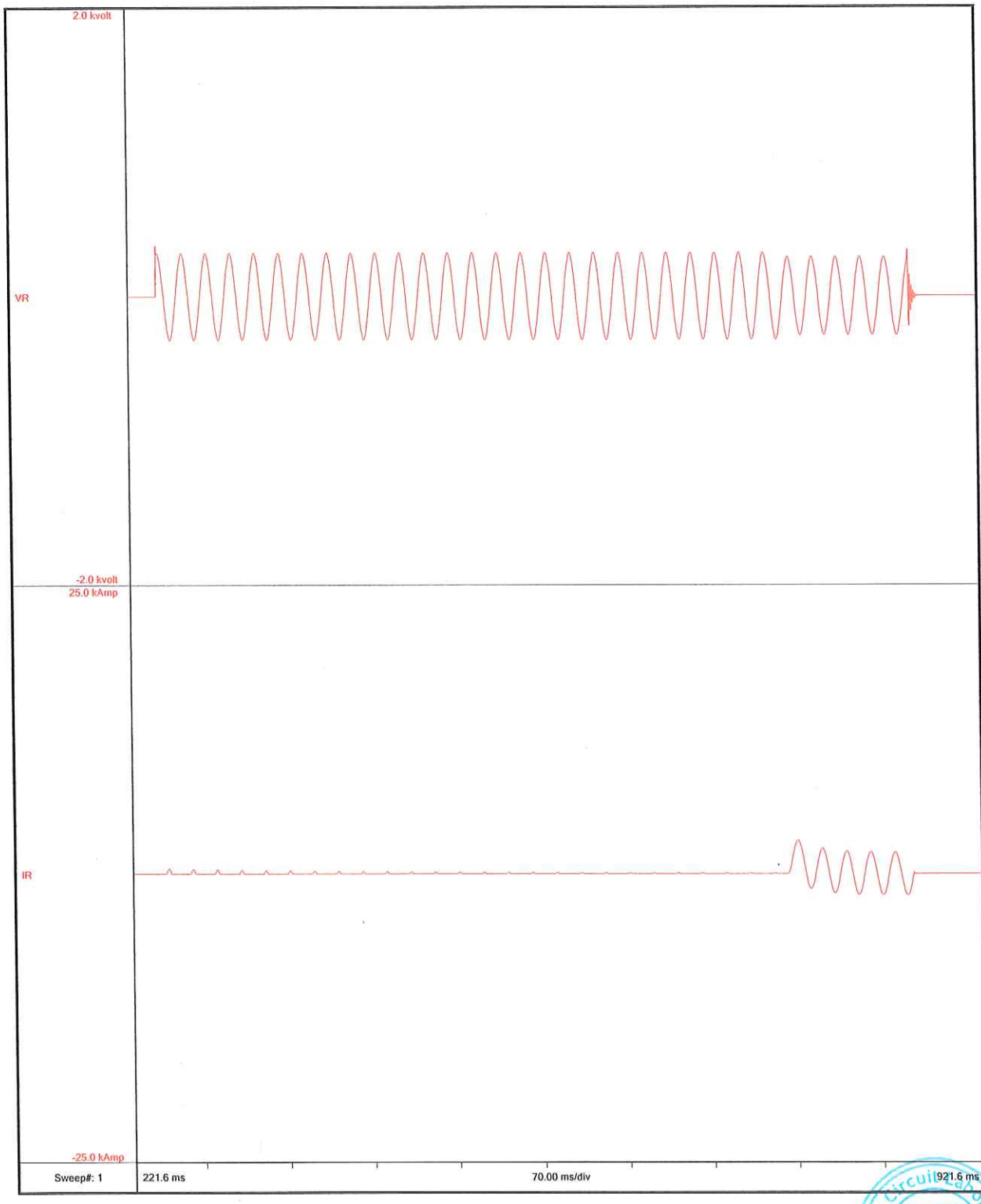

OSCILLOGRAM NO. : 1352/01

TC 2405007

Certificate No. : TC-5389

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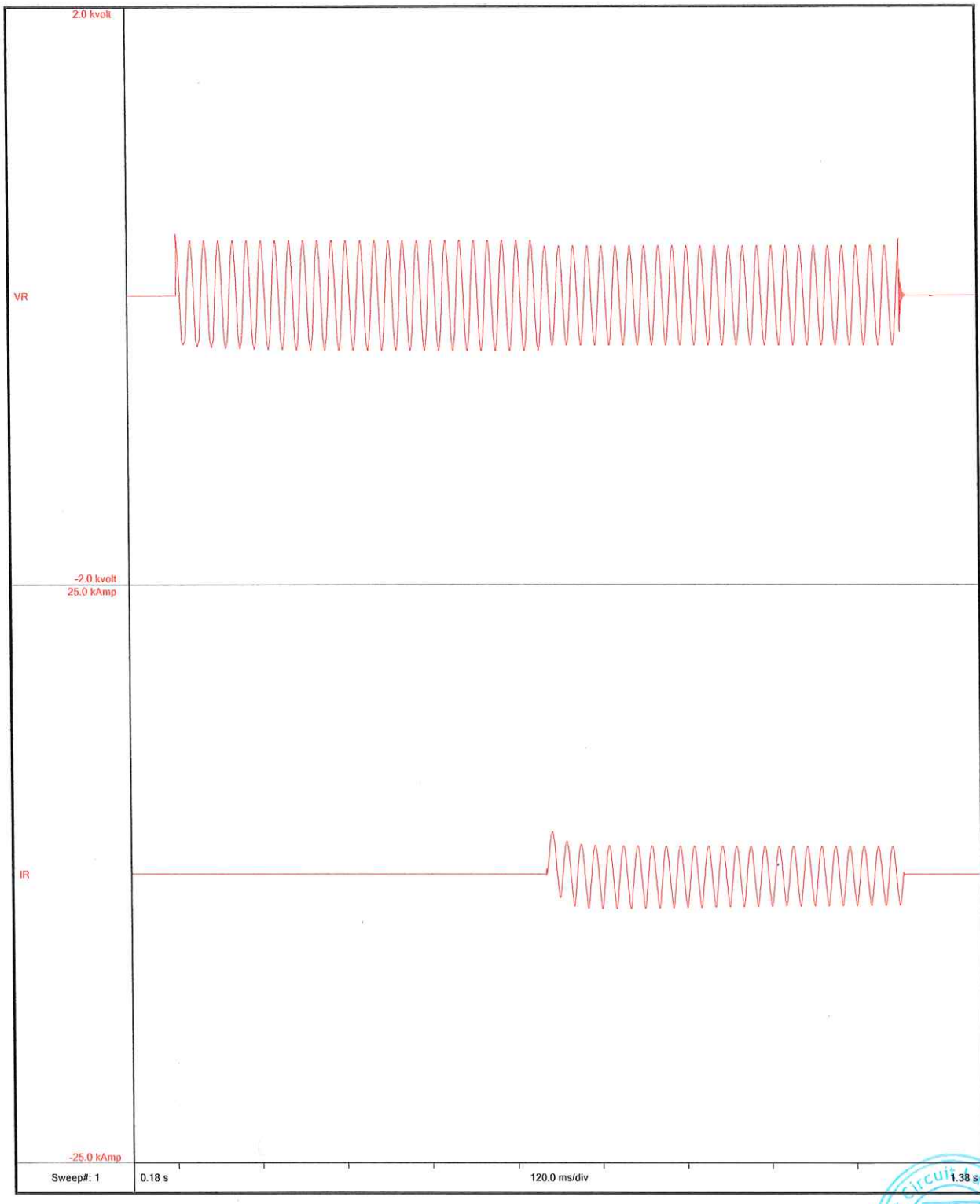

OSCILLOGRAM NO. : 1352/02

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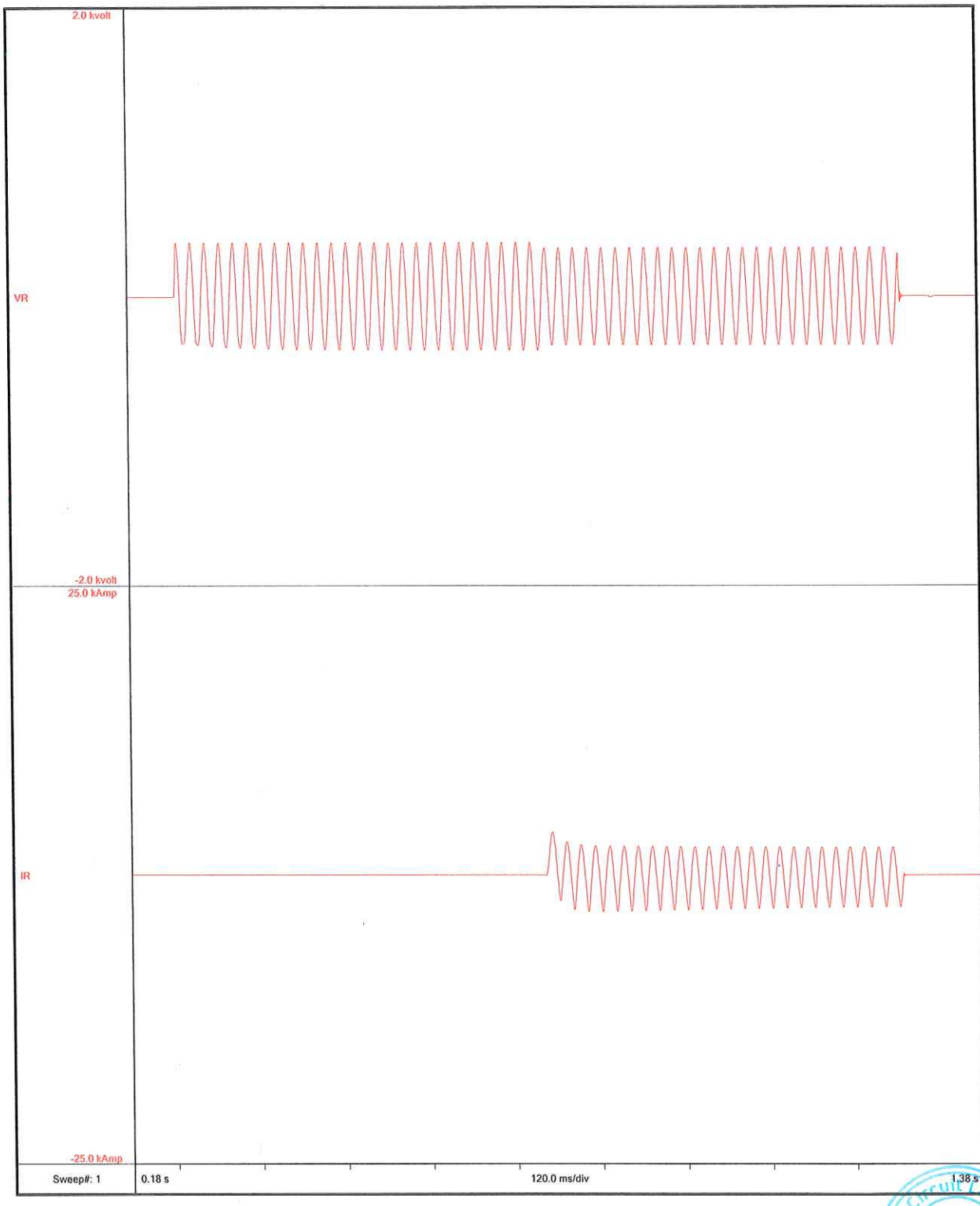
REPORT NO.: RP-1718-050430 **DATE:** 10.01.2018



OSCILLOGRAM NO. : 1352/03

TC 2405009

Certificate No. : TC-5389

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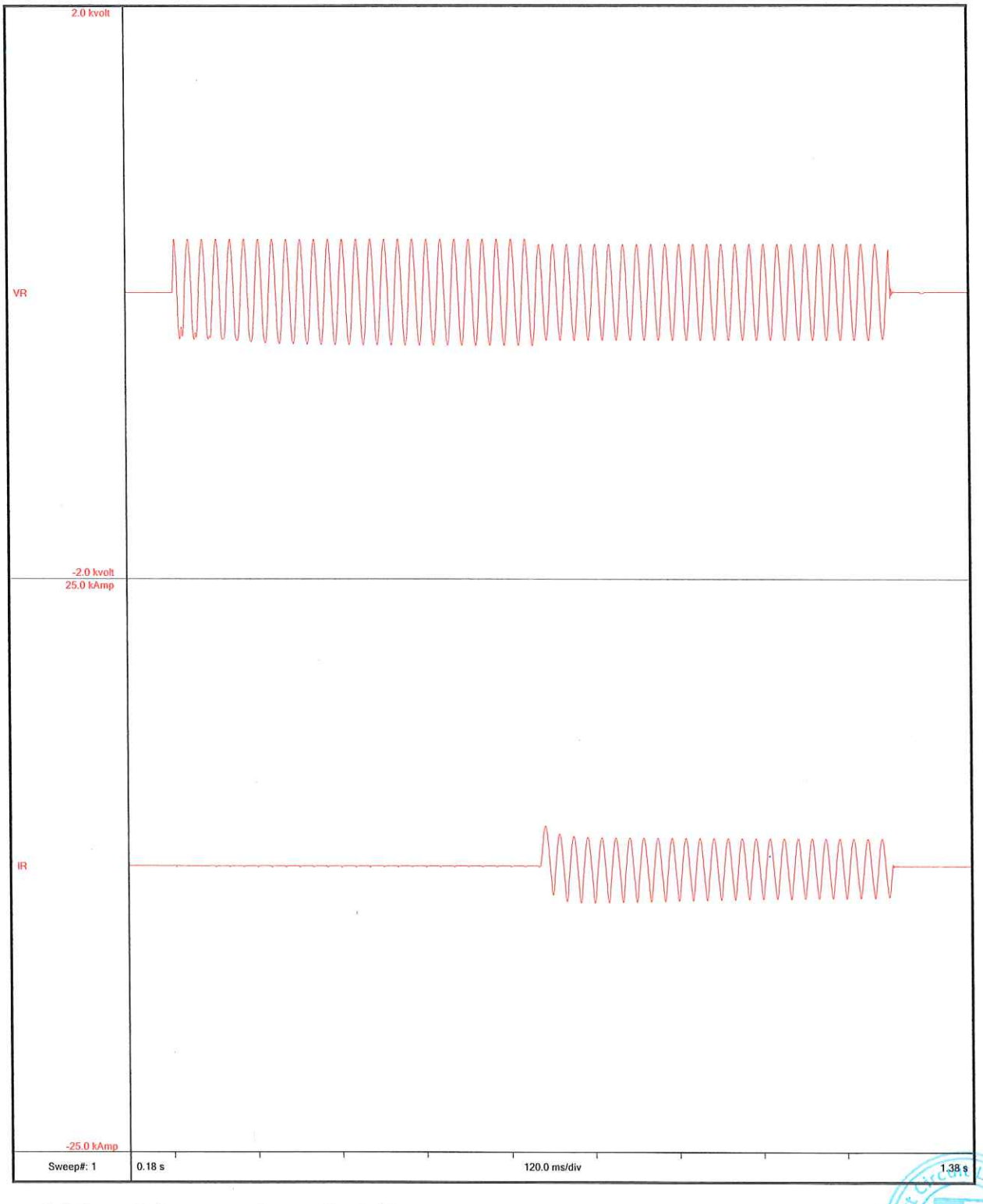
EPABX : +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
E-mail : erda@erda.org
Web : http://www.erda.org

REPORT NO.: RP-1718-050430 **DATE:** 10.01.2018



OSCILLOGRAM NO. : 1352/04

TC 2405010

Certificate No. : TC-5389

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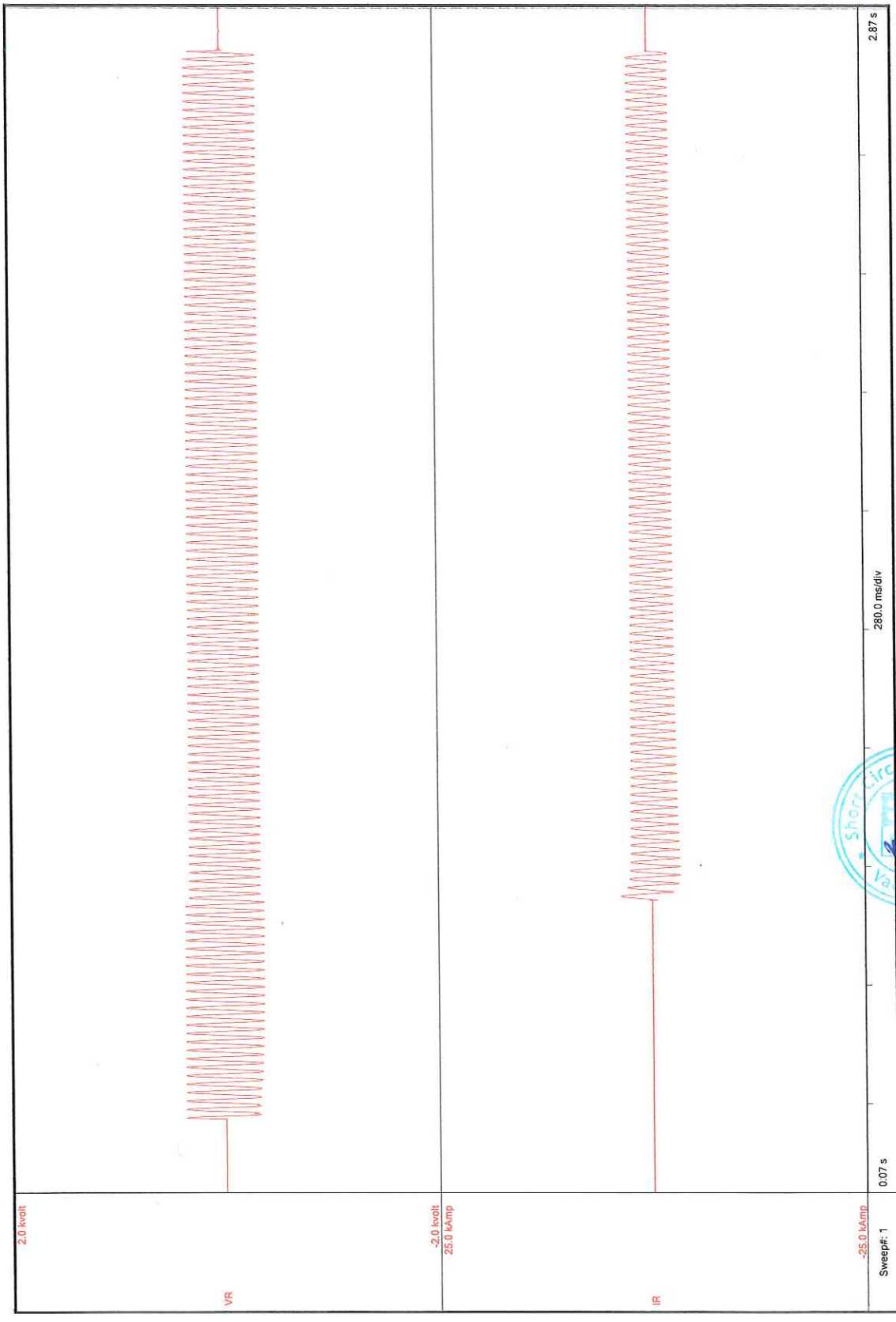
REPORT NO.: RP-1718-050430 **DATE:** 10.01.2018



OSCILLOGRAM NO.: 1352/05

TC 2405011

Certificate No. : TC-5389

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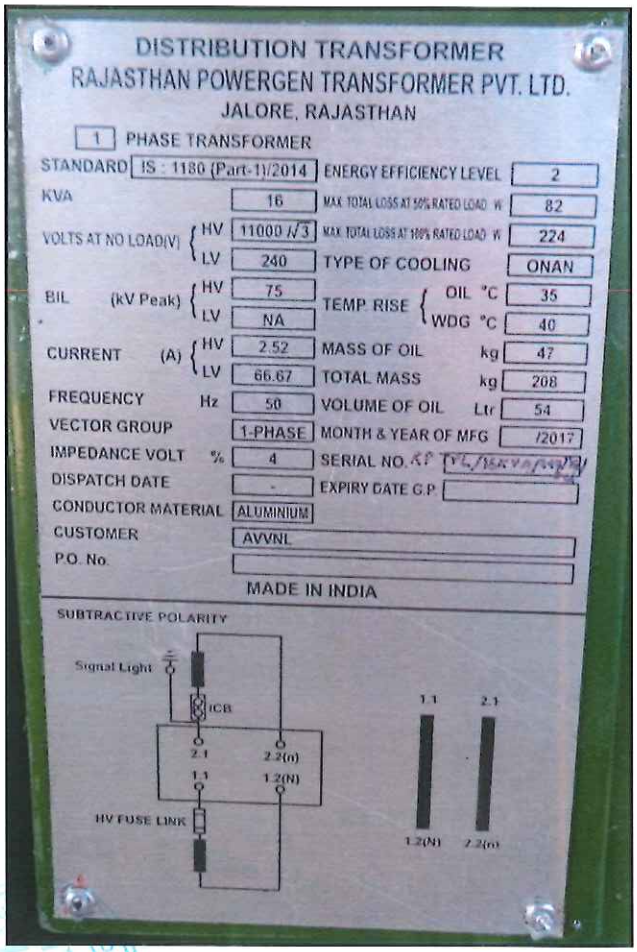
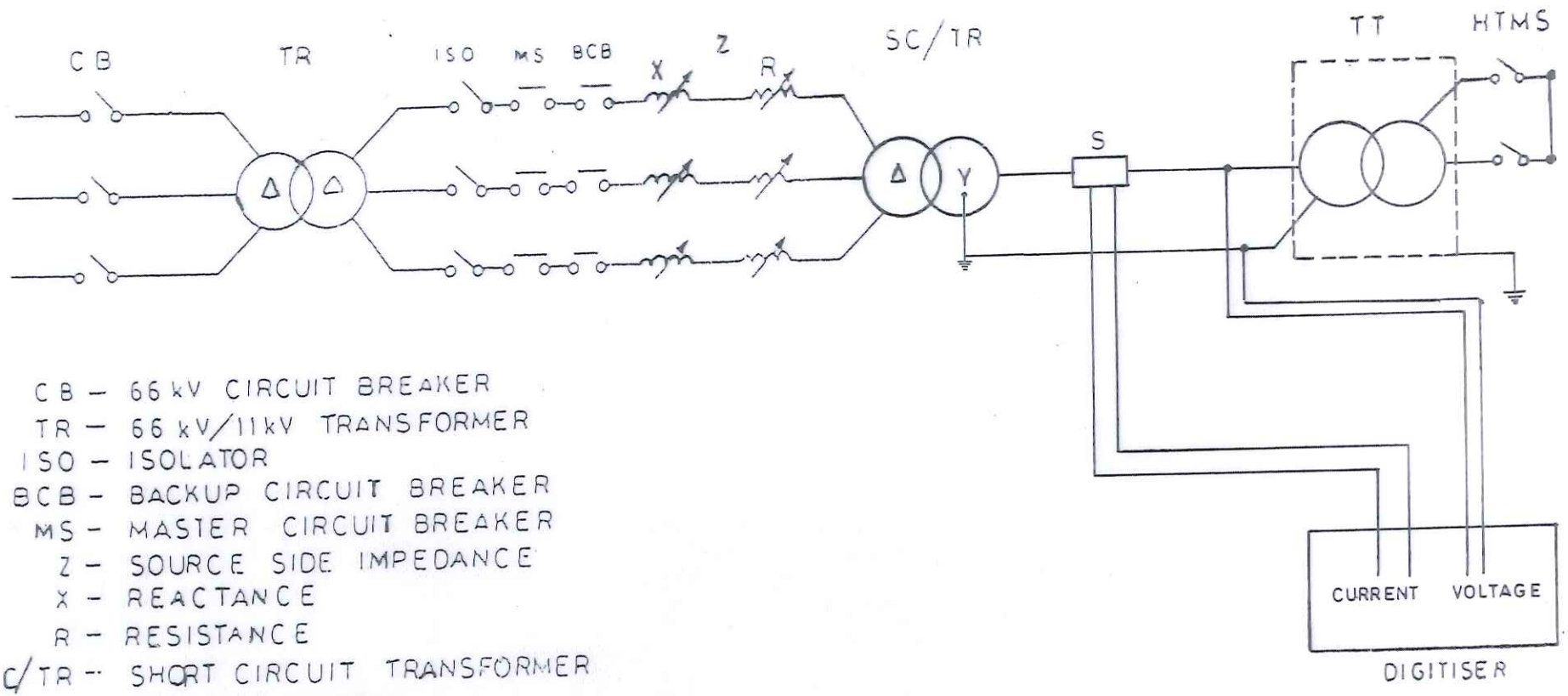


TC 24228298



CB – 66 kV CIRCUIT BREAKER
TR – 66 kV/11kV TRANSFORMER
ISO – ISOLATOR
BCB – BACKUP CIRCUIT BREAKER
MS – MASTER CIRCUIT BREAKER
Z – SOURCE SIDE IMPEDANCE
X – REACTANCE
R – RESISTANCE
SC/TR – SHORT CIRCUIT TRANSFORMER
HTMS – H.T. MAKE SWITCH
T.T. – TEST TRANSFORMER
S – CURRENT MEASURING DEVICE

REPORT NO.: RP-1788-050430
DATE : 10.01.2018

Short Circuit Laboratory Vadodara

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION			
SCHEMATIC CIRCUIT DIAGRAM			
DRN. BY	CKD.	DATE	DRG. NO.
S.B.S.	A.V.D.	30.9.01	OLSC/DTC/05

4 HOLES of Ø3.6mm

DISTRIBUTION TRANSFORMER

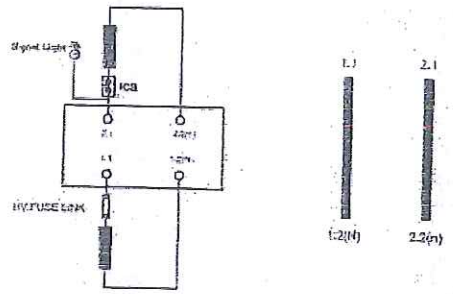
RAJASTHAN POWERGEN TRANSFORMER PVT LTD
JALORE, RAJASTHAN

1 PHASE TRANSFORMER

STANDARD	IS : 1180 (Part-1)2014	ENERGY EFFICIENCY LEVEL	2
KVA	16	MAX. TOTAL LOSS AT 50% RATED LOAD W	82
VOLTS AT NO LOAD (V) HV	11000/√3	MAX. TOTAL LOSS AT 100% RATED LOAD W	224
VOLTS AT NO LOAD (V) LV	240	TYPE OF COOLING	ONAN
BIL (kV Peak) HV	75	TEMP. RISE OIL °C	35
BIL (kV Peak) LV	NA	TEMP. RISE WDG °C	40
CURRENT (A) HV	2.52	MASS OF OIL kg	47
CURRENT (A) LV	66.67	TOTAL MASS kg	209
FREQUENCY Hz	50	VOLUME OF OIL Ltr	54
VECTOR GROUP	1-PHASE	MONTH & YEAR OF MFG.	/2017
IMPEDANCE VOLT %	4	SERIAL NO.	RPTPL/16KVA/2017/11/0014
DISPATCH DATE	-	EXPIRY DATE O.P.	-
CONDUCTOR MATERIAL	ALUMINIUM		
CUSTOMER	AVVNL		
P.O. No.			

MADE IN INDIA

SUBTRACTIVE POLARITY



Test Report No. RP-1718-050430
Date 10.01.2018
Product 16 KVA 1-Ø DT
Verified by K. L. Patel
Verification of this drawing by ERDA is limited to relevant dimensional checks only. Verified dimensions are marked with ***

NOTES :-
1. * MARKED ITEMS SHOULD BE PUNCHED AT THE TIME OF DISPATCH.
2. ALL LETTERS, FIGURES ETC. TO BE ENGRAVED & POLISHED BLACK.
3. MATERIAL - STAINLESS STEEL 2.0 WITH TOLERANCE ± 0.1 MM. THICK.
4. ALL DIMENSIONS ARE IN MM.

Rev	Date	Draw	Checked	Approved	Description
00	23.08.17				ORIGINAL ISSUE.

Title : RATING & DIAGRAM PLATE

Work Order : ---

Rating : 16 KVA, 11/√3/0.240 KV, 1Ø, 50 Hz, TRF.

Drawing No. : RPTPL/RP/02 Rev. : 00

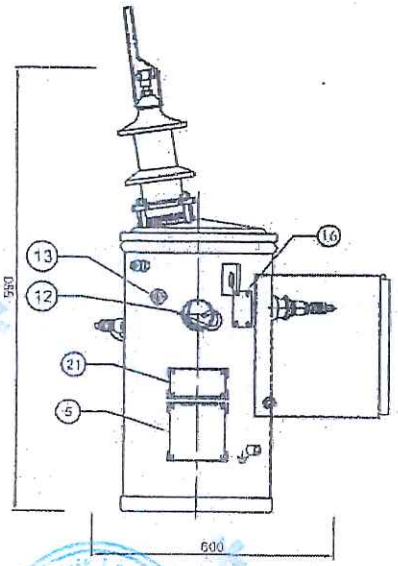
Sheet No. : 00

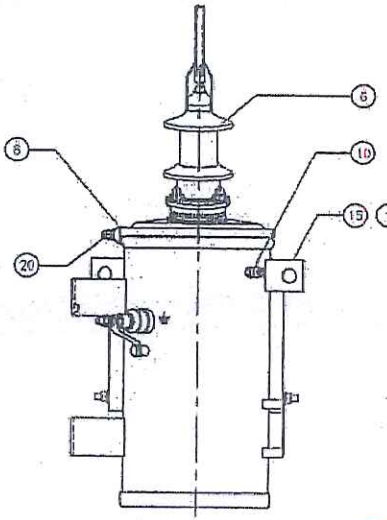
Total Sheets : 00

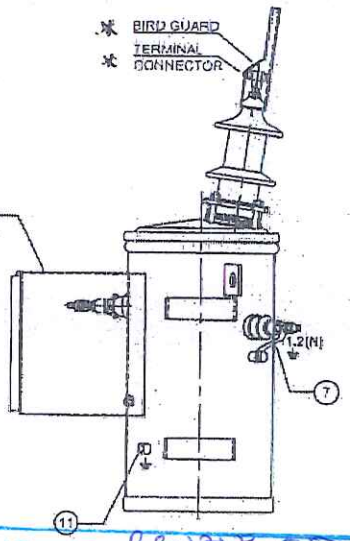
RAJASTHAN POWERGEN TRANSFORMER P. LTD.
Karola – Bhinmal Road, Karola, Sanchore – 343041 Dist – Jalore, Rajasthan (India)

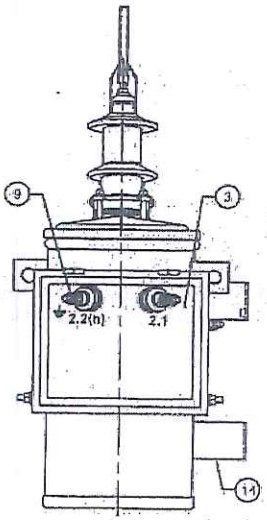
All dimensions are in millimeters unless otherwise stated. If in doubt - Please Ask !

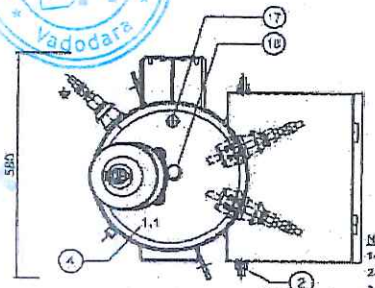
Scale : NTS











Tank diameter	440 mm
Tank height	635 mm

WEIGHTS / QTY.		
TRANSFORMER OIL	Ltrs.	54
TOTAL TRANSFORMER	Kg.	208
TRANSFORMER OIL	Kg.	47
TANK & FITTINGS	Kg.	42
INTERNAL ASSEMBLY	Kg.	119

AIR CLEARANCES (MM)		
VOLTAGE	H.V.	L.V. (enclosed)
PHASE TO PHASE	NA	NA
PHASE TO EARTH	140	20

S. No.	Description	Qty.
21	TERMINAL PLATE	1
20	TOP COVER ANTI THEFT BOLT	-
19	-	-
18	OIL FILLING HOLE WITH WELDED COVER AND WITH EXTENDED PIPE as per IS 1180	1
17	THERMOMETER POCKET WITH CAP	1
16	OIL LEVEL GUAGE	1
15	Lifting lugs for complete unit	2
14	Pole mounting bracket (as per spec)	2
13	Signal light*	1
12	Internal Circuit Breaker handle*	1

S. No.	Description	Qty.
11	Tank Earthing terminal	2
10	Pressure relief device	1
9	L.V. Bushing	2
8	Top cover rim	-
7	H.V. Neutral bushing	1
6	H.V. Bushing	1
5	Rating & terminal marking plate	1
4	H.V. Terminal marking	1 set
3	L.V. Terminal marking	1 set
2	Earthing terminal (LV box)	2
1	LV cable box*	1

Notes :-
1- All dimensions are in mm. Tolerance ±5%
2- This drawing shows only general disposition of fittings.
3- Tank side plate - 2.0 mm. Thk.M.S.
Top & bottom - 2.5 mm. Thk.M.S.
4- Paint Shade : Olive Green Color conforming to No. 220 of IS : 5 / 1961

* Not Provided during testing

Test Report No. RP-1377-052430
Date 10.01.24
Product 16KVA 1-Ø D.T
Verified by K.S. Patel
Verification of this drawing by ERDA is limited to relevant dimensional checks only.
Verified dimensions are marked with ✓

Rev.	Date	Drawn	Checked	Approved	Description
00	23.08.2017				ORIGINAL ISSUE

Title: OUTLINE GENERAL ARRANGEMENT

Work Order: ---

Rating: 16 KVA, 11/√3-0.240 KV, 1Ø, 50 Hz. TRF.

Drawing No.: RPTPL/OGA/02 Rev.: 00

Sheet No.: 01 Total Sheets: 01

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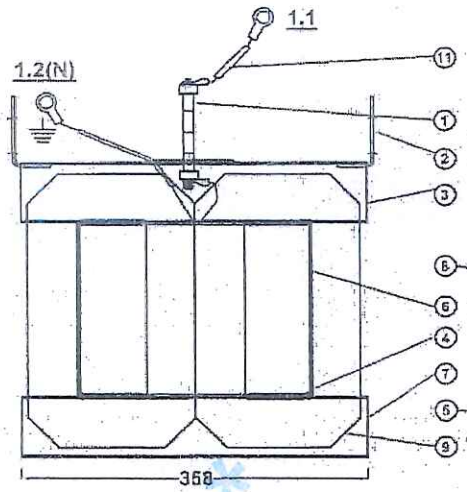
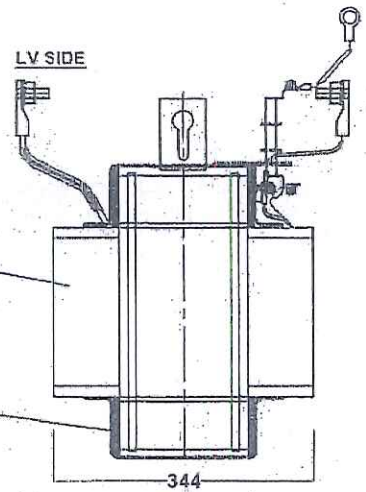
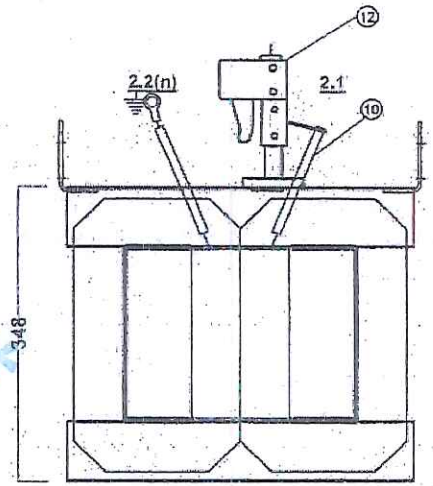
Scale: N.T.S



H.V. SIDE VIEW



SIDE VIEW



L.V. SIDE VIEW

CONDUCTOR SIZE		
	LV	HV
Bare	14.0 x 3.0	2.50 Dia
Covered	14.4 x 3.4	2.60 Dia
Aluminium	DPC	Polyesterimide enamel (Class H)
Coolpack Configuration	1W x 2D	

CORE SIZE	
Core Window Height	240 mm
Core build up	2 x 43.5 mm
Core Sheet width	160 mm

COIL DIMENSIONS		
	LV	HV
ID	93 x 160	169 x 234
OD	152 x 220	270 x 344
AXIAL HT.	358	

Sl..No.	LIST OF FITTINGS	Qty.
12	INTERNAL CIRCUIT BREAKER*	1
11	HV LEAD	-
10	LV LEAD	-
9	CORE (CRGO)	2 nos
8	LV & HV COIL (ALUMINIUM)	1 set
7	BOTTOM CORE CLAMP	1
6	COIL SEPARATOR	1 set
5	CHANNEL SEPARATOR	1 set
4	END INSULATION	1 set
3	TOP CORE CLAMP	1
2	LOCKING CUM LIFTING LUG	2
1	HV FUSE LINK*	1

Notes :-
1- All dimensions are in mm. Tolerance ±5%
2- This drawing shows only general disposition of fittings.

Test Report No. RP-1718-050430
Date 10.01.2018
Product 16 KVA 1-ϕ D.T
Verified by K.I. Patel
Verification of this drawing by ERDA is limited to relevant dimensional checks only. Verified dimensions are marked with ***

Rev	Date	Draw	Checked	Approved	Description
00	23.05.2017				ORIGINAL ISSUE

RAJASTHAN POWERGEN TRANSFORMER P. LTD.
Kandla – Bhimasar Road, Kandla, Bachchau – 370201 Dist – Kutch, Gujarat (India.)

Title: INTERNAL CONSTRUCTIONAL DETAIL DRAWING

Work Order: ---

Rating: 16 KVA, 11kV/0.240 kV, 1Ø, 50 Hz, TAF

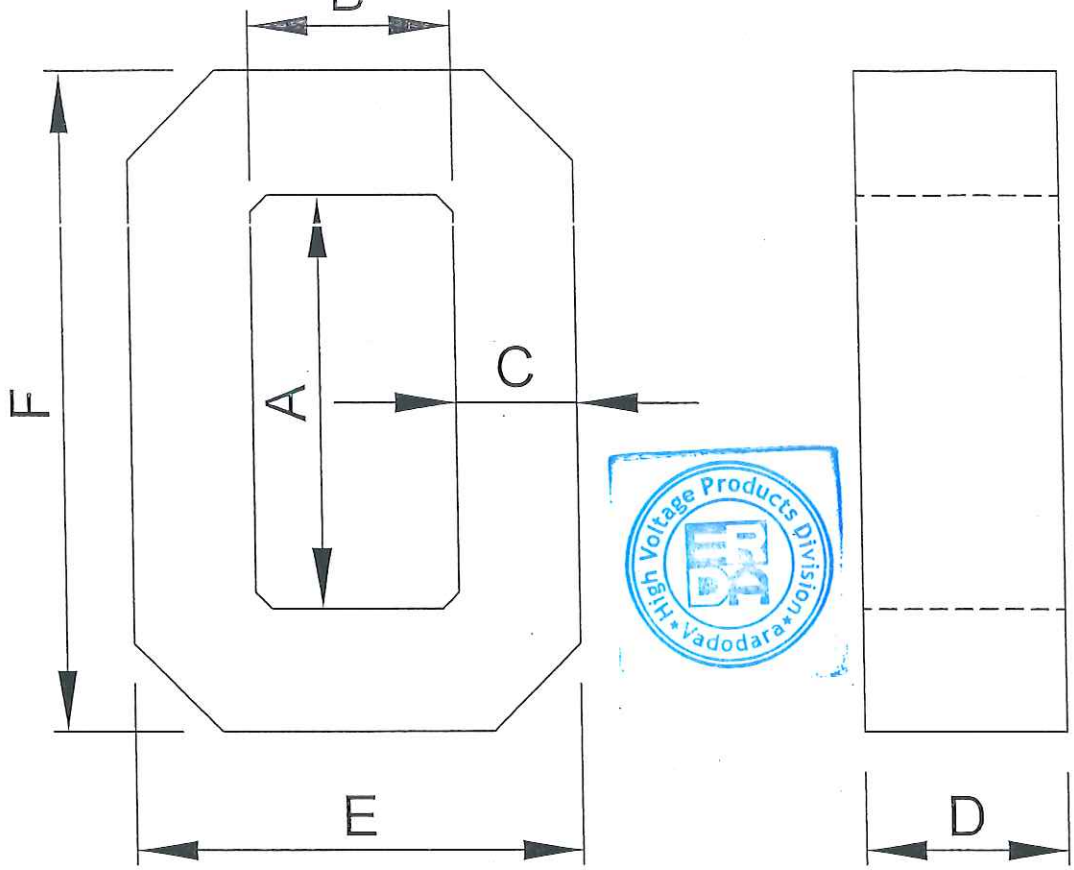
Drawing No.: RPTPL/IC/02 Rev.: 00

Sheet No.: 01 Total Sheets: 01

All dimensions are in millimeters unless otherwise stated. If in doubt - Please Ask.

Scale: N.T.S

CRGO WOUND CORE



MATERIAL - CRGO

FLUX DENSITY CALCULATION

CORE DIMENSION :-

WIDTH	- 160 mm.
STACK	- 43.5 mm.
No. OF LOOPS	- 2 Nos.
GROSS AREA	- 13920 Sq. mm.
STACKING FACTOR	- 0.96
NET CORE AREA (A)	- 13363.2 Sq. mm.
FREQUENCY (f)	- 50 Hz.
No. OF LV TURNS (N)	- 60 *
SECONDARY VOLTAGE (V)	- 0.240 kV

$$\text{FLUX DENSITY} = \frac{0.24 \times 10^9}{4.44 \times 50 \times 13363.2 \times 60}$$

$$= 1.348 \text{ TESLA}$$

High Voltage Products Division * Vadodara *

Test Report No. : RP-1718-0904300
Date : 10/01/2018
Product : 16 kVA x 2 nos
Verified By :

verification of this drawing by ERDA is limited to relevant dimensional checks only. Various dimensions are marked with this

	Dimensions (MM)
A	246
B	95
C	43.5
D	160
E	182
F	333
Qty. :	2 No's

Calculated Weight :	85 kg

Notes :-
1) All dimensions are in mm. Unless othewise specified.

Rev	Date	Draw	Checked	Approved	Description
00	23.08.17				ORIGINAL ISSUE.

Title : CORE DRAWING

Work Order : ----

Rating : 16 KVA, 11/√3/0.240 KV, 1Ø, 50 Hz, TRF.

Drawing No. : RPTPL/CD/02 Rev. : 00

Sheet No. : 00

Total Sheets: 00

RAJASTHAN POWERGEN TRANSFORMER P. LTD.
Karola – Bhinmal Road, Karola, Sanchore – 343041 Dist – Jalore, Rajasthan (India)

All dimensions are in millimeters unless otherwise stated. If in doubt - Please Ask !

Scale : NTS