CESI

TEST REPORT

APPROVED B5023261

Client	**MF TRASFORMATORI S.r.l.**
Address of the client	Loc. S. Anna 22/24 25011 Calcinato (BS) Italia
Manufacturer	MF TRASFORMATORI S.r.l.
Tested samples/items	Non-enclosed three-phase dry-type power transformer, with encapsulated windings, for continuous duty, with cooling by air natural convection (AN): Type TReco - 630 kVA - 20 kV / 0,4 kV
Tests carried out	Measurement of winding resistance Measurement of no-load loss and current Measurement of short-circuit impedance and load loss
Standards/Specifications	IEC 60076-11 {Ed.1.0} (2004-05)

Tests date **from** November 09, 2015 **to** November 09, 2015

The results reported in this document relate only to the tested samples/items.

No. of pages	12	**No. of pages annexed**	--
Issue date	November 09, 2015		
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Verified	PSV - Vidori Mauro, PMV - Magistris Paolo B5023261 2158654 VER B5023261 2158660 VER		
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N. R.E.A. 429222

Tests witnessed by

Mr. Morelli MF TRASFORMATORI S.r.l.

Identification of the object not requested

Revision history

Revision No.	Date	List of modifications
0	09/11/2015	First issue

Only for laboratory requirement, in order to reproduce the test conditions, all the laboratory data are contained in the document marked: ---

The measurement uncertainties stated in this Test Report have been determined in accordance with the current Publication EA-4/02.
They are expressed as expanded uncertainty obtained multiplying the standard uncertainty by a coverage factor k = 2, normally corresponding to a confidence level of about 95 %.(CESI procedure B3008625)

Voltage a.c.	$\leq \pm 3{,}0$ %
Current a.c.	$\leq \pm 3{,}0$ %
Resistance d.c.	$\leq \pm 0{,}50$ %
Temperature (with TC type T)	$\leq \pm 2{,}0$ °C
Transformer voltage ratio	$\leq \pm 0{,}25$ %
Time	$\leq \pm 2{,}0$ s

Laboratory information

Receipt date of the sample

Test location CESI – Via Rubattino 54 – Milan

CESI testing team Mr. Garanzini
Mr. Carboni

Test laboratory MP3 / P120

Activity code n. order 0070003707

Rated characteristics of the tested object assigned by the Client

Dry-type power transformer	
Manufacturer	**MF TRASFORMATORI S.r.l.**
Type	TReco
Manufacturer's serial number	191015/1
Year of manufacturing	2015
Number of phases	3
Rated voltage of the high-voltage winding (primary winding)	20 kV ± 2 x 2,5 % kV
Rated voltage of the low-voltage winding (secondary winding)	415 V
Rated voltage ratio	20 kV / 0,415 kV
Rated frequency	50 Hz
Rated power	630 kVA
Rated current of the high-voltage winding (primary winding)	18,2 A
Rated current of the low-voltage winding (secondary winding)	876,5 A
Short-circuit impedance	6,0 %
Connection symbol	Dyn11
Cooling method	AN
No load loss	≤ 1100 W
Load loss	≤ 7600 W
Total mass transformer	1865 kg

Characteristics of the windings	
Rated insulation levels	LI 125 AC 50 / AC 3
Insulation class	F / F
Type of construction	with circular concentric coils
High-voltage winding conductor	aluminum strip
Low-voltage winding conductor	metal foil (aluminum)
Maximum temperature rise for 40°C ambiente temperature	100 K / 100 K

Name and signature of Client's witness:

Photo no.	1

Photo no.	2


MF Trasformatori srl
Calcinato, Brescia
Italy, Tel. 030/9636596
EN 60076-11
UE 548/2014
TRASFORMATORE A SECCO INGLOBATO IN RESINA
630 kVA N° 191015 / 1 Anno 2015 Raffr. AN N° fasi 03
50 Hz Vcc 6 % Gruppo Dyn11 Classe isolamento term. F
Sovratemperatura 100 K
Pos. ALTA TENSIONE
+ + 21000 V
+ 20500 V
0 20000 V
- 19500 V
- - 19000 V
18.2 A
Livello isolamento alta tensione 24 - 50 - 125 kV
BASSA TENSIONE
415 V
876.5 A
Livello isolamento bassa tensione 1.1 - 3 kV
Perdite a vuoto a 100% Vn ≤ 1100 W
Perdite a carico a 120°C ≤ 7600 W
PEI a 120°C %
Potenza riferimento PEI kVA
Pcu (sist. raffr. a vuoto) W
Materiale avvolgimenti Al / Al
Peso avvolgimenti 310 kg
Modello trasformatore TReco
Massa trasformatore 1865 kg
Massa box di protezione kg
Grado di protezione IP00
Classe ambientale: E2
Classe climatica: C2
Classe comportamento al fuoco: F1

Photo no.	3

Measurement of winding resistance

Measured values
The measurement were performed using winding analyser TETTEX 2293, after the transformer without excitation, for a time higher than three hours.

Date: November 09, 2015

Tap-changer position	High-voltage winding resistance measured between terminals			ambient	Low-voltage winding resistance measured between terminals			ambient
	U-V	V-W	W-U	temperature	u-v	v-w	w-u	temperature
-	Ω	Ω	Ω	°C	mΩ	mΩ	mΩ	°C
0	7,293	7,288	7,299	19,9	1,164	1,163	1,172	19,9

Calculated values *(by resistance measured between terminals)*

Tap-changer position	Phase resistance (average value) of the high-voltage winding		of the low-voltage winding	
	at ambient temperature	at 120 °C	at ambient temperature	at 120°C
-	Ω	Ω	mΩ	mΩ
0	10,94	15,41	0,5830	0,8213

Photo no. 4

Photo no. 5

Measurement of winding resistance

Measurement of no-load loss and current

Measured values

The measurement were performed applying voltage values close to the rated voltage (at rated frequency) to the low-voltage winding and the high-voltage winding open.

Date: November 09, 2015

Measurement effected	V_O	P_O	I_O
No.	V	W	A
1	422,5	1111,5	5,140
2	419,8	1080,1	4,616
3	416,1	1043,4	4,099
4	414,7	1031,9	3,968
5	410,3	992,3	3,525

Calculated values

The following values were obtained by interpolation of the measured values.

No-load loss P_O at rated voltage U_r	No-load current I_O at rated voltage U_r	
W	A	%
1034	3,99	**0,46**

Photo no. 6

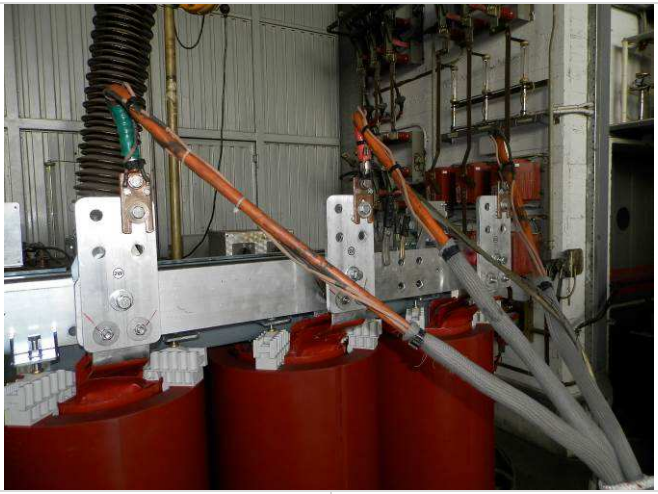
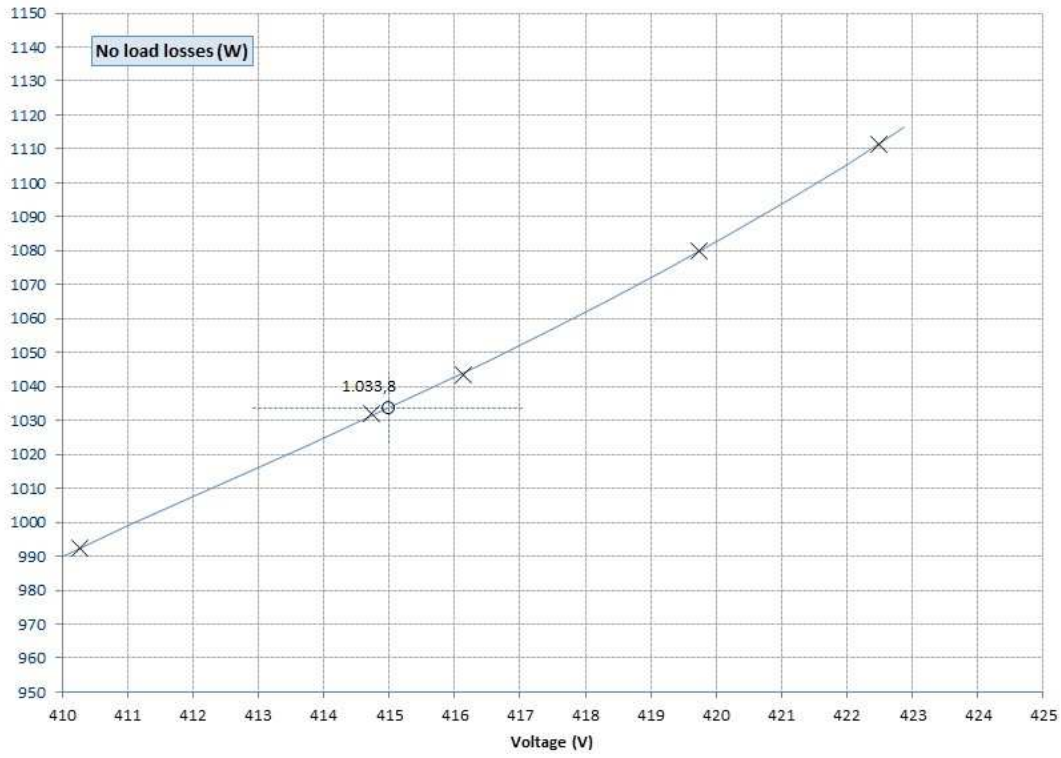
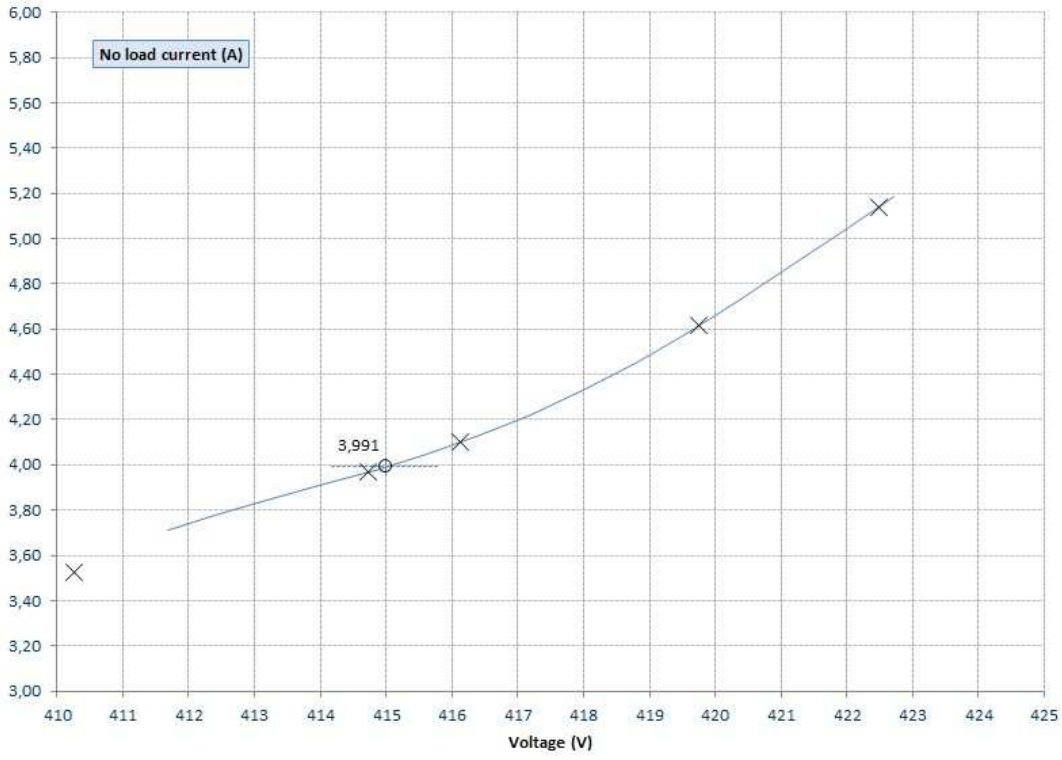


Photo no. 7

Measurement of no-load loss



interpolation of the no-load losses measured values



interpolation of the no-load current measured values

Measurement of short-circuit impedance and load loss

Measured values
The measurement were performed supplying the high-voltage winding at current values close to the rated current (at rated frequency) and the low-voltage winding short-circuited.

Date: November 09, 2015

Tap-changer position	V_{SC} (average value)	I_{SC} (average value)	P_{SC} (average value)	Ambient Temperature
-	V	A	W	°C
0	1076	16,23	4401	20,0
	1075	16,22	4402	
	1075	16,22	4399	

Calculated values (at rated current)

Tap-changer position	$R_{SC}I_r$ at 120°C	$X_{SC}I_r$ at 120°C	$Z_{SC}I_r$ at 120°C	Load loss - P_{SC} at 120°C
-	%	%	%	W
0	1,170	5,964	**6,08**	**7368**

Photo no. 8

Photo no. 9

Measurement of short-circuit impedance and load loss

Copper bar (1000x10 mm) short-circuit during measurement of short-circuit impedance and load loss

Laboratory information

Test laboratory: P118 / MP3

Characteristics of supply circuit

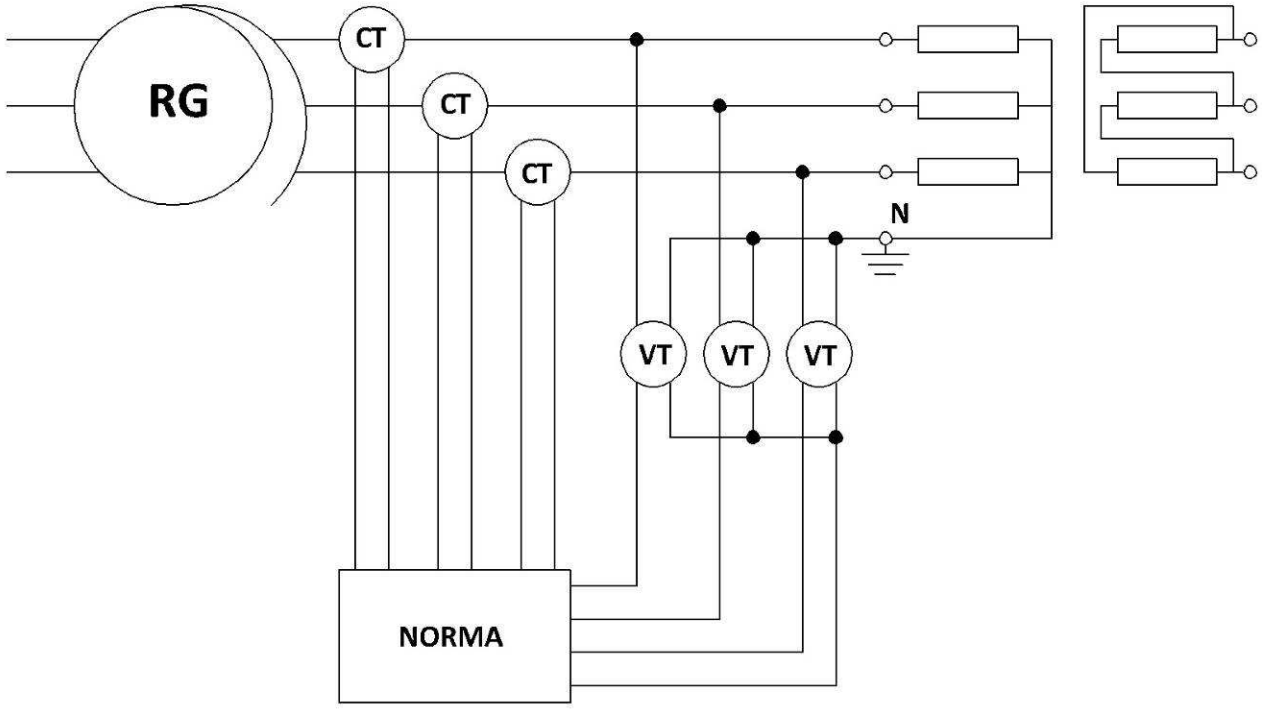
Test	Regulator		Alternator		Transformer	
	type	diagram	type	diagram	type	ratio
routine test	RG3	Y / Ys	-	-	-	-

characteristics of measuring instrumentation

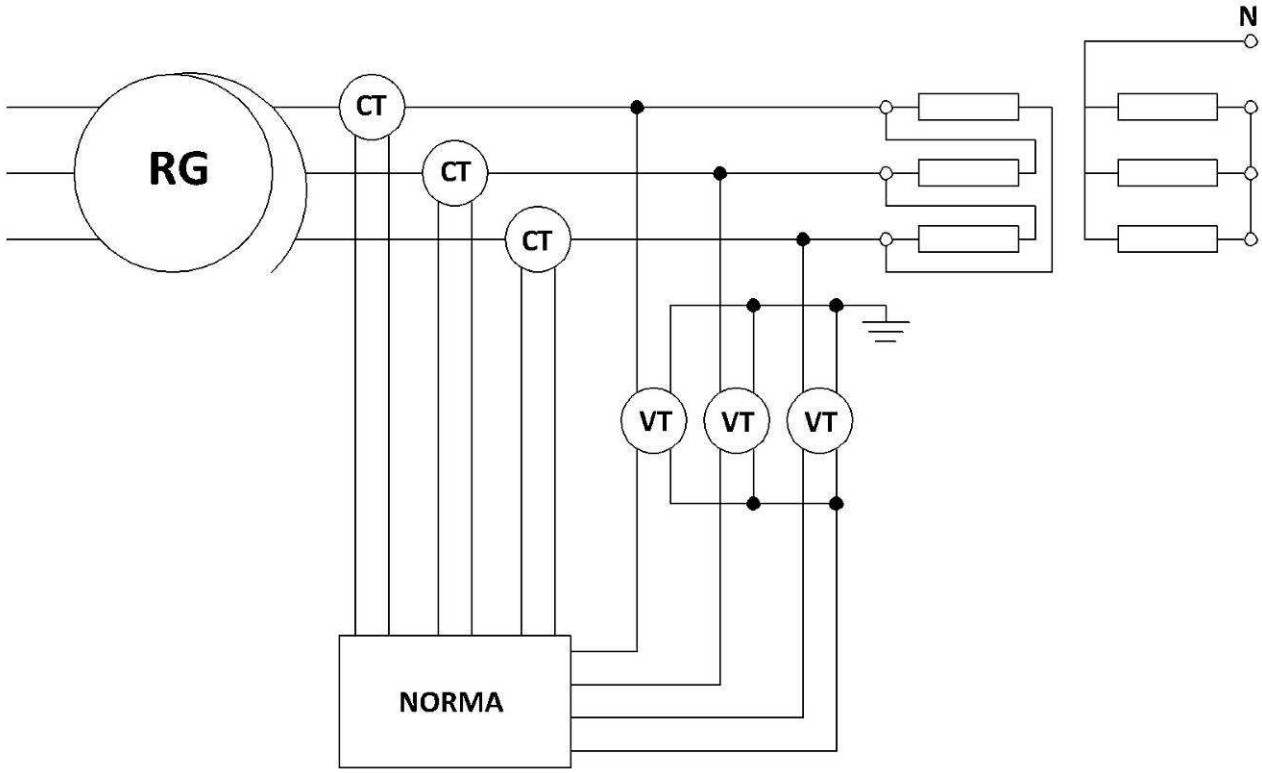
measure	*instrument*	*CESI n°*	*Calibration Report*	*Data Acq. Syst*
Data Acq. Syst	NORMA D5255 T	014002	B5001731	-
Data Acq. Syst	HP3497A (1)	006462	B4014315	-
Data Acq. Syst	Yokogawa DL850	057031	B5007717	-
Data Acq. Syst	NORMA D5255 T(2)	011579	B5001728	-
AC current *(routine and temperature-rise)*	CT *(10-30-100/5)*	013001 013002 013003	B5020128 B5020128 B5020128	NORMA D5255 T
	CT *(0,5-1-3/5)*	013004 013005 013006	B5021853 B5021853 B5021853	
AC voltage *(routine and temperature-rise)*	VT	009440 009441 009442	B0030011 B0030010 B0030008	NORMA D5255 T
AC voltage *(sound level)*	-	-	-	NORMA D5255 T(2)-
Resistance / ratio	winding analyser 2293	-	B4016087	Resistance / ratio
temperature	-	-	-	HP3497A (1)
Dielectric test	VT	000262 000263 013155	B0030007 B0030006 B1010409	-
Determination of sound levels	main frame + microphones	56443…56449	B2040049	-

Measurement of temperatures:
The copper-constantan thermocouples used for measuring the temperatures were previously checked in accordance with CESI procedure NOA A8029278.

Measuring software: SAD P120	Software release: 1.1



Measurement of no-load loss and current



Measurement of short-circuit impedance and load loss