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Certificate No. : TC-5389

TEST REPORT

ULR-TC538919000026095F

NAME & ADDRESS OF CUSTOMER	**TEST REPORT NO.:** RP-1920-019523 **DATE:** 24/08/2019	
RAJASTHAN POWERGEN TRANSFORMER PVT. LTD. Khasra No. 911-914, Karola-Bhinmal Road, Karola Sanchore, Rajasthan-343041	**CUSTOMER REF. No.:** NIL	**DATED:** 12/07/2019
	DATE OF SAMPLE RECEIPT:	**DATE OF TESTING:**
	12/07/2019	17/07/2019 to 24/08/2019

SAMPLE DESCRIPTION	**SAMPLE IDENTIFICATION**
160 kVA Distribution Transformer 11000/433 Volts, 8.40/213.34 Amp., Oil filled, Vector Group: Dyn-11, **ENERGY EFFICIENCY LEVEL:** 2 Further details as per sheet No. 3 OF 21.	**ERDA SAMPLE CODE NO.:** ERDA-00324652 **SERIAL NO.:** RPTPL/01 **YEAR OF MFG.:** 2019

TEST DETAILS	**TEST SPECIFICATIONS**
Short-circuit withstand test [Cl. No. (17 & 21.3 c)]	As per customer's requirement, Test procedure followed as per IS 1180 (Part 1): 2014 [Amendment No. 1, 2 & 3]

ENCLOSURES:

Number of oscillograms	: Eleven
Number of photograph	: One
Number of test circuit diagram	: One
Number of drawings	: Three

TEST WITNESSED BY: Mr. Irfan Khatri

REMARKS: The sample **conforms** to the requirements of standard for short-circuit withstand test as specified by customer.

PREPARED BY	**CHECKED BY**	**J. R. TAHILWANI** **APPROVED BY**

NOTE:
1. This report relates only to the particular sample received for testing in good condition at ERDA.
2. This report cannot be reproduced in part under any circumstances.
3. Publication of this report requires prior permission in writing from Director, ERDA.
4. Only test asked for by customer have been carried out.
5. In case of any dispute, Vadodara will be the exclusive jurisdiction & shall be construed as where the cause has arised.

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5.	Oscillograms	Sheet No. 10 OF 21 to 20 OF 21
6.	Photograph	Sheet No. 21 OF 21
7.	Oscillogram No.	0486/01 to 0486/11
8.	Photograph No.	1920-005611/0552
9.	Test circuit diagram No.	OLSC/DTC/03
10.	Drawing No.	NP/160/08 RPTL-OGA-160-07 IGA/160/02

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ULR-TC538919000026095F
TEST REPORT NO.: RP-1920-019523 SHEET 3 OF 21
DATE: 24/08/2019

TECHNICAL SPECIFICATIONS OF TEST OBJECT ASSIGNED BY CUSTOMER

1.	Name of manufacturer	: **RAJASTHAN POWERGEN TRANSFORMER PVT. LTD.**
2.	Equipment	: **160 kVA Distribution Transformer**
3.	Standard No.	: As per customer's requirement, Test procedure followed as per [Cl. No. (17 & 21.3 c)] of IS 1180 (Part 1): 2014 [Amendment No. 1, 2 & 3]
4.	Serial No.	: RPTPL/01
5.	Energy efficiency level	: 2
6.	Type	: Outdoor, Oil Cooled, Non Sealed, Aluminium wound, CRGO core
7.	kVA rating	: 160
8.	Rated voltage H.V. (Volts)	: 11000
	L.V. (Volts)	: 433
9.	Rated current H.V. (Amp.)	: 8.40
	L.V. (Amp.)	: 213.34
10.	Number of phases	: 3
11.	Connection H.V./L.V.	: Delta/Star
12.	Frequency (Hz.)	: 50
13.	Type of cooling	: ONAN
14.	Temperature rise of oil/winding	: 35°C/40°C
15.	Percentage Impedance	: 4.5%
16.	Type of winding	: Concentric
17.	Primary winding conductor	: SEM Aluminium wire, bare dia. 2.65mm
18.	Secondary winding conductor	: DPC Aluminium strip, bare size (8.85mm x 5.2mm) x 6 Nos. in parallel
19.	Quantity of oil (Litre)	: 280
20.	Weight of oil (kg.)	: 230
21.	Total weight (kg.)	: 1035
22.	Vector group	: Dyn-11
23.	Year of manufacture	: 2019
24.	Insulation level H.V.	: 28 kVrms
25.	Insulation level L.V.	: 03 kVrms
26.	Total losses at 75°C (Watts)	: 670 Max. (at 50 % load)
27.	Total losses at 75°C (Watts)	: 1950 Max. (at 100 % load)

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ROUTINE TEST RESULTS BEFORE SHORT CIRCUIT

a) MEASUREMENT OF WINDING RESISTANCE

Measurement at average oil temperature: 37.5°C					
LV Winding resistance (mΩ)			HV Winding Resistance (Ω)		
u – v	v – w	w – u	U – V	V – W	W – U
6.9110	6.8905	6.9720	7.0515	7.0410	7.0395

b) MEASUREMENT OF VOLTAGE RATIO AND CHECK OF PHASE DISPLACEMENT

Vector group: Dyn-11 was verified.

Rated turns Ratio	Measured turns ratio between Terminals					
	U-V/u-n	Difference %	V-W/v-n	Difference %	W-U/w-n	Difference %
44.001	43.895	-0.241	43.989	-0.027	43.958	-0.098

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

Average oil temp.: 38.4°C

Test current (Amp.) Iavg.	Impedance voltage (V) Vavg.	Frequency (Hz.)	Load loss measured (Watts)	Impedance Voltage (%Z) at 50 Hz.	Load loss computed at 75°C (Watts)	%Z at 75°C
8.400	504.954	49.959	1334.06	4.594	1491	4.613

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

Average oil temp.: 38.4°C

Test current (Amp.) Iavg.	Impedance voltage (V) Vavg.	Frequency (Hz.)	Load loss measured (Watts)	Load loss computed at 75°C (Watts)
4.199	251.930	49.898	332.79	372

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DATE: 24/08/2019

e) MEASUREMENT OF NO-LOAD LOSS AND CURRENT

Average oil temp.: 38.4°C

Applied Voltage (V) Vavg.	Current (Amp.) Iavg.	Frequency (Hz.)	Losses Measured (Watts)
433.048	0.744	50.013	268

- Total losses at 75°C: 640 Watts (at 50 % load)
- Total losses at 75°C: 1759 Watts (at 100% load)

f) MEASUREMENT OF INSULATION RESISTANCE

Average oil temp.: 37.5°C

Measured between	DC Test Voltage (V)	IR value (MΩ)
HV to LV winding	2500	> 2000
HV winding to LV + EARTH	2500	> 2000
LV winding to HV + EARTH	500	> 2000

g) INDUCED OVER-VOLTAGE WITHSTAND TEST

Sr. No.	Test	Applied voltage (V)	Applied Freq. (Hz.)	Duration (sec.)	Remarks
1.	Between LV windings with tank connected to earth.	866	100	60	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	28	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 transformer by connecting the secondary winding to three phase balanced source and primary winding short circuited using synchronization switch. The test conducted with short circuiting of the primary winding follow the application of the voltage to the secondary winding of the transformer as per schematic circuit diagram No. OLSC/DTC/03.

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

Supply Frequency: 50 Hz.

Test No.	Oscillogram No.	Applied voltage (Vrms)	Short circuit current on LV (kA)			Duration (sec.)	Remarks
			Peak	RMS	Avg.		
1.	0486/01	-	- 7.142 -	3.356 3.338 3.407	3.367	0.1	Calibration shot
2.	0486/02	433	- 10.004 -	4.582 4.501 4.503	4.529	0.5	No Abnormality
3.	0486/03	433	- 10.094 -	4.417 4.356 4.492	4.422	0.5	No Abnormality
4.	0486/04	433	- 10.025 -	4.457 4.505 4.502	4.488	0.5	No Abnormality
5.	0486/05	433	- - 9.616	4.557 4.338 4.507	4.467	0.5	No Abnormality
6.	0486/06	433	- - 9.602	4.388 4.458 4.858	4.558	0.5	No Abnormality
7.	0486/07	433	- - 9.649	4.467 4.515 4.506	4.496	0.5	No Abnormality
8.	0486/08	433	9.696 - -	4.438 4.520 4.515	4.491	0.5	No Abnormality
9.	0486/09	433	9.704 - -	4.481 4.531 4.530	4.514	0.5	No Abnormality
10.	0486/10	433	9.972 - -	4.487 4.545 4.534	4.514	0.5	No Abnormality
11.	0486/11	433	- 9.892 -	4.492 4.508 4.536	4.512	2.0	Thermal Shot* No Abnormality

*As per customer's requirement

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Measurement of the % reactance during the short circuit test

LV winding was short circuited. Three phase 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		
			U	V	W	U	V	W
1.	Before test		4.52	4.53	4.50	-	-	-
2.	After the test no.	2.	4.52	4.53	4.50	0.00	0.00	0.00
3.	After the test no.	3.	4.52	4.53	4.50	0.00	0.00	0.00
4.	After the test no.	4.	4.52	4.53	4.50	0.00	0.00	0.00
5.	After the test no.	5.	4.52	4.53	4.50	0.00	0.00	0.00
6.	After the test no.	6.	4.52	4.53	4.50	0.00	0.00	0.00
7.	After the test no.	7.	4.52	4.54	4.51	0.00	0.22	0.22
8.	After the test no.	8.	4.52	4.54	4.51	0.00	0.22	0.22
9.	After the test no.	9.	4.51	4.54	4.51	-0.22	0.22	0.22
10.	After the test no.	10.	4.52	4.54	4.51	0.00	0.22	0.22
11.	After the test no.	11.	4.51	4.53	4.52	-0.22	0.00	0.44

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ROUTINE TEST RESULTS AFTER SHORT CIRCUIT

a) MEASUREMENT OF WINDING RESISTANCE

Measurement at average oil temperature: 33.5°C					
LV Winding resistance (mΩ)			HV Winding Resistance (Ω)		
u – v	v – w	w – u	U – V	V – W	W – U
6.7475	6.7710	6.8330	6.8910	6.8800	6.8805

b) MEASUREMENT OF VOLTAGE RATIO AND CHECK OF PHASE DISPLACEMENT

Vector group: Dyn-11 was verified.

Rated turns Ratio	Measured turns ratio between Terminals					
	U-V/u-n	Difference %	V-W/v-n	Difference %	W-U/w-n	Difference %
44.001	43.891	-0.250	43.990	-0.025	43.954	-0.107

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

Average oil temp.: 33.7°C

Test current (Amp.) Iavg.	Impedance voltage (V) Vavg.	Frequency (Hz.)	Load loss measured (Watts)	Impedance Voltage (%Z) at 50 Hz.	Load loss computed at 75°C (Watts)	%Z at 75°C
8.396	503.542	49.903	1301.690	4.589	1478	4.610

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

Average oil temp.: 33.7°C

Test current (Amp.) Iavg.	Impedance voltage (V) Vavg.	Frequency (Hz.)	Load loss measured (Watts)	Load loss computed at 75°C (Watts)
4.196	251.354	49.897	324.430	369

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e) MEASUREMENT OF NO-LOAD LOSS AND CURRENT

Average oil temp.: 33.7°C

Applied Voltage (V) Vavg.	Current (Amp.) Iavg.	Frequency (Hz.)	Losses Measured (Watts)
433.041	0.741	50.007	269

- Total losses at 75°C: 638 Watts (at 50 % load)
- Total losses at 75°C: 1747 Watts (at 100% load)

f) MEASUREMENT OF INSULATION RESISTANCE

Average oil temp.: 33.5°C

Measured between	DC Test Voltage (V)	IR value (MΩ)
HV to LV winding	2500	> 2000
HV winding to LV + EARTH	2500	> 2000
LV winding to HV + EARTH	500	> 2000

g) INDUCED OVER-VOLTAGE WITHSTAND TEST

Sr. No.	Test	Applied voltage (V)	Applied Freq. (Hz.)	Duration (sec.)	Remarks
1.	Between LV windings with tank connected to earth	866	100	60	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	28	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 spacers : Intact
3) 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.

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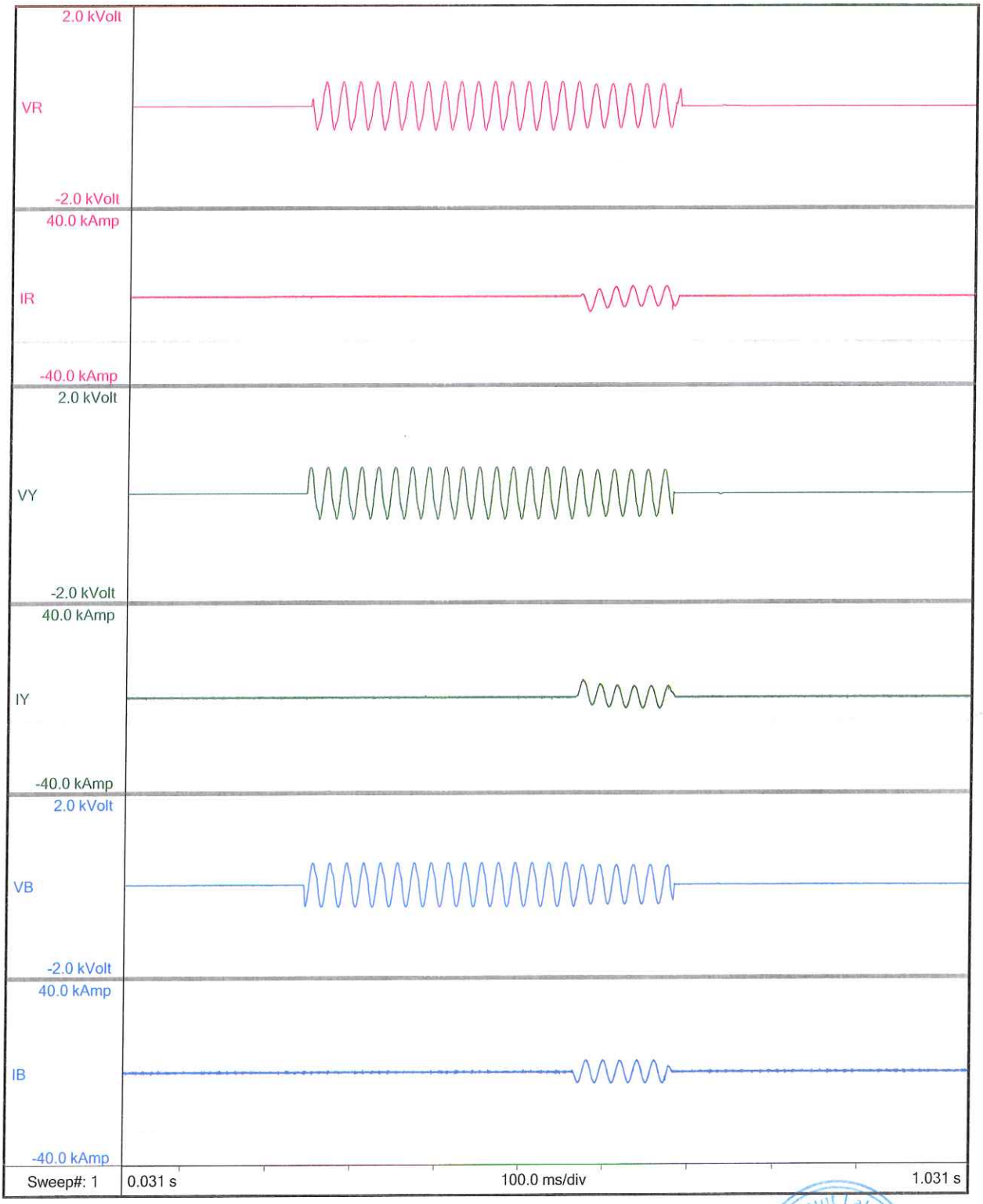

OSCILLOGRAM NO. : 0486/01

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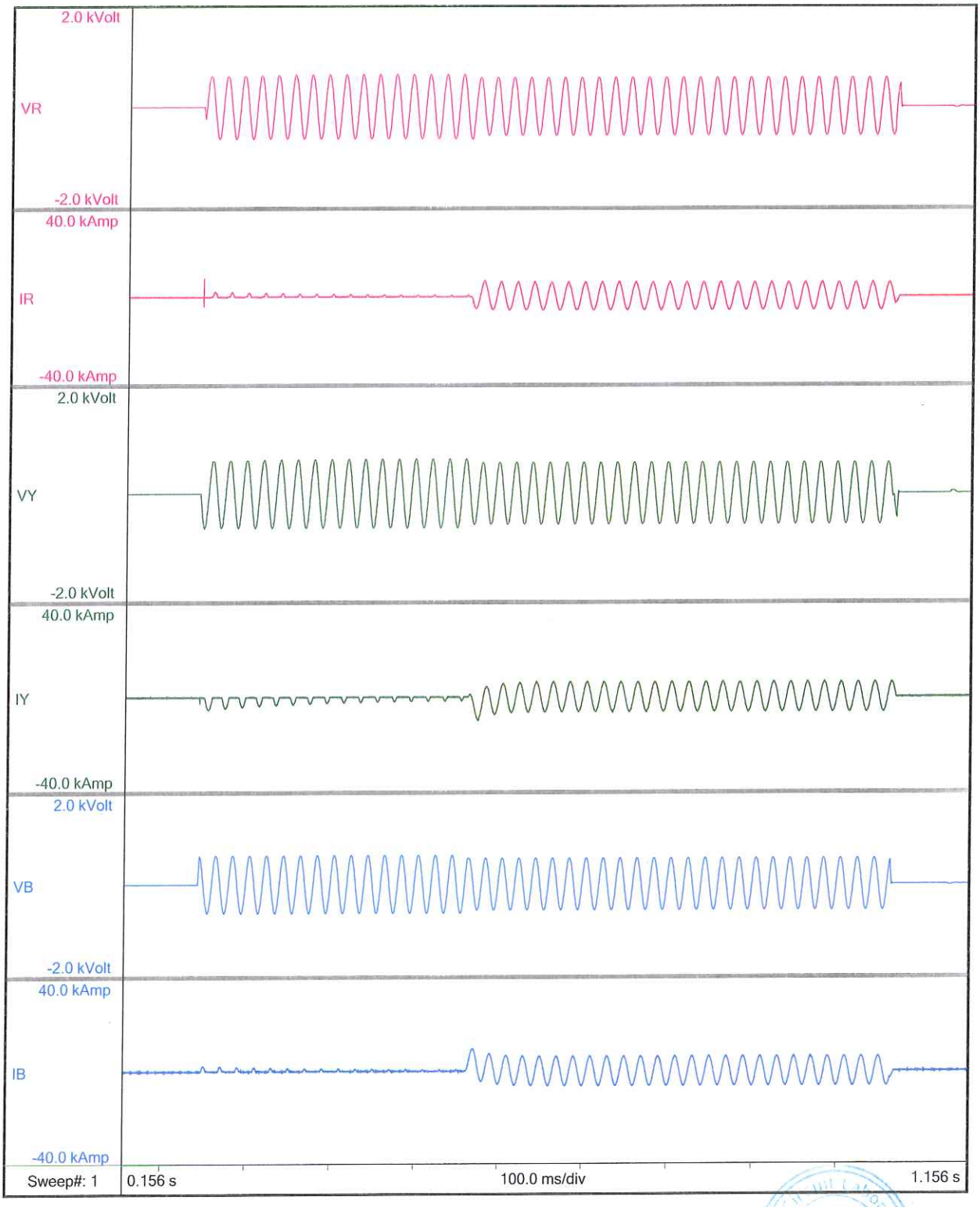

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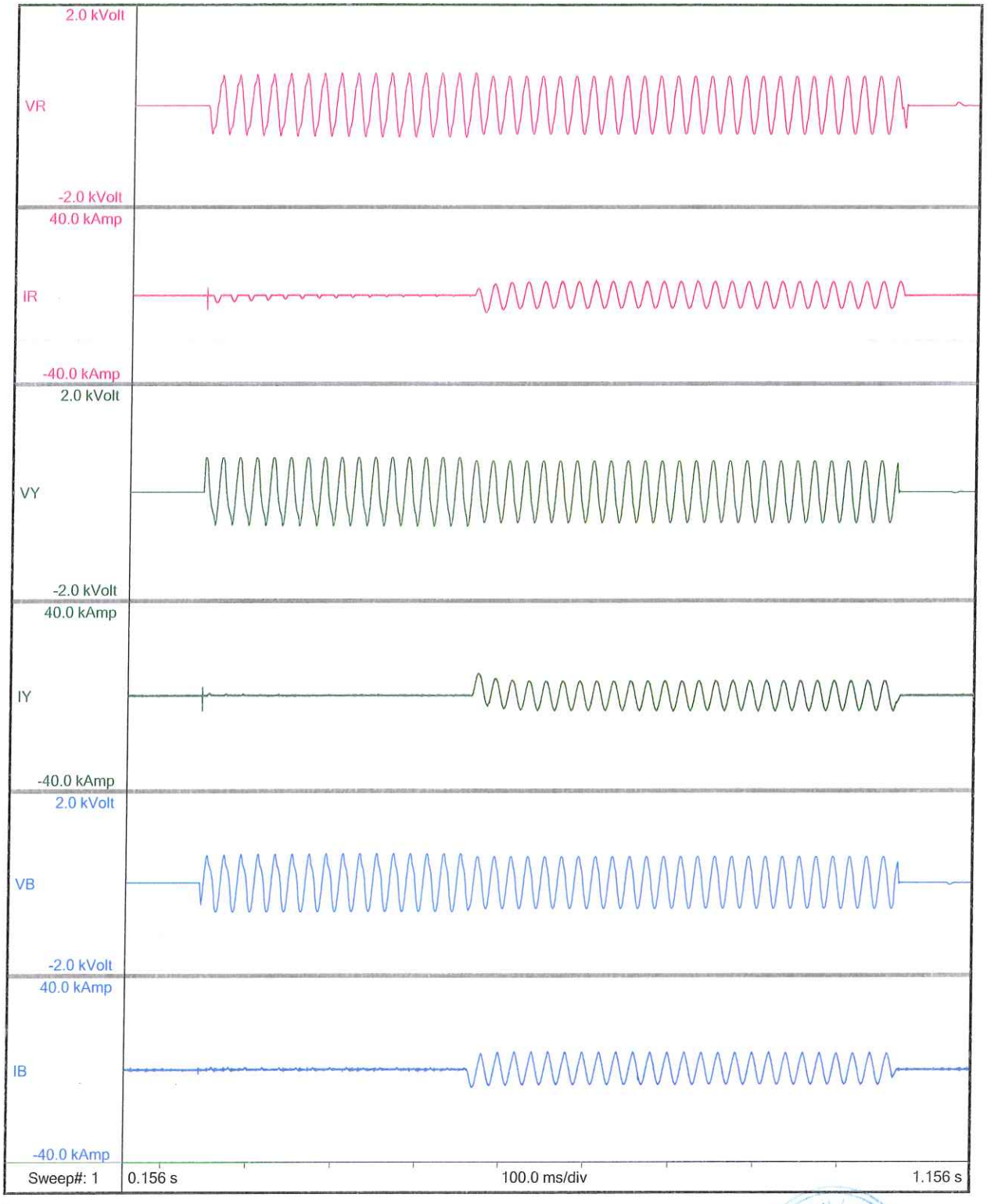

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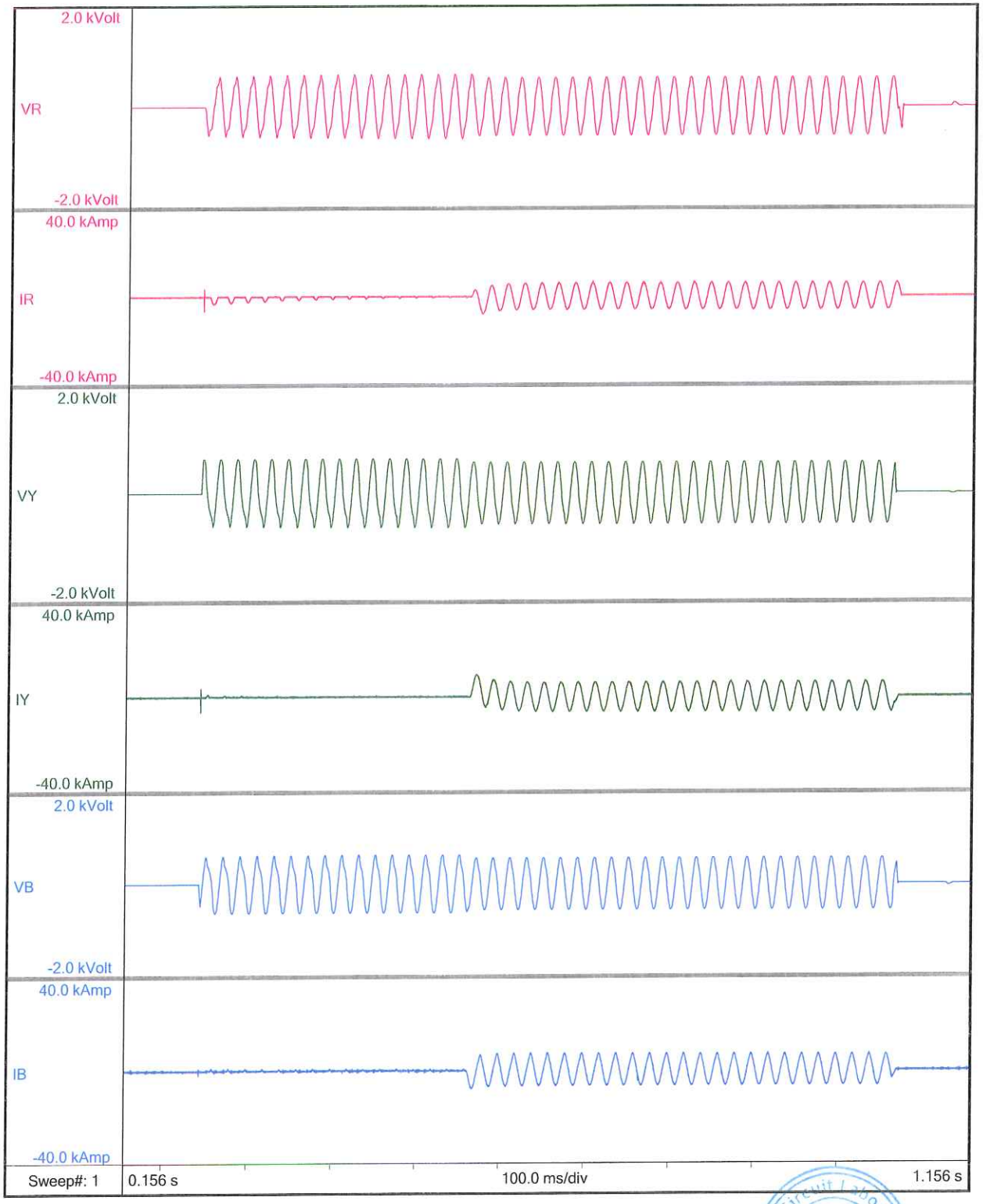

OSCILLOGRAM NO. : 0486/04

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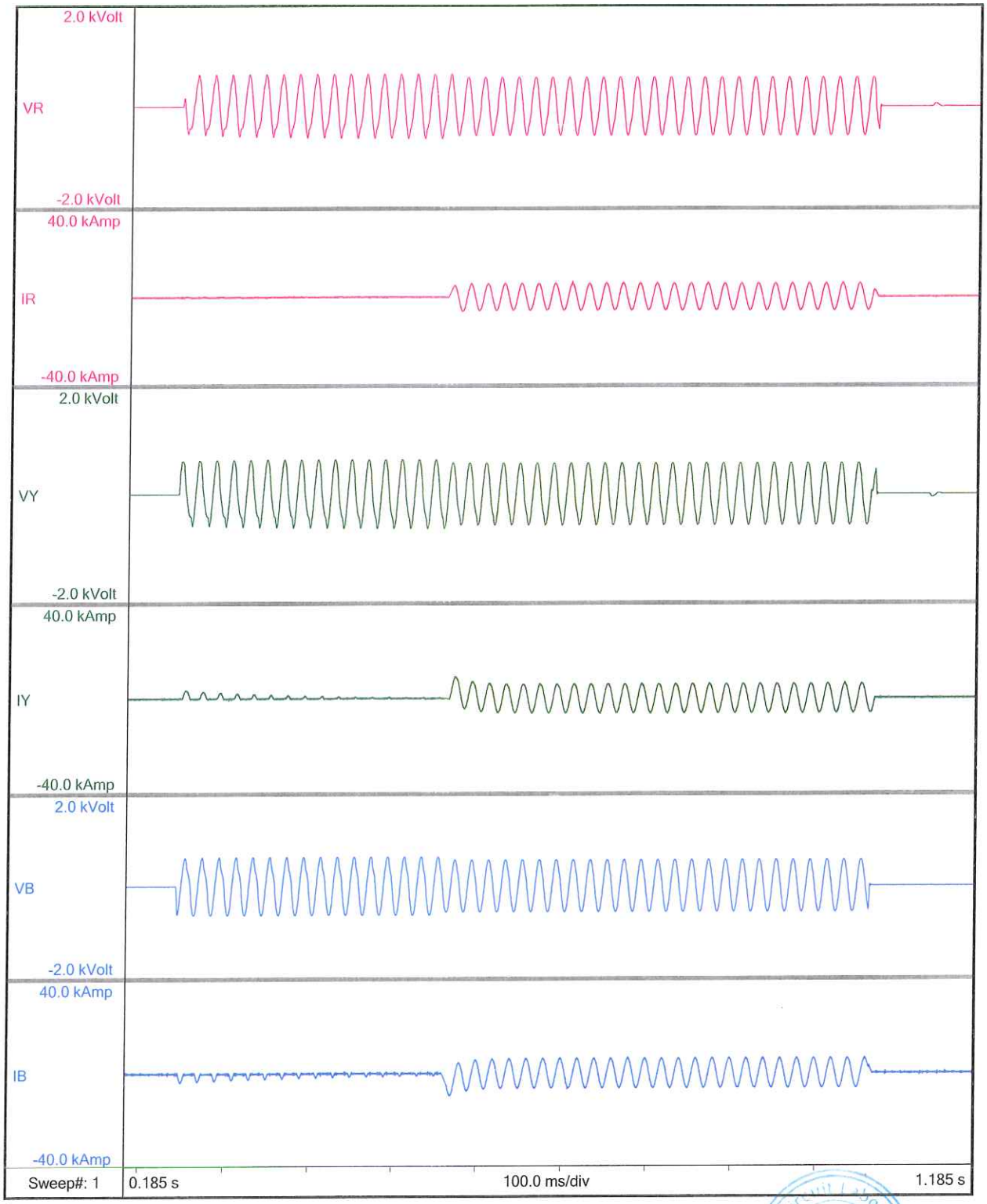

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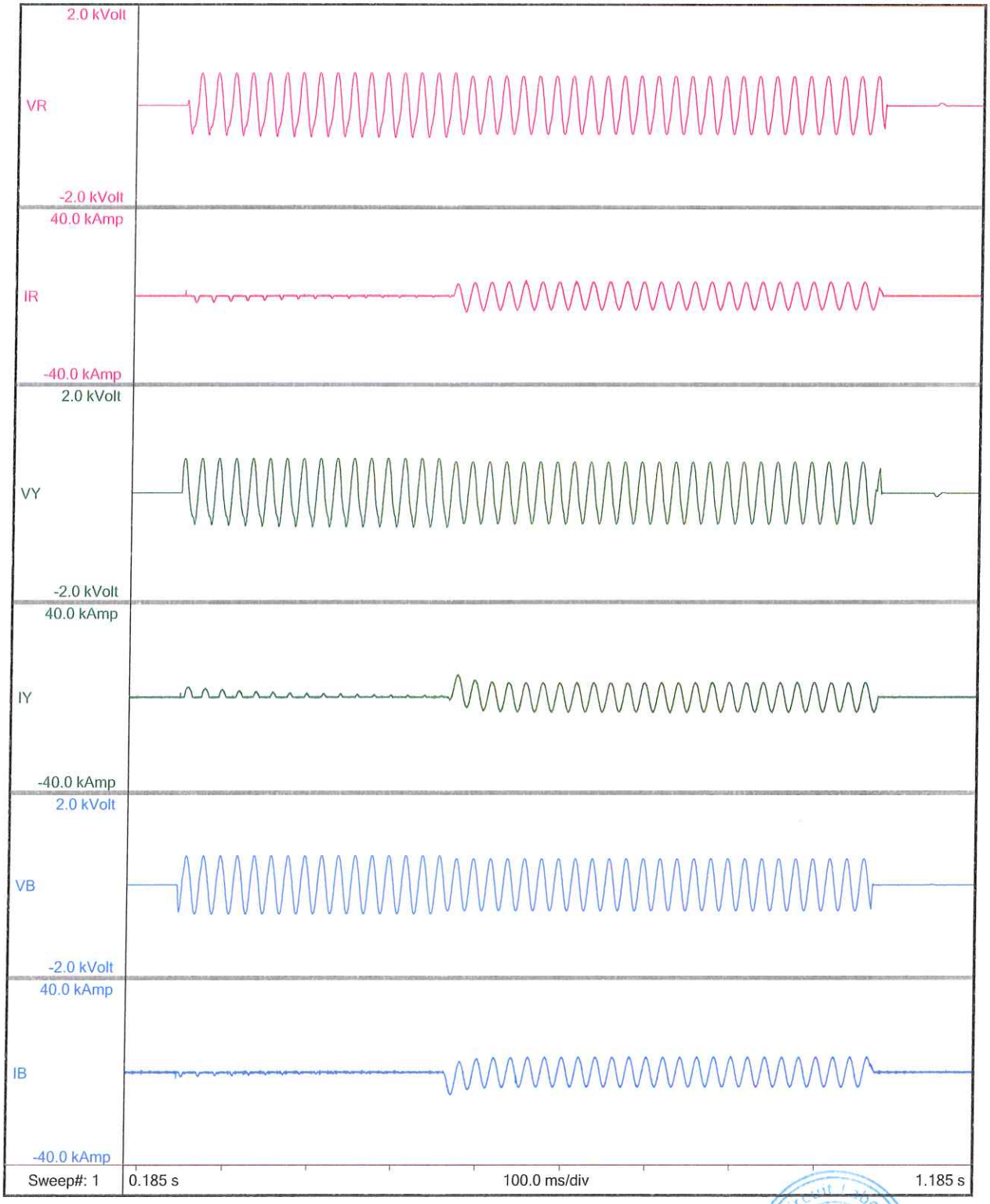

OSCILLOGRAM NO. : 0486/06

PREPARED BY **CHECKED BY**

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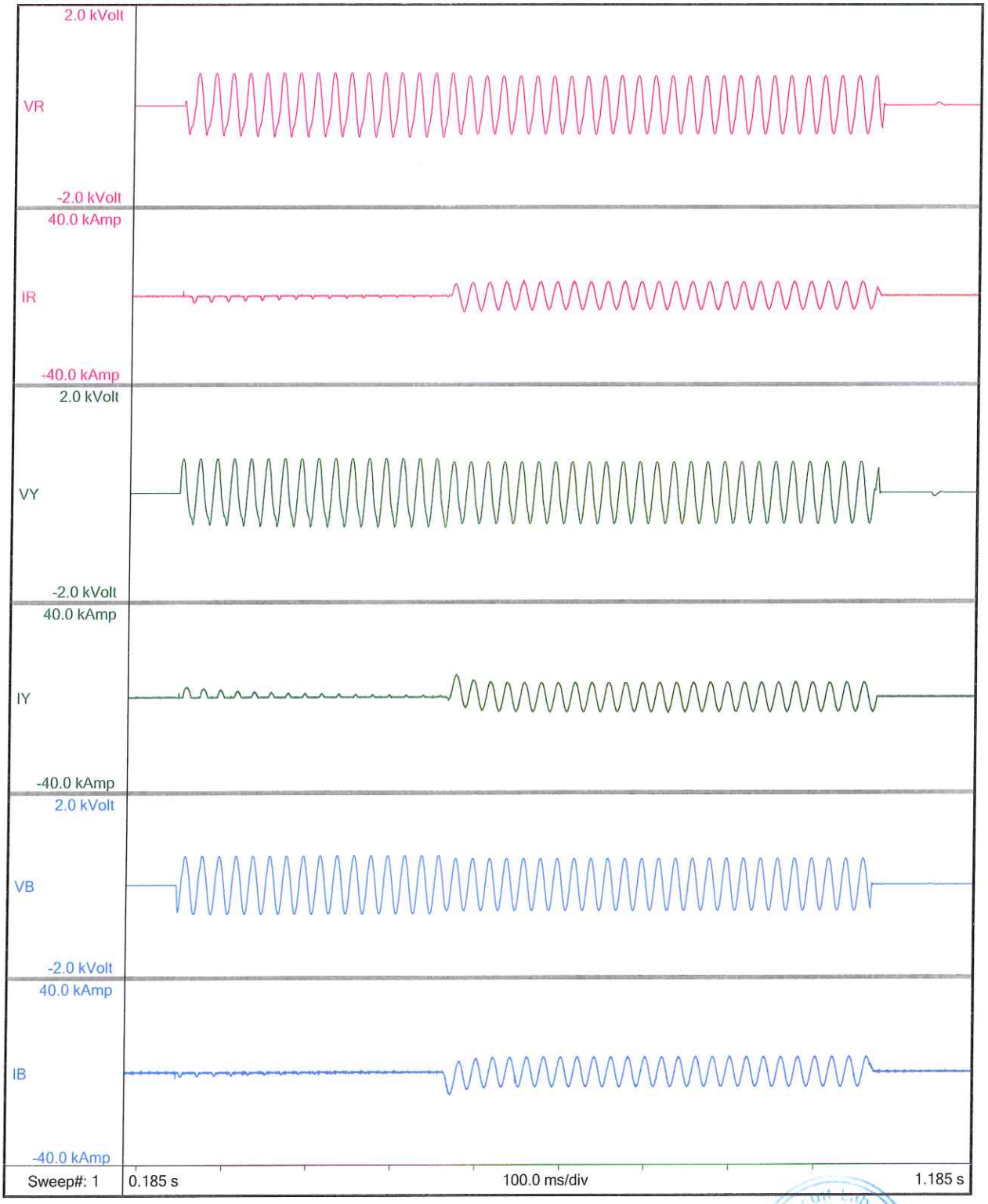
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX : +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
E-mail : erda@erda.org
Web : http://www.erda.org
Certificate No. : TC-5389

ULR-TC538919000026095F
TEST REPORT NO.: RP-1920-019523
DATE: 24/08/2019



OSCILLOGRAM NO. : 0486/07

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Short Circuit Laboratory Vadodara

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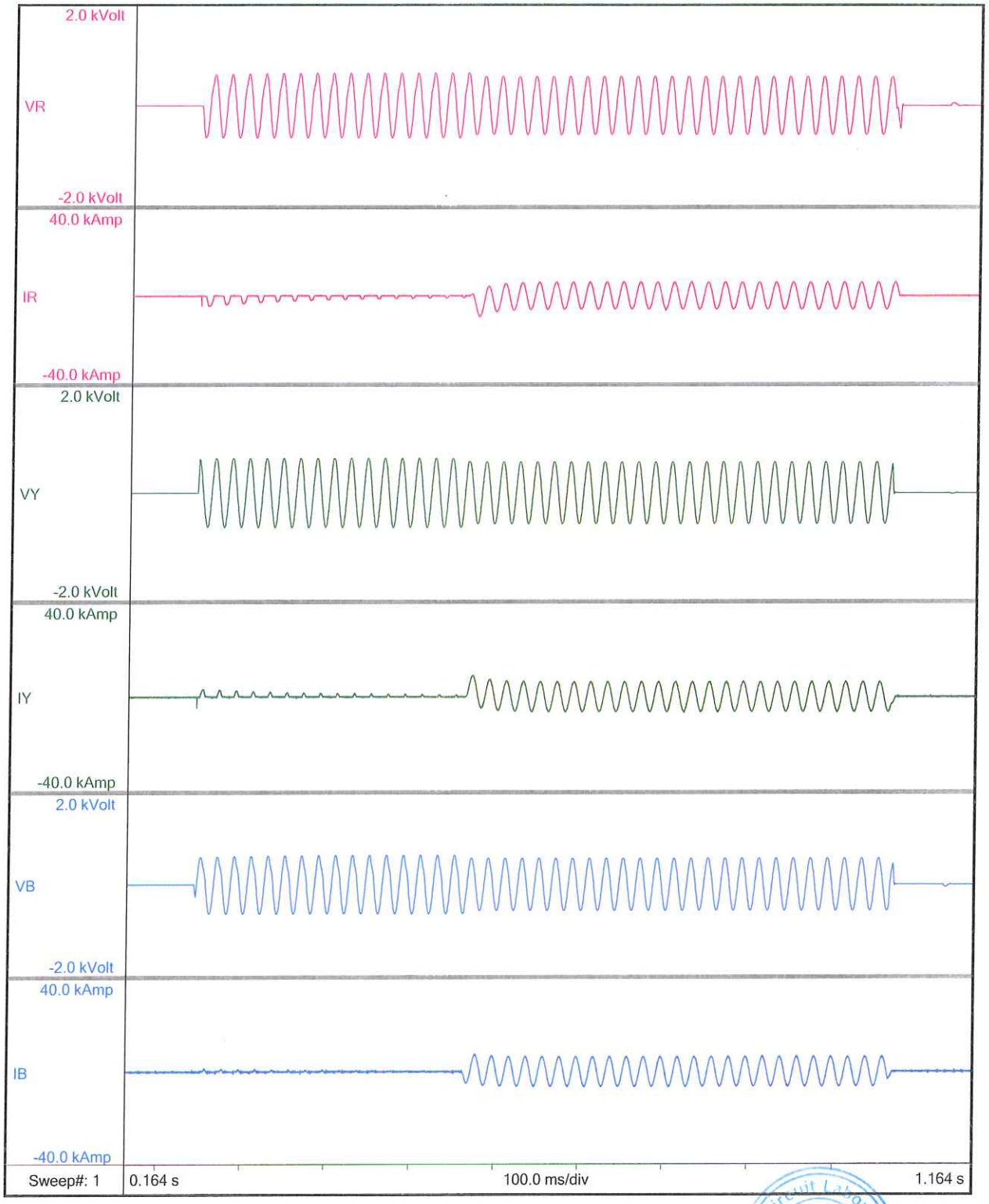
TEST REPORT NO.: RP-1920-019523 SHEET 17 OF 21
DATE: 24/08/2019



OSCILLOGRAM NO. : 0486/08

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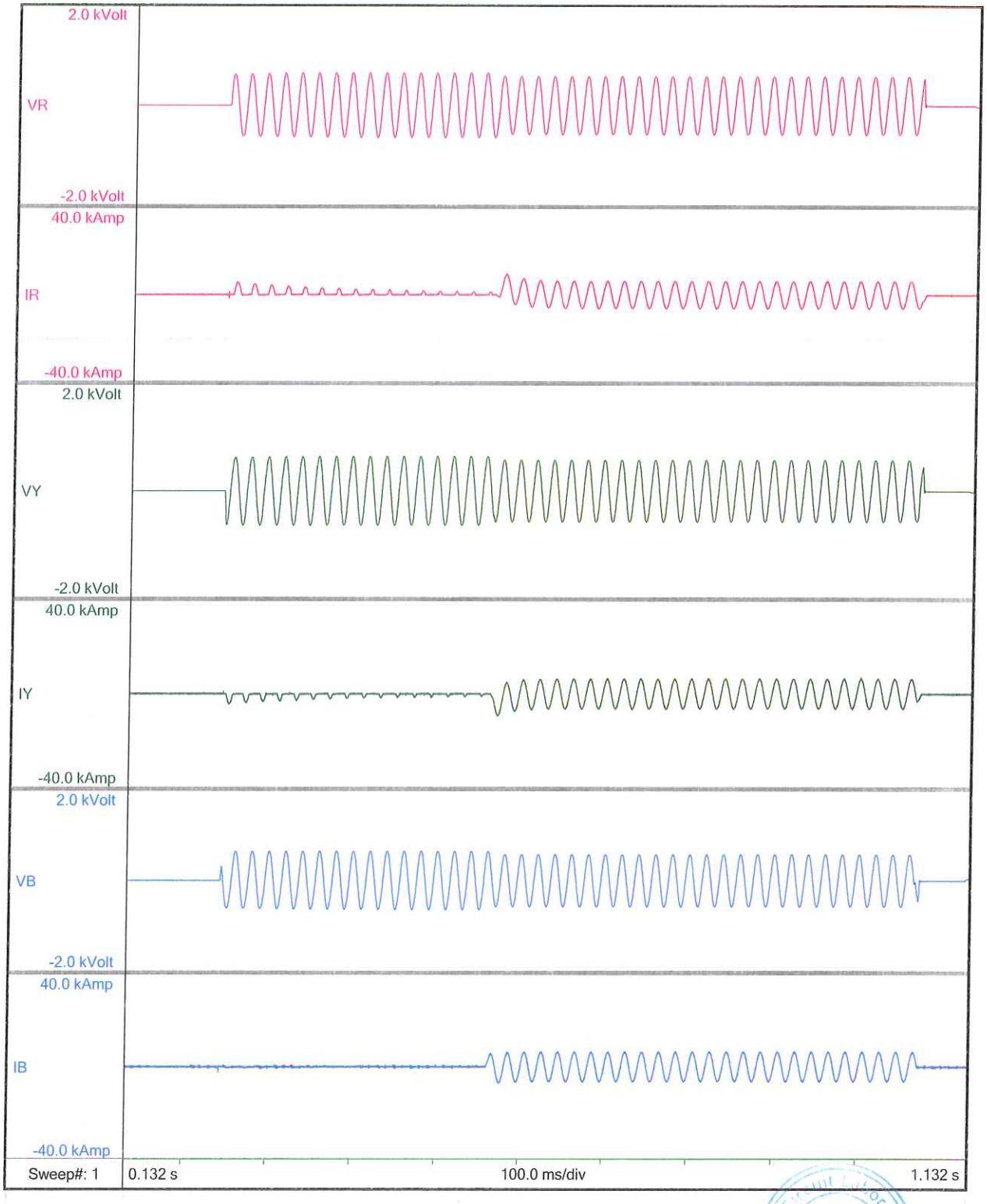
TEST REPORT NO.: RP-1920-019523 SHEET 18 OF 21
DATE: 24/08/2019



OSCILLOGRAM NO. : 0486/09

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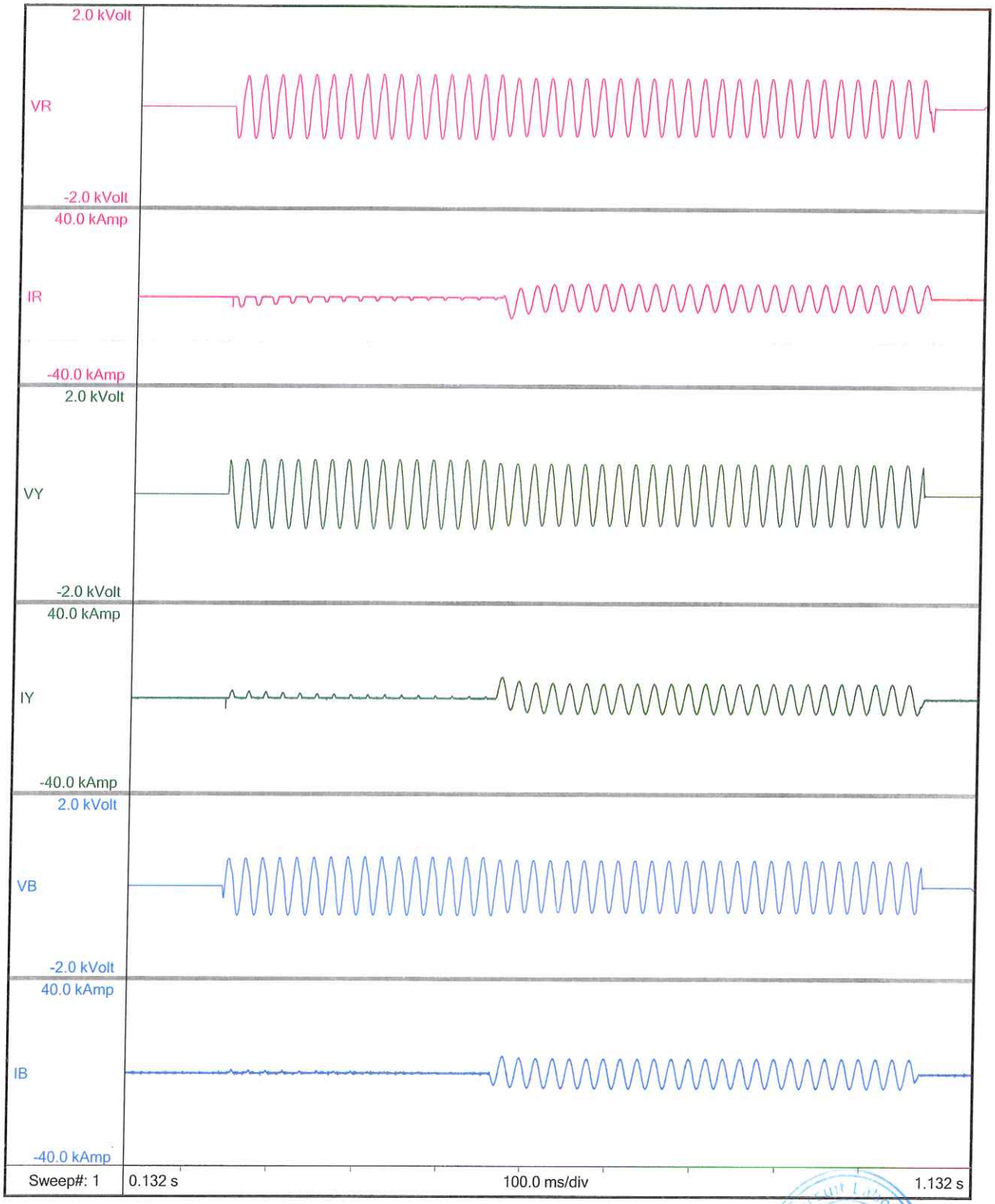
DATE: 24/08/2019



OSCILLOGRAM NO. : 0486/10

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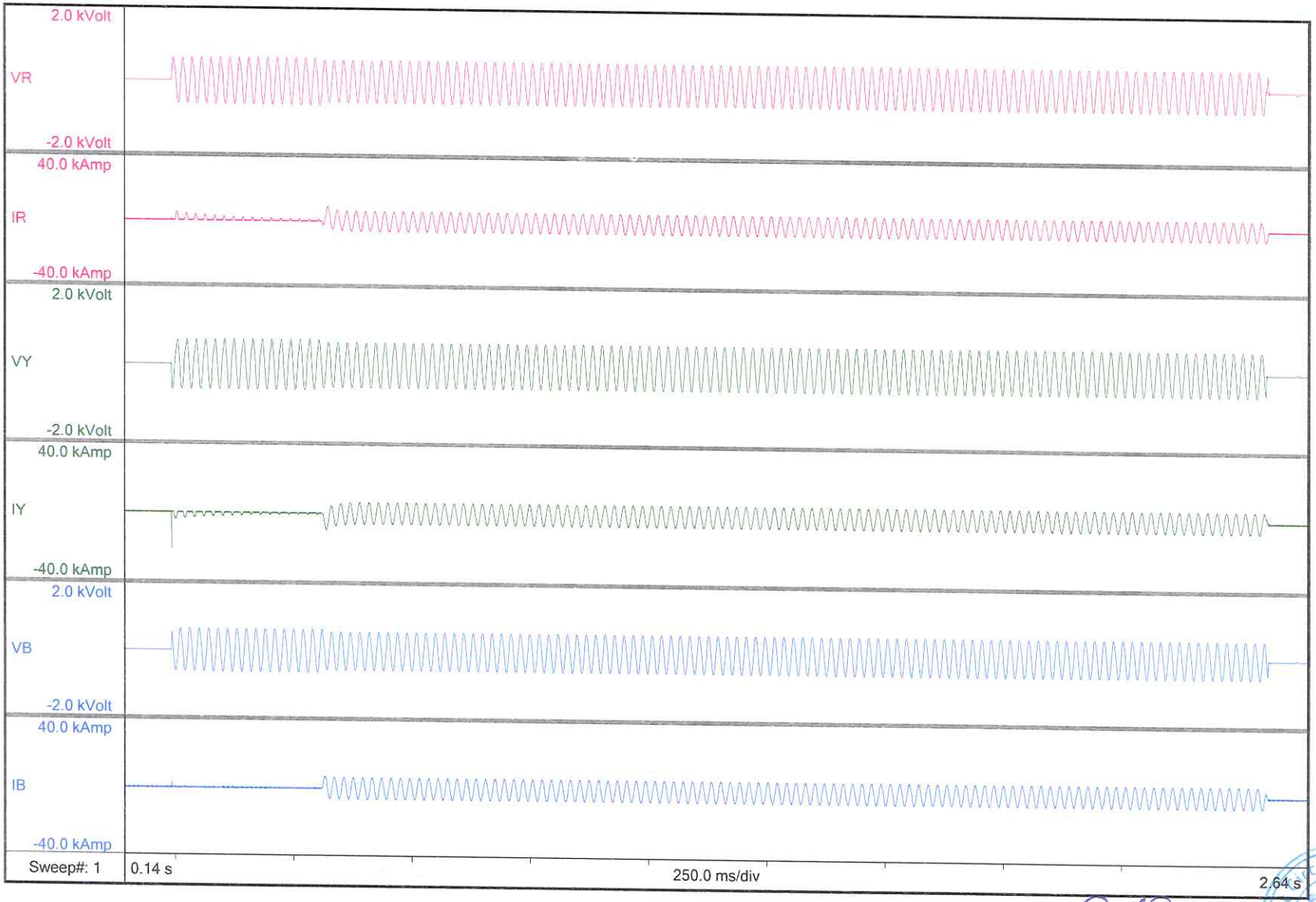
TC 2822159

TC 2822160

ULR-TC538919000026095F
TEST REPORT NO.: RP-1920-019523
DATE: 24/08/2019



OSCILLOGRAM NO.:0486/11

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ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
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TEST REPORT NO.: RP-1920-019523 SHEET 21 OF 21
DATE: 24/08/2019

PREPARED BY

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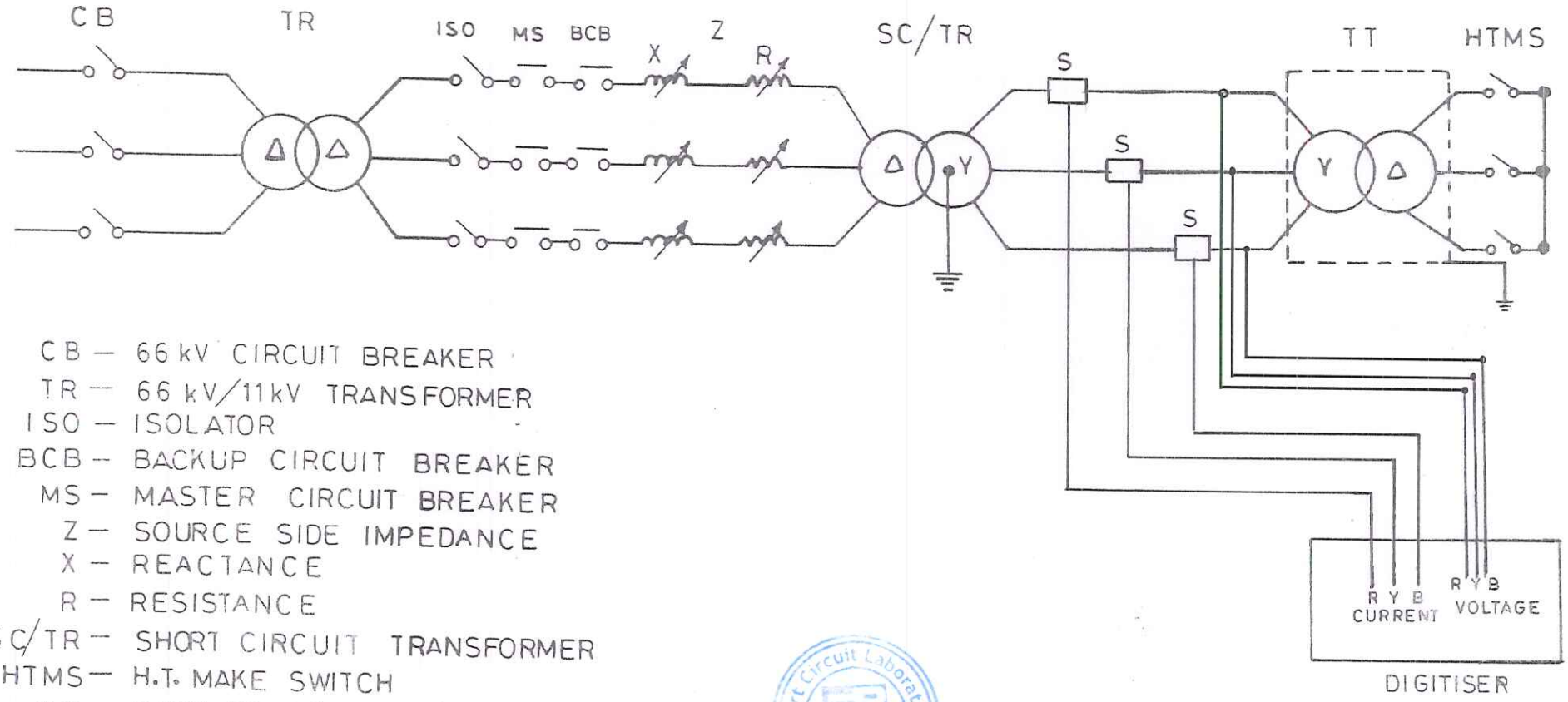
TC 2839642



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

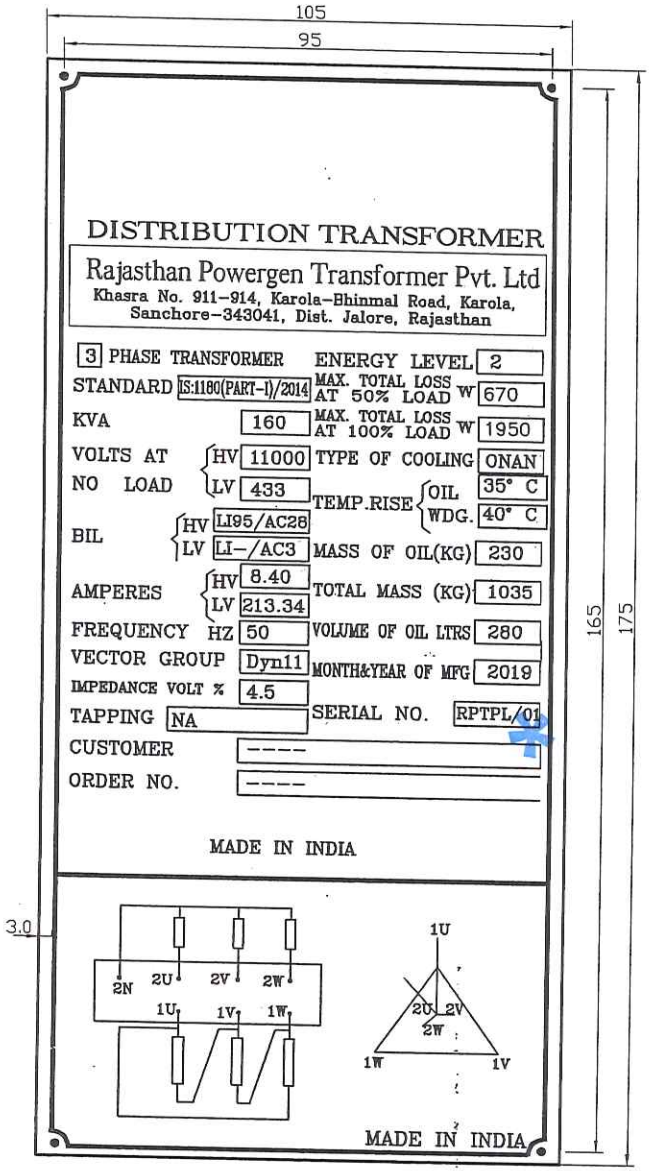
Short Circuit Laboratory ERDA Vadodara

REPORT NO.: RP-1920-019523
DATE : 24/08/2019

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION

SCHEMATIC CIRCUIT DIAGRAM

DRN. BY	CKD.	DATE	DRG. NO.
S.B.S.	A.V.B.	22-5-98	OLSC/DTC/03



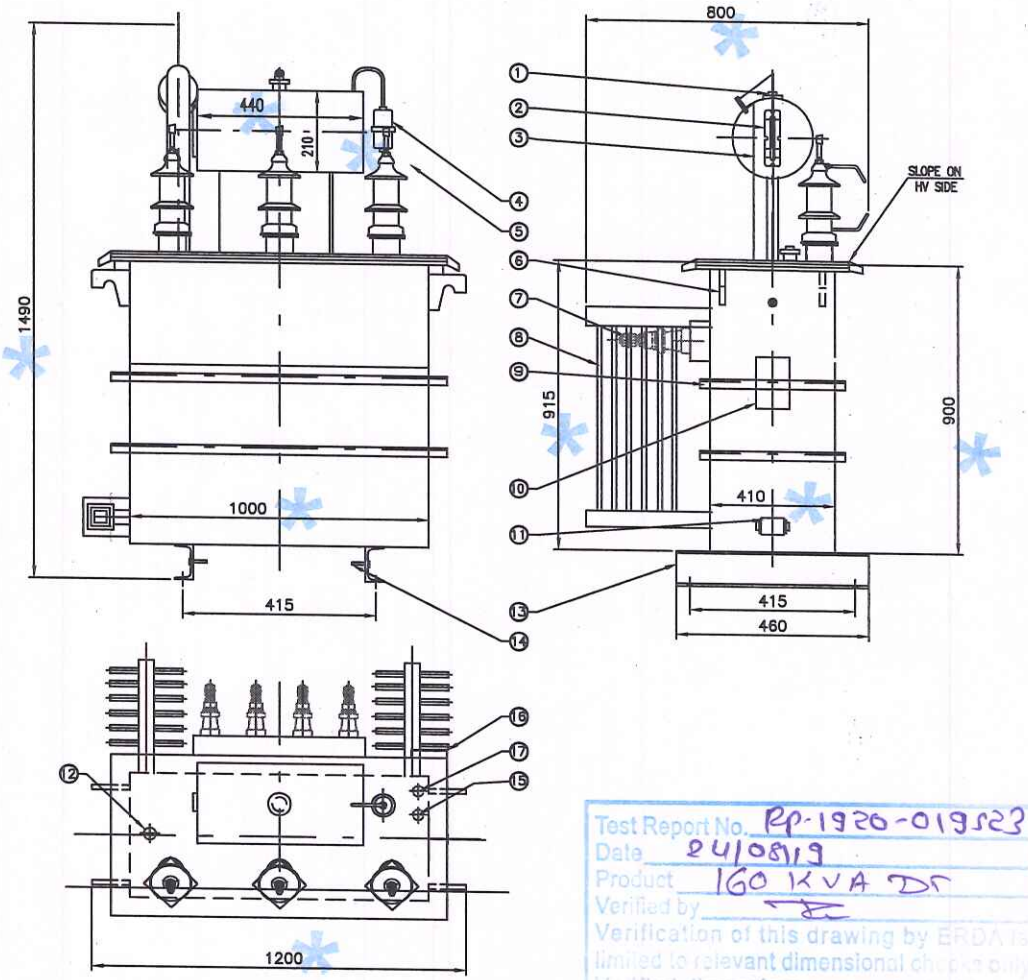
Test Report No. RP-1920-019523
Date 24/08/19
Product 160 KVA DT
Verified by
Identification of this drawing by S.C.L is to indicate relevant dimensions. All dimensions are ma...

Short Circuit Laboratory Vadodara

RAJASTHAN POWERGEN TRANSFORMER PVT. LTD
KHASRA No. 911–914, KAROLA–BHINMAL ROAD, KAROLA,
SANCHORE–343041, DIST. JALORE, RAJASTHAN

TITLE:– NAME PLATE DRAWING OF 160 KVA,11/0.433KV ALUMINIUM WOUND ENERGY EFFICIRNCY LEVEL–2 TRANSFORMER

CUSTOMER	---
T.S.No.	---
SCALE	N T S
DRG. No.	NP/160/08



WEIGHT CHART		
1.	CORE & WINDING	570 Kgs.
2.	TANK & FITTING	235 Kgs.
3.	WEIGHT OF OIL	230 Kgs.
4.	TOTAL WEIGHT	1035Kgs.
5.	VOLUME OF OIL	280 Ltrs.

MIN ELECTRICAL CLEARANCE IN AIR			
PH. TO PH.		PH. TO EARTH	
HV	255	HV	140
LV	75	LV	40

TANK THICKNESS	
SIDE WALL	4.0mm
TOP&BOTTOM	5.0mm

	S.No.	DESCRIPTIONS	QTY.
	17.	THERMOMETER POCKET	1
*	16.	IDENTITY PLATE	1
	15.	AIR RELEASE PLUG	1
	14.	EARTHING TERMINALS	2
	13.	UNDER BASE CHANNELS (100mm x 50 mm)	2
	12.	EXPLOSION VENT	1
	11.	DRAIN CUM SAMPLING VALVE 20mm	1
	10.	NAME RATING & DIAGRAM PLATE	1
	9.	STIFFNER (50 mm x 50 mm x 6 mm THICK)	2
	8.	PRESS STEEL RADIATOR (600C/CX300W)-6FINS	2
	7.	L.V. BUSHING	4
	6.	TRANSFORMER LIFTING LUGS 8 mm THICK	4
	5.	H.V. BUSHING WITH ARCKING HORN & BIMETTALIC CONNECTOR	3
*	4.	SILICAGEL BREATHER 500 Grm.	1
	3.	OIL CONSERVATOR WITH DRAIN PLUG	1
	2.	OIL LEVEL INDICATORS	1
	1.	OIL FILLING HOLE WITH CAP	1

Test Report No. RP-1920-019523
Date 24/05/19
Product 160 KVA DT
Verified by
Verification of this drawing by ERDA is limited to relevant dimensional check only. Verified dimensions are marked with ✓

Short Circuit Laboratory ERDA Vadodara

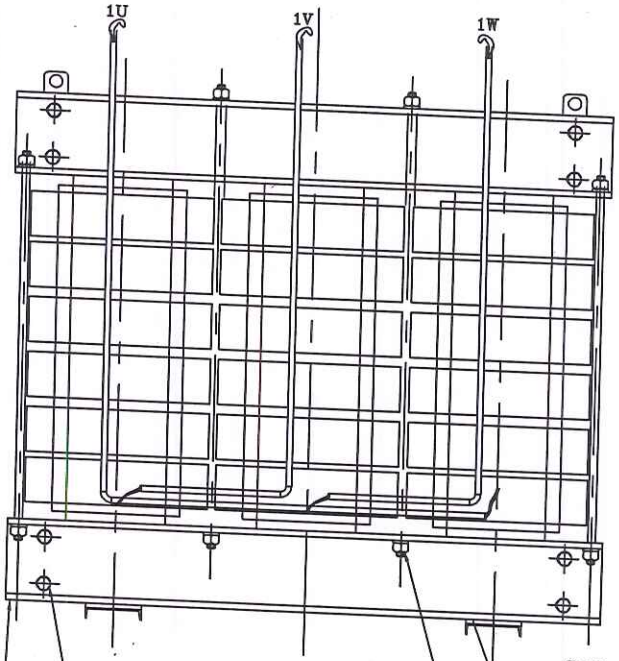
NOTES:-

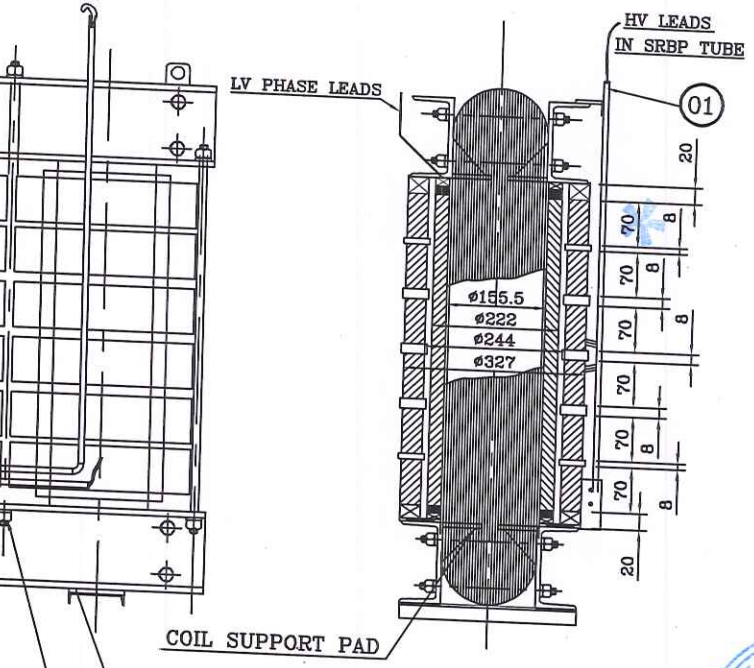
1. ALL DIMENSIONS ARE IN mm.
2. TOLERANCES ON OVERALL DIMENSION, TANK & WEIGHT ARE ±10%
3. (*) ACCESSORIES NOT PROVIDED DURING TESTING

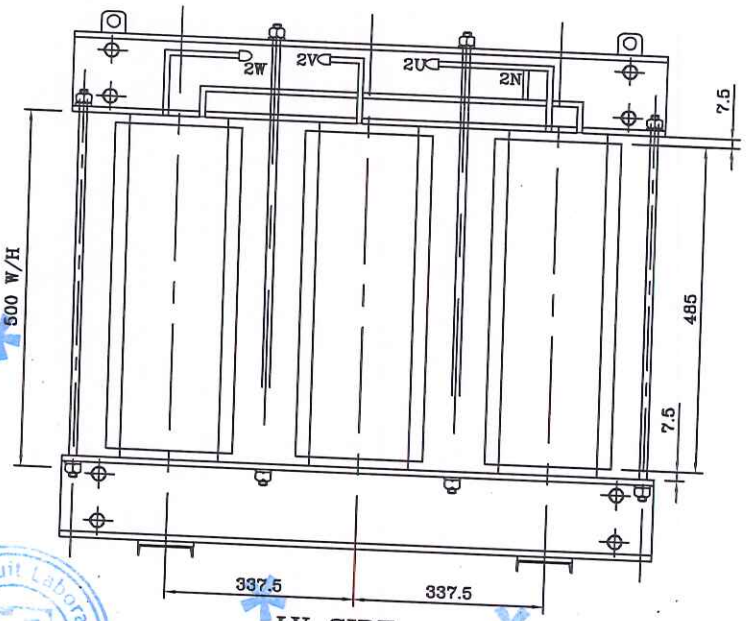
RAJASTHAN POWERGEN TRANSFORMER PVT LTD
KHASRA NO. 911-914, KAROLA-BHINMAL ROAD, KAROLA, SANCHORE-343041, Dist. JALORE, RAJASTHAN

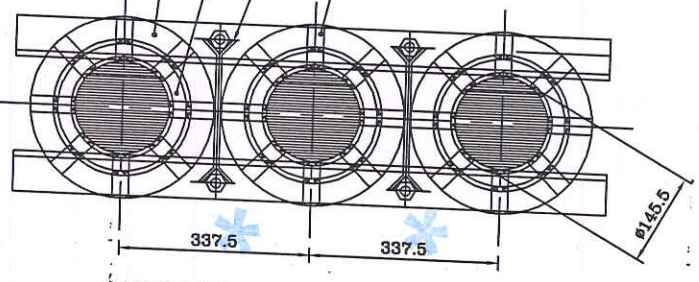
TITLE:- OUTLINE G.A. DRAWING OF 160KVA,11/0.433KV ALUMINIUM WOUND ENERGY EFFICIENCY LEVEL-2 TRANSFORMER

DRN.	VVS	CUSTOMER	---
		T.S.No.	---
		SCALE	N T S
DATE	10-07-2019	DRG. No.	RPTL-OGA-160-07









NOTES:–

1. ALL DIMENSIONS ARE IN MM .
2. LV CONDUCTOR SIZE : (8.85x5.2)mmX6 DPC ALUMINIUM STRIP
3. HV CONDUCTOR SIZE : 2.65 MM DIA.SEM ALUMINIUM WIRE

Short Circuit Laboratory Vadodara

Test Report No. RP-1920-01952
Date 24/05/19
Product 160 KVA DT
Verified by
Verification of this drawing by ERDA is limited to relevant dimensional checks only. Verified dimensions are marked with *

ITEM No.	NOMENCLATURE	QTY.
9.	M.S. FOOT CHANNEL (100X50)MM	2
8.	M.S. TIE ROD ø12 mm.	8
7.	P.B. SPACER BETWEEN SECTION	8
6.	P.B. SEPERATOR (1.5 mm X2)	2
5.	L.V. COIL/LIMB 1 No.	3
4.	H.V. COIL/LIMB 6 Nos.	18
3.	M.S. CORE BOLTS ø12 mm.	8
2.	M.S. CORE CHANNEL (125X65)	4
1.	SRBP TUBES	3

RAJASTHAN POWERGEN TRANSFORMER PVT LTD
KHASRA NO> 911-914, KAROLA-BHINMAL ROAD, KAROLA,
SANCHORE-343041, JALORE, RAJASTHAN

Title:– CORE COIL ASSEMBLY DRAWING OF 160KVA,11/0.433KV ALUMINIUM WOUND ENERGY EFFICIENCY LEVEL-2 DISTRIBUTION TRANSFORMER

DRN.	---	CUSTOMER	---
		T. NO	
APPD.	--	SCALE	N T S
DATE	---	DRG. No.	IGA/160/02