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Enterprise No.:
NO 939 350 675 MVA

TEST REPORT

TITLE

Dielectric Test of Booster Transformer

TEST CONDUCTED BY (AUTHOR(S))

Horst Förster *Hof*
Rolf Hegerberg

/ajf

CLIENT(S)

Møre Trafo

LR NO.

LR F2416

DATE

2006-03-10

CLIENT'S REF.

Kårstein Longva

ELECTRONIC FILE CODE

060301rh14392

RESPONSIBLE

Laboratory Manager Rolf Hegerberg *Rolf Hegerberg*

PROJECT NO.

14X30013

NUMBER OF PAGES

10

TEST LOCATION

High voltage laboratory, SINTEF Energy Research

TEST OBJECT

Single-phase booster transformer; 95kVA; 119/119 V; 2-winding; 16 2/3 Hz
Type OEK 10180; Ser.No 0600378

TEST OBJECT RECEIVED

2006-02-27

TEST PROGRAM

Lightning impulse voltage test at 170 kV 1,2/50 µsec according to client's
specification.

DATE OF TEST

2006-02-28

SUMMARY

The test object fulfilled the requirements according to the client's specification. No flashover or
puncture occurred.

The test results relate only to the items tested

The report is the client's property and cannot be given to a third party without the client's written consent.
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KEYWORDS

SELECTED BY
AUTHOR(S)

IEC 60076-3

Dielectric testing

Booster transformer

Lightning impulse

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1 TEST OBJECT

The test object was a single-phase booster transformer; 95kVA; 119/119 V; 2-winding; 16 2/3 Hz
Type: OEK 10180, Ser.No: 0600378

2 TEST PROGRAM

Standard lightning impulses was applied to each of the line terminals (A and B) while the other terminal were earthed through a low impedance of 343 Ω in order to be able to produce an acceptable waveshape of the lightning impulse. IEC publication 60722 (1982) recommends an impedance to ground to keep the overshoot of the impulse of less than 10 %. With the chosen impedance, this overshoot was limited to 14%, while the rise-time of the impulse was kept within the required range of $1,2 \pm 30 \% / 50 \pm 20 \%$. The low voltage terminals were solidly earthed during the tests.

An impulse of 50% of the rated LI withstand level were applied to establish a reference for the voltage and current recordings. Subsequently three impulses of rated LI level of 170 kV was applied to each of the terminals.

The impulse voltage and the tank current was recorded for each impulse.

The tests were witnessed by:

Kårstein Longva

Arnulf Karlsvik

Terje Værnes.

all representing Møre Trafo.

3 RESULTS

The results are shown in table 1.

Rec.No	Terminal	Peak voltage (kV)	Rise/fall time (μ sec)	Comment
1 *	A	85,0	1,15/42,9	50 %
2	A	169,3	1,17/43,8	
3 *	A	169,3	1,17/43,9	
4	A	169,5	1,17/43,9	
8 *	B	85,2	1,13/42,5	50 %
9 *	B	169,6	1,13/43,3	
10	B	169,5	1,13/43,4	
11	B	169,6	1,13/43,6	

*) Oscillogram included in the report. All oscillograms are stored in the laboratory's archives and are available on request.

A comparison of records 8 and 9 are shown in figure 1. In these oscillograms, the curve marked Difference is computed as the difference between records 8 and 9 after scaling such that the peak values overlap. Both voltage and current oscillograms are compared, and apart from some high frequency oscillations at the start of the current trace, caused by trigger jitter or sampling errors, the oscillograms do not show any significant differences between voltage and current transients recorded at reduced voltage and full voltage

No breakdown or flashover occurred during the tests.

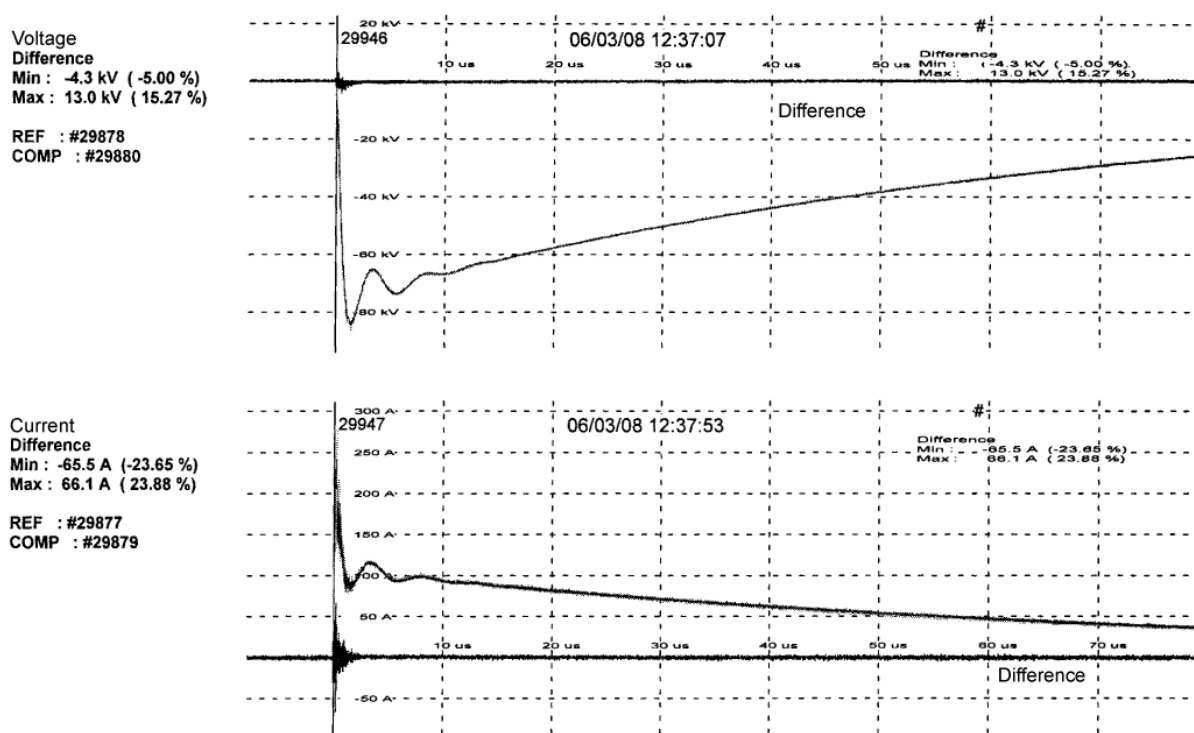
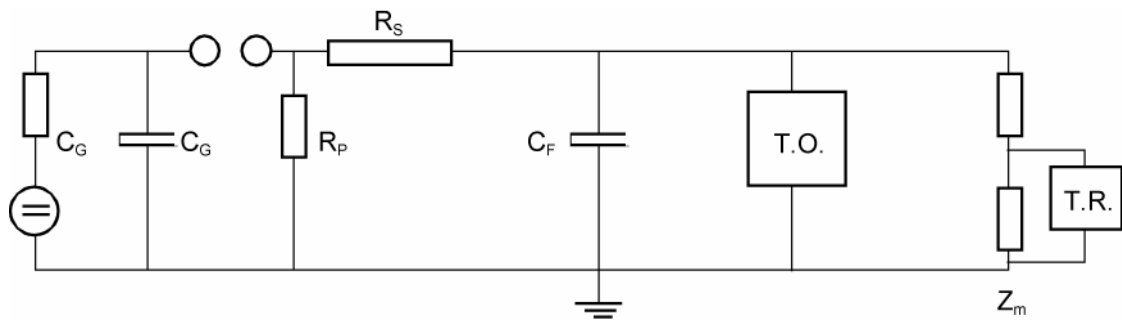


Figure 1: Comparison of voltage and current oscillograms No 8 and 9.

4 TEST CIRCUIT



$$R_S = 252 \, \Omega$$

$$R_P = 760 \, \Omega$$

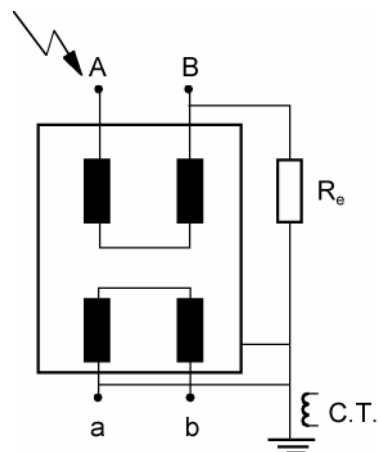
$$C_F = 0 \text{ (No front capacitor used)}$$

Z_M : Measuring impedance (Instr.No EFI 016-0321/0335)

T.R.: Transient recorder (Instr. No. SEfAS G05-0087)

I.G. : Impulse generator (Instr No EFI B03-0247)

T.O.: Test object (see below)



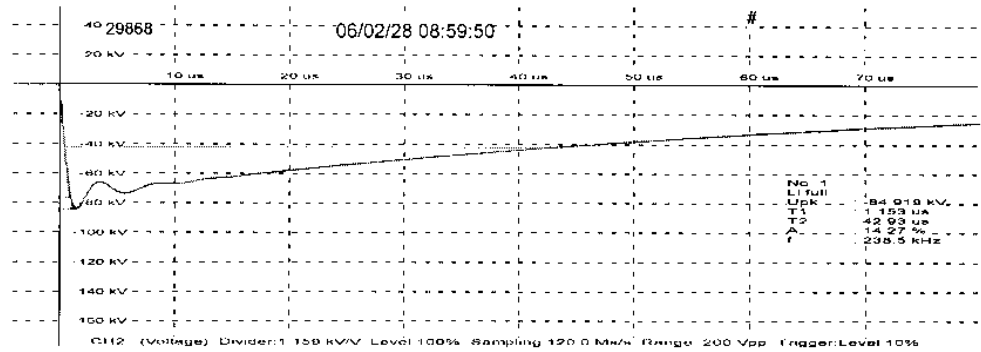
$$R_e = 343 \, \Omega$$

C.T.: Current transformer (Instr. No EFI I04-0284)

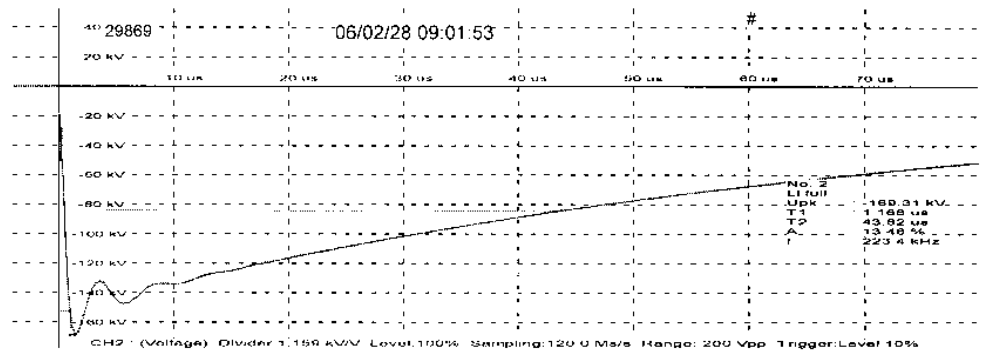
Figure 2: Test circuit and test object connections.

5 OSCILLOGRAMS

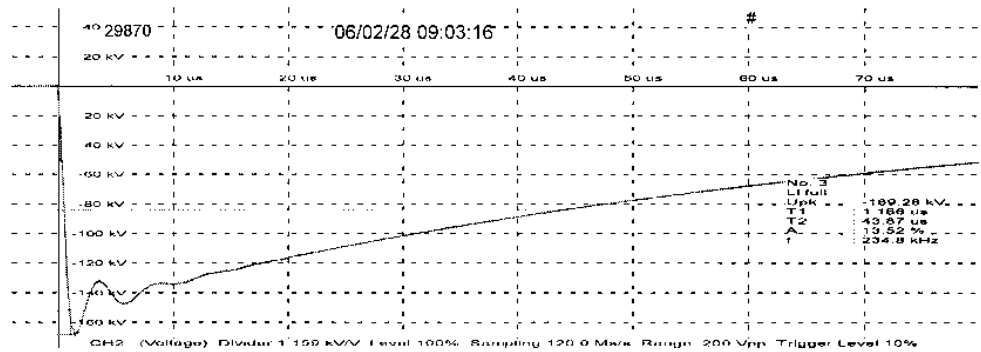
No. 1
LI full
Upk: -84.919 kV
T1 : 1.153 μ s
T2 : 42.93 μ s
A : 14.27 %
f : 238.5 kHz



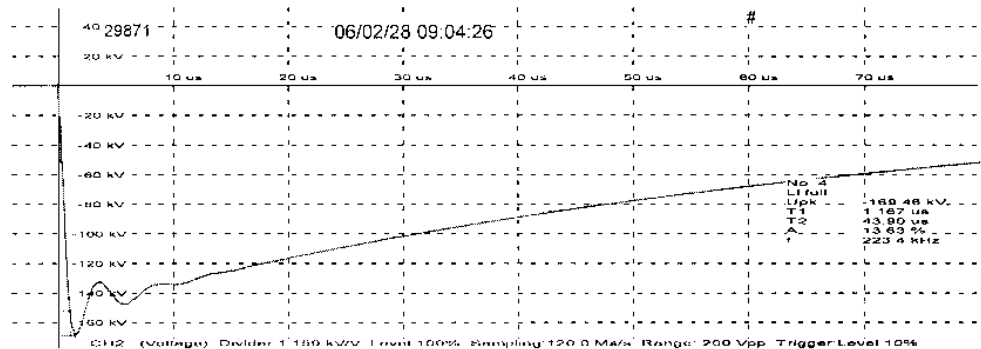
No. 2
LI full
Upk: -169.31 kV
T1 : 1.166 μ s
T2 : 43.82 μ s
A : 13.48 %
f : 223.4 kHz



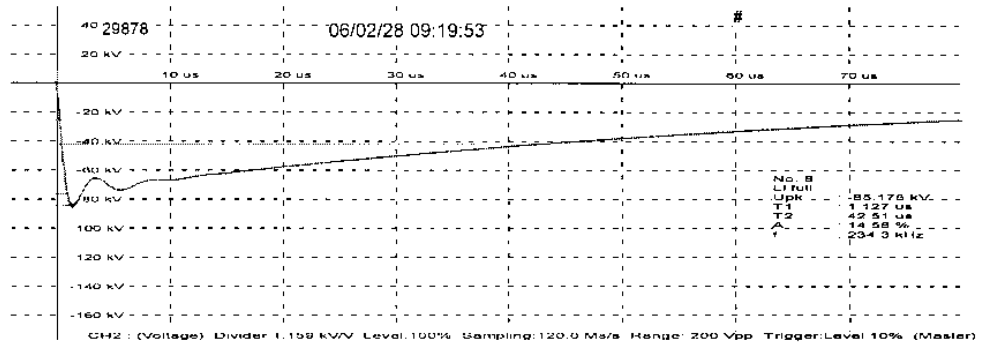
No. 3
LI full
Upk: -169.28 kV
T1 : 1.166 μ s
T2 : 43.87 μ s
A : 13.52 %
f : 234.8 kHz



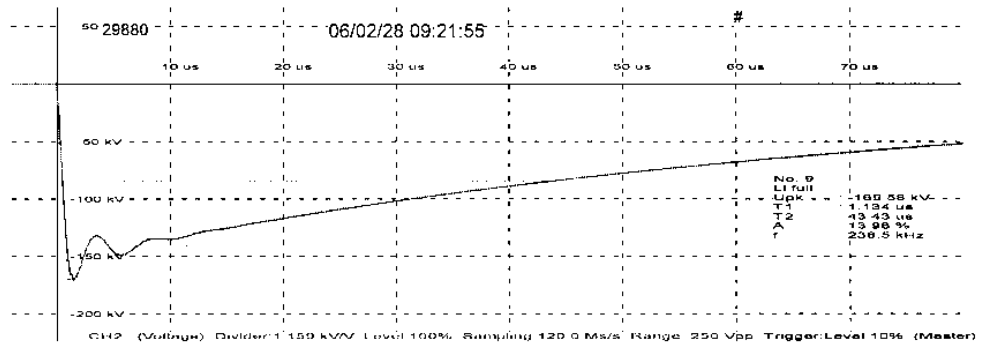
No. 4
LI full
Upk: -169.46 kV
T1 : 1.167 μ s
T2 : 43.90 μ s
A : 13.63 %
f : 223.4 kHz



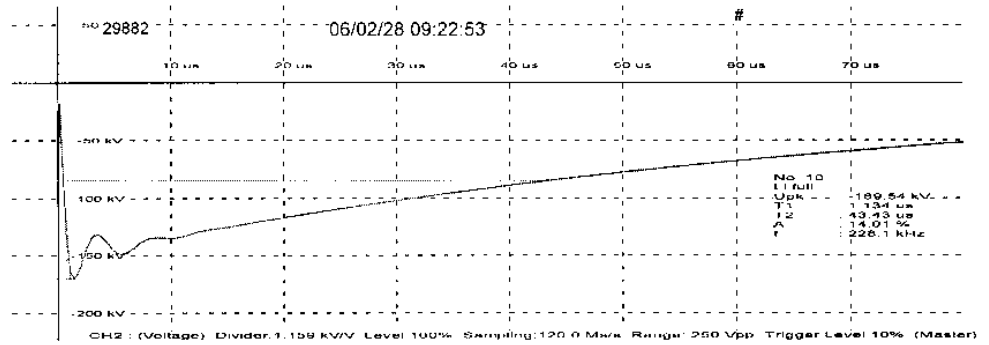
No. 8
LI full
Upk: -85.176 kV
T1 : 1.127 us
T2 : 42.51 us
A : 14.58 %
f : 234.3 kHz



No. 9
LI full
Upk: -169.58 kV
T1 : 1.134 us
T2 : 43.43 us
A : 13.96 %
f : 238.5 kHz



No. 10
LI full
Upk: -169.54 kV
T1 : 1.134 us
T2 : 43.43 us
A : 14.01 %
f : 228.1 kHz



No. 11
LI full
Upk: -169.57 kV
T1 : 1.132 us
T2 : 43.60 us
A : 14.01 %
f : 232.5 kHz

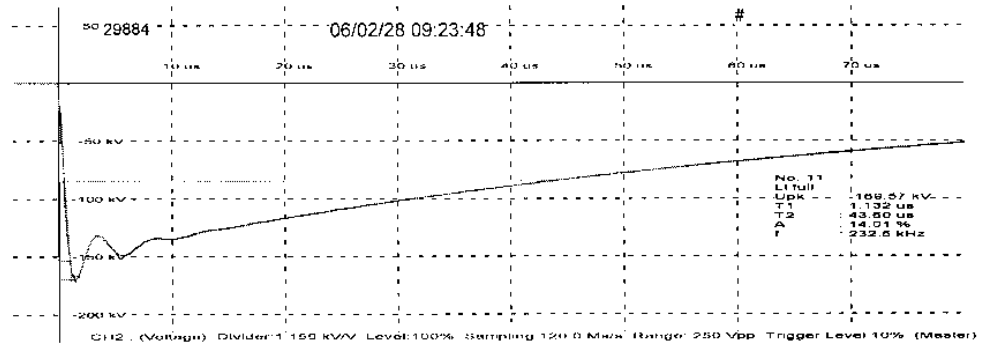


Figure 3: Example lightning impulse oscillograms.

6 RATINGS PLATE

02.03.2006

08:37:41

VD24845 BH800.123

Engelsk Skilt
Varenr. skilt :

SKILTDATA
Merking X : ☐

CENELEC

02-mar-2006
Salgsordre:

Hermetically sealed				MØRE TRAFØ AS	
TRANSFORMER				N-6230 SYKKYLVEN	
Do not open for service !				NORWAY	
				Environment	Class
				Climatic-Temp.	
				Humidity/Pollu.	
				Fire behaviour	
Prod.year: 2006		Norm. IEC60076 -1996		ISO 9001	
		IEC		CE	
Type : OEK 10180	Serial no. 0		Approved oil : Type : NYTRO 10X		
	2 - winding transformer		Environm.appr. oil		IEC296-IA,IIA
1 -phase		16,67 Hz	Duty :	Cont.	Cooling ONAN
Terminal	AB		ab		Position 1 AB
Connections					Tappings Volt
kVA	95		95		1
Volts	119 + x %		119		2
	- x %				3
Amp.	798,32		798		4
Vector group	I in0				5
zt %					6
Ro mOhm					7
Xo mOhm					Total 3388 kg
Insul. class	A 105				Oil 697 kg
Temp. class	A 105				Core total 2213 kg
Temp. rise wind.	65 Δ T				Coresheet 1340 kg
Insul. level	LI 170 AC 70				Enclosure 0 kg
Wind. material	Cu		Cu		Encl.level IP 00
Weight windings	382 kg		296		Soundpo.LwA 37 dB
Temp. rise oil	60	Oilpressure dP 0,200 bar	Ms/Cu/Al -kg : 43		Soundpr. LpA 27 dB
Total. surface m2	40	Design amb. 20 °C	Connect.diagr. KS5509		Soundint.LIA dBA

Figure 4: Ratings plate.

7 DIMENSION DRAWING

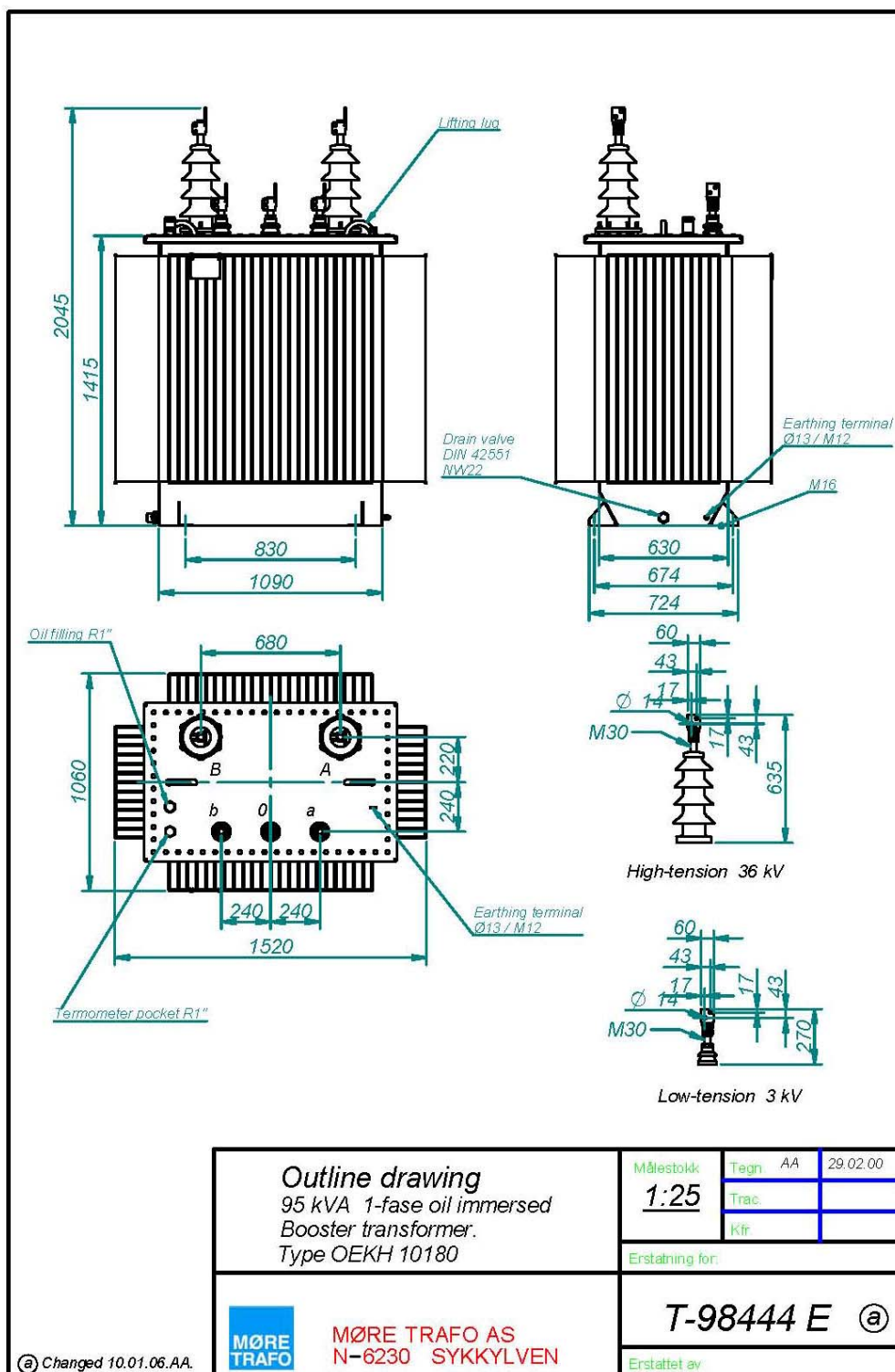


Figure 5: Dimension drawing.

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