



СПИСЪК НА ПРОВЕДЕНИТЕ ИЗПИТВАНИЯ

*Сертификат за акредитация
рег. №81ЛИ валиден до 11.12.2018 г.
издаден от ИА"БСА", съгласно
изискванията на стандарт
EN ISO/IEC 17025:2006*

- Трифазен маслен трансформатор, херметически затворен,
тип ТМ 630/20, фабричен №209926, година на производство - 2016.
- Заявител на изпитанието: “Леми Трафо” ЕАД; гр.Перник, ул. Владайско въстание №1,
заявка № 0019/18.05.2016г.
- Производител: “Леми Трафо” ЕАД; гр.Перник, ул. Владайско въстание №1.
- Технически данни:

Обозначение	ТМ630/20	
Номинална мощност (kVA)	630	
Честота (Hz)	50	
Номинално напрежение (V)	ВН	20000
	НН	400
Загуби на (W)	Празен ход	600
	Късо съединение към 75°C	6500
Напрежение на късо съединение - (%)	4	
Схема и група на свързване	Dyn5	
Регулационни отклонения на страна ВН	± 2 x 2.5%	
Изоляционен клас	ВН	24 kV (50 kV rms / 125 kV peak)
	НН	1.1kV (3kV rms / - kV peak)
Охлаждане	ONAN, казан с ребра	
Надморска височина	<1000 m	

- Дата на получаване на продукта за изпитване в лабораторията: 15.06.2016г.



6. Извършени изпитвания:

6.1. Рутинен тест:

- 6.1.1. Измерване на коефициента на трансформация и група на свързване - (IEC 60076-1:2011- cl.11.3);
- 6.1.2. Измерване на активното съпротивлението на намотките с постоянен ток - (IEC 60076-1:2011-г.11.2);
- 6.1.3. Измерване на загубите и тока на празен ход - (IEC 60076-1:2011-cl.11.5);
- 6.1.4. Измерване на загубите и напрежението на късо съединение - (IEC 60076-1:2011-cl.11.4);
- 6.1.5. Диелектрични изпитвания - (IEC 60076-3:2013)
 - 6.1.5.1. Изпитване на изолацията с напрежение, приложено от външен източник (IEC 60076-3:2013-т.10);
 - 6.1.5.2. Изпитване на изолацията с индуктирано напрежение - (IEC 60076-3:2013-т.11.2);

6.2. Типов тест:

- 6.2.1. Определяне на звуковото ниво - (IEC 60076-10:2005);

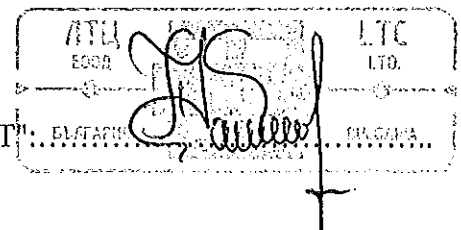
7. Период на изпитване: 16.06.2016г.

8. Резултат от изпитванията: **Продуктът „Трифазен маслен трансформатор, херметически затворен” тип ТМ 630/20, фабричен № 209926, премина успешно изпитанията.**


Резултати от изпитанията са включени в тестови протоколи: № 0024-1/16.06.2016;
№ 0024-2/16.06.2016;

9. Списъка от изпитванията съдържа 2 страници.

РЪКОВОДИТЕЛ НА "ЛТЦ-ТЕСТ"



инж. Катерина Райчева
(подпис и печат)


	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/7	
	ROUTINE TEST REPORT	Page 1	All pages 7
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TEST REPORT

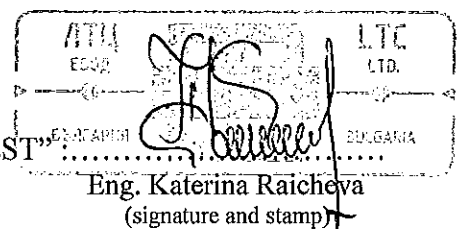
№ 0024-1/16.06.2016

*Certificate of accreditation
reg.№81JII valid until 11.12.2018
issued by Executive Agency "BAS",
According to the requirements of standard
EN ISO/IEC 17025:2006*

1. Three phase oil-immersed transformer, hermetically sealed,
TM 630/20/0.4, Dyn5, №209926, 2016r.
2. Customer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
Order 0019/18.05.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-1:2011;
IEC 60076-3:2013;
5. Date on which the product was received in test room: 15.06.2016
6. Tests performed:
 - 6.1. Measurement of voltage ratio and check of phase displacement
(IEC 60076-1:2011- cl.11.3);
 - 6.2. Measurement of winding resistance (IEC 60076-1:2011-cl.11.2);
 - 6.3. Measurement of no-load losses and current (IEC 60076-1:2011-cl.11.5);
 - 6.4. Measurement of short circuit impedance and load losses
(IEC 60076-1:2011-cl.11.4);
 - 6.5. Dielectric routine tests (IEC 60076-3:2013)
 - 6.5.1. Separate source AC withstand voltage test (IEC 60076-3:2013-cl.10);
 - 6.5.2. Induced AC withstand voltage test (IEC 60076-3:2013-cl.11.2);
7. Test date: 16.06.2016
8. Test result: The product passed the tests
9. The report contains: 7 pages



Head of "LTC-TEST":

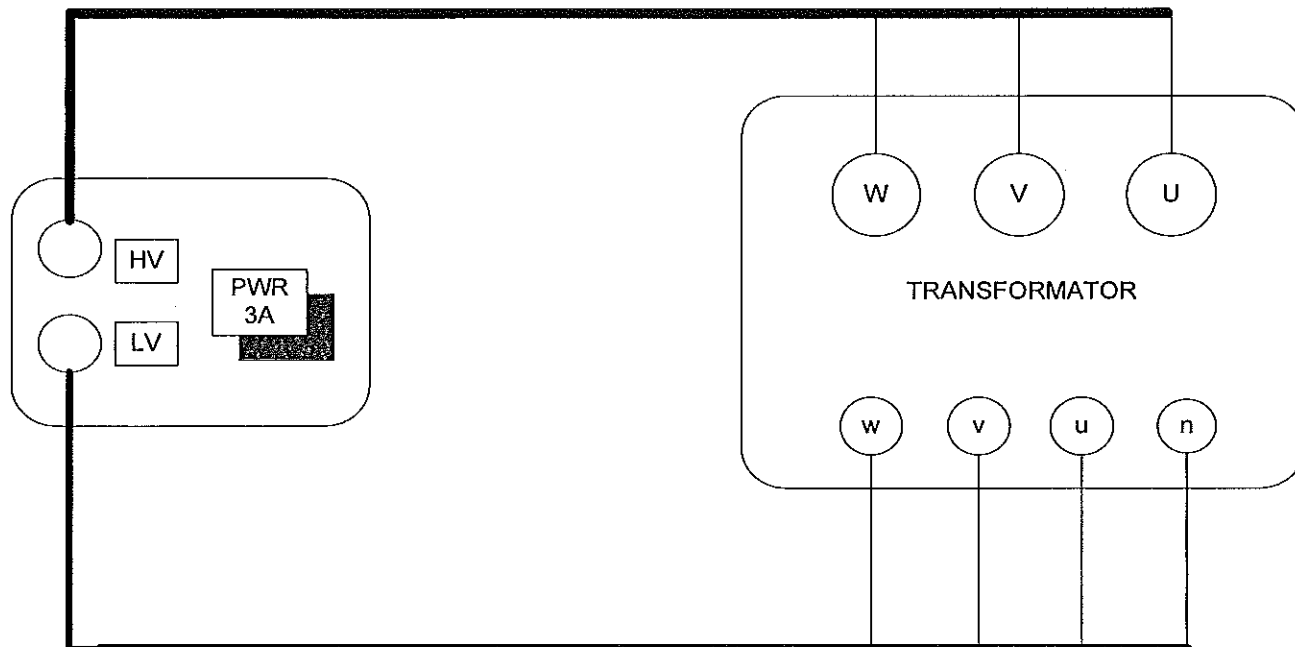


Eng. Katerina Raicheva
(signature and stamp)



10. Test results:

10.1. Measurement of voltage ratio (20000/400V) and check of phase displacement:



Tap changer position	Phase A	Transformation coefficient's error, %	Phase B	Transformation coefficient's error, %	Phase C	Transformation coefficient's error, %	Vector group
1	90,995	0,07	91	0,07	91	0,07	Dyn5
2	88,805	0,04	88,805	0,04	88,81	0,05	
3	86,66	0,07	86,665	0,07	86,665	0,07	
4	84,47	0,04	84,475	0,04	84,475	0,04	
5	82,325	0,06	82,33	0,07	82,33	0,07	

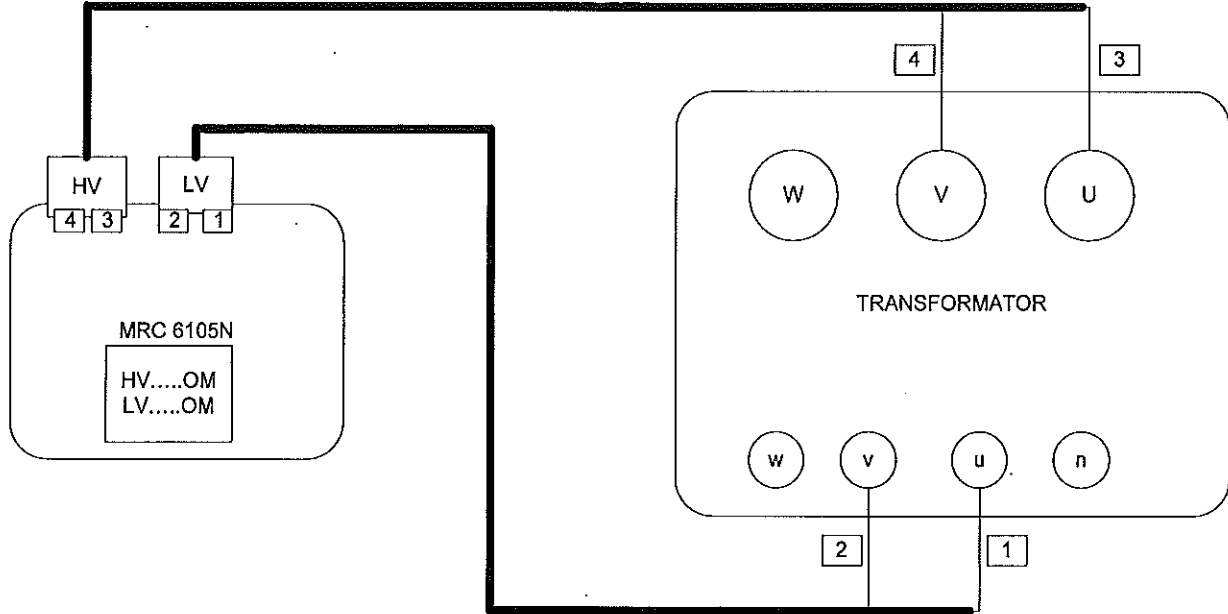
Measurements were performed with expanded uncertainty of 3% and the confidence level P = 95%.

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10.2 Measurement of winding resistance:



Tap changer position	R_{U-V}, Ω	R_{U-W}, Ω	R_{V-W}, Ω	Temperature during test 24°C	
				R_{U-V}, Ω	
1	-	-	-	R_{U-V}, Ω	0,0019484
2	-	-	-	R_{U-W}, Ω	0,001963
3	5,32	5,324	5,318	R_{V-W}, Ω	0,00193
4	-	-	-		
5	-	-	-		

Measurements were performed with expanded uncertainty 0,5% and the confidence level $P = 95\%$.

10.3 Measurement of no-load losses and current:

Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	398,33	400,72	400,88	1,7737	1,4937	1,4964	247,4	154,2	189,9

Uav. [V]	Iav. [A]	P _{0tot.} [W]	I ₀ [%]
399,98	1,58793	592	0,18

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level $P = 95\%$.



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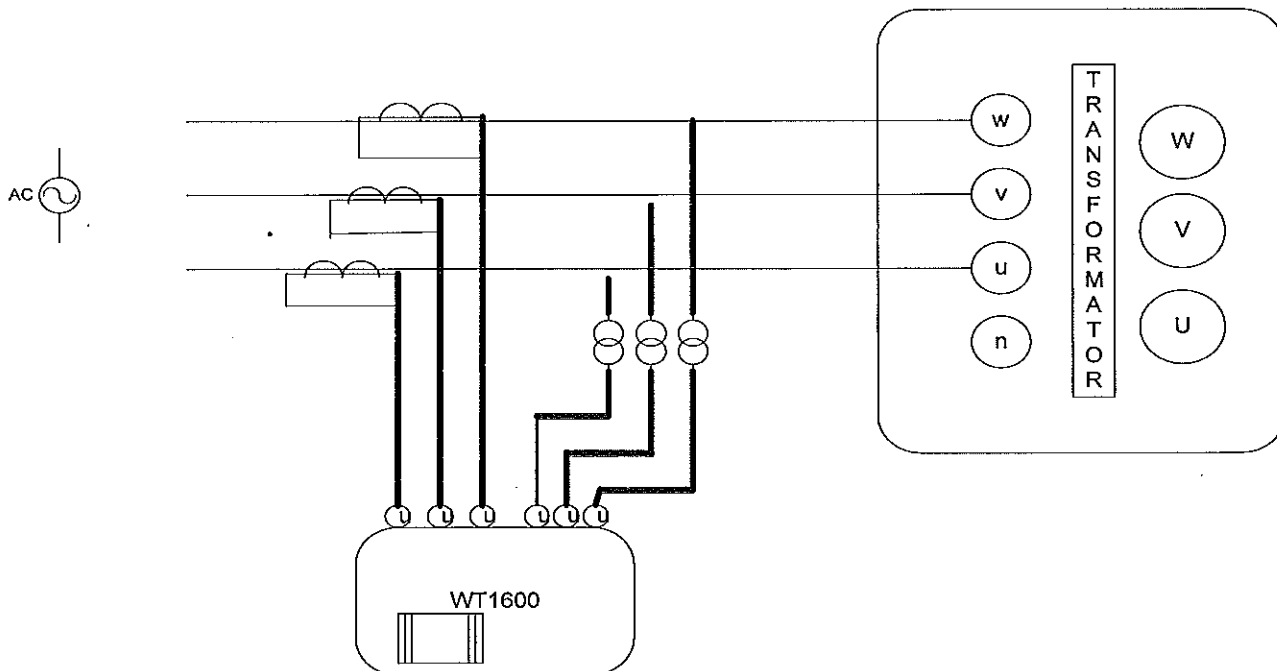
FC 5.10 - 1/7

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10.4 Measurement of short circuit impedance and load losses at temperature 24 °C:

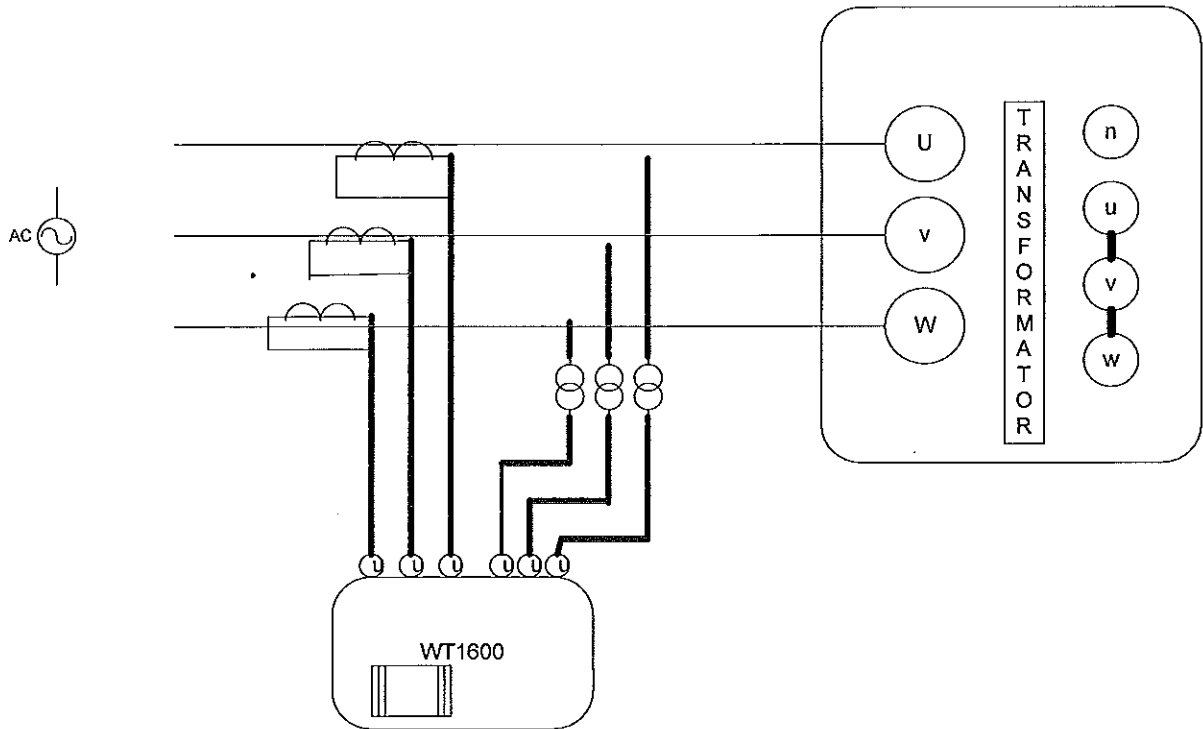
Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	431,59	431,9	431,6	9,991	10,058	10,051	547,4	529,2	549,3

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level P = 95%.

Uav. [V]	Iav. [A]	ΣP [W]	Pk ^{75°C} [W]	Uk ^{75°C} [%]
431,69	10,033	1625,9	6290	3,95

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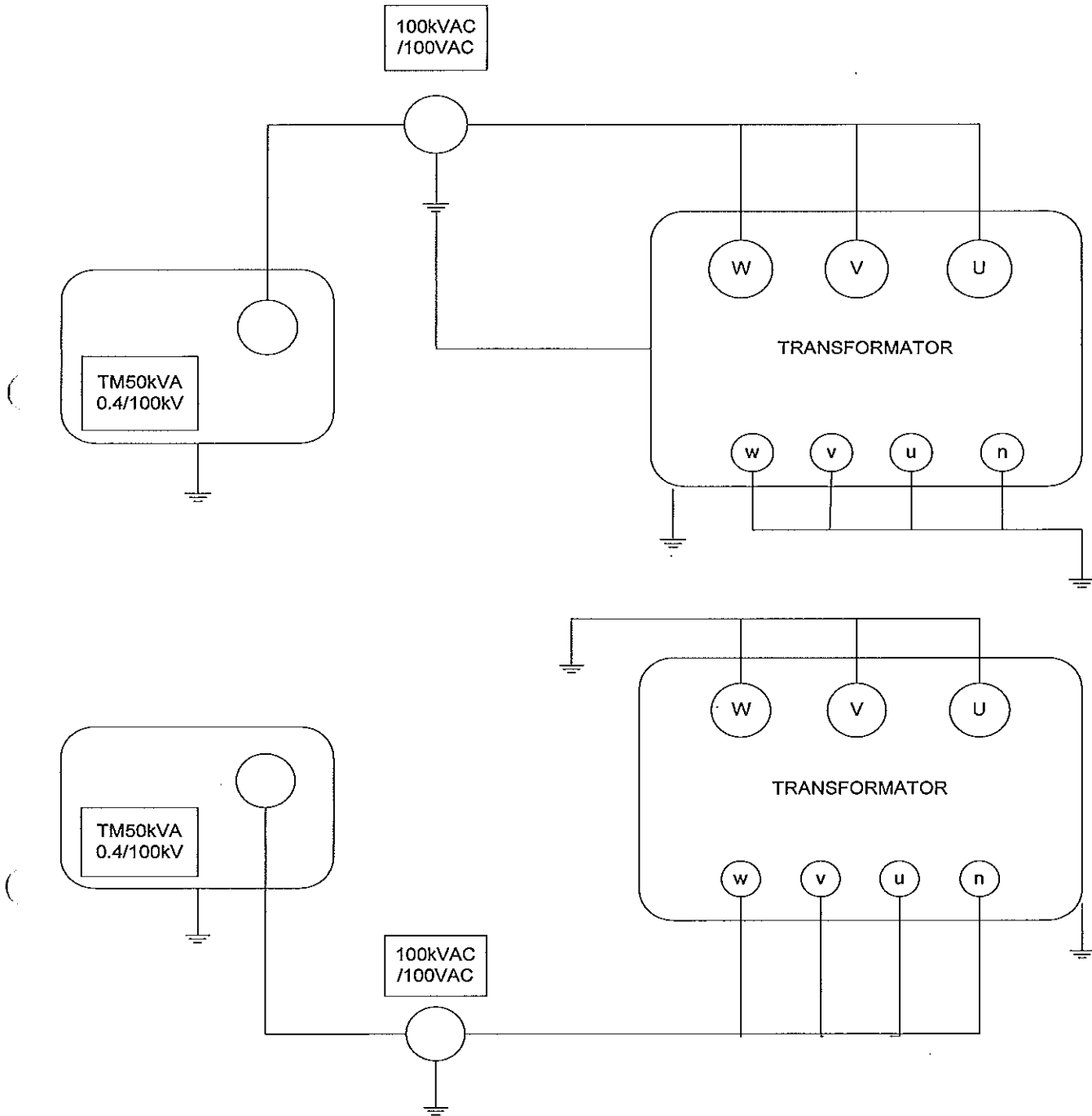


10.5 Dielectric routine tests:

10.5.1 Separate source AC withstand voltage test:

Winding	Earthing	Test voltage, [kV]	Frequency, [Hz]	Test time, [s]
High voltage	LV+tank	50	50	60
Low voltage	HV+tank	3	50	60


Measurements were performed with expanded uncertainty: 3,6% for voltage and the confidence level P = 95%.



10.5.2 Induced AC withstand voltage test:

Test voltage $2xU_n$, [V]	Frequency, [Hz]	Test time, [s]
800	150	40

Measurements were performed with expanded uncertainty: 2% for voltage, 0,0016% for frequency and the confidence level $P = 95\%$.

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11. Instruments used for the tests:

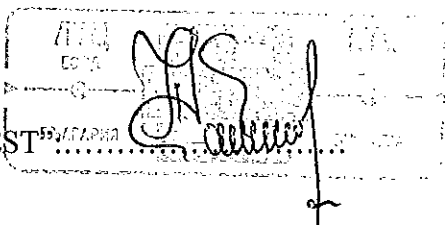
- Turn ratio meter PWR 3-A serial nr.0928-5305;
- Microohmmeter-MRC6105N-serial nr.0928-5306;
- Wattmeter " Yokogava"-WT1600 serial nr.91J702269;
- Cast resin VT Cl.3.6kV(1500-3000/100V)-VKM24/2/H-serial nr.:
- 345080101; 345080102; 345080103;
- Cast resin CT(25-300/5A)-AOS-serial nr.: 09195334; 09195335; 09195336;
- Capacitor divider(100V/100kV)- serial nr.1954
- Digital thermometer type HI 8757 serial nr.1203939
- Mechanical chronometer type Slava serial nr.0521682

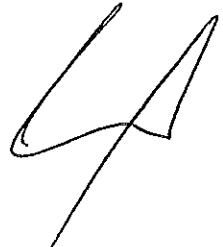
- Notes:**
1. The results from the tests are referred for the tested product only.
 2. Reproduction or copying of the contents of this report in any other form unless its complete photocopying is not allowed without written consent from LTC-TEST.


TESTED BY:

1. Oleg Tsvetanov:.....
(signature)
2. Vasil Vasilev:.....
(signature)



Head of "LTC-TEST".....

 Eng. Katerina Raicheva
 (signature and stamp)



	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 1	All pages 3
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TEST REPORT

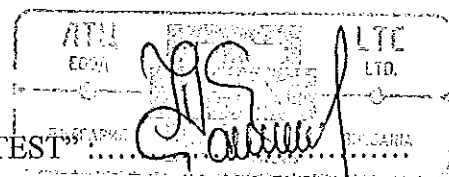
№ 0024-2/16.06.2016

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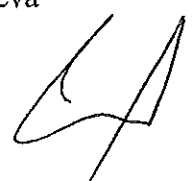
1. Three phase oil-immersed transformer, hermetically sealed,
TM 630/20/0.4, Dyn5, №209926, 2016
2. Customer : LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
order 0019/18.05.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-10:2003;
5. Date on which the product was received in test room: 15.06.2016
6. Tests performed:
6.1 Determination of sound levels - (IEC60076-10 cl.11.2)
7. Test date : 16.06.2016
8. Test result: The product passed the tests
9. The report contains: 3 pages
10. Site: Test Room "LTC-TEST", Pernik




Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)



	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 2	All pages 3
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11. Test result:

Details of transformer

Serial No : 209926 kVA: 630 Voltage: 20000 ± 2x2,5%/ 400

Details of measuring instrument

Brand: Brüel & Kjær Type: 2238 Mediator Serial No : 2684705

Microphone type : 4188 Microphone serial No : 2690664

Test conditions

Feeding voltage: 400V Frequency: 50 Hz

A weighted sound pressure level L_{pA} :

- Oil-immersed transformer - hermetically sealed
 Oil-immersed transformer - with conservator

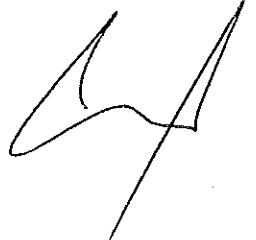
Measuring position	dB 1	dB 2	dB 3	Measuring position	dB 1	dB 2	dB 3
1	41,6	25,5	41,6	9	41,8	26,0	41,8
2	41,3	25,8	41,3	10	42,4	26,2	42,4
3	42,9	25,3	42,9	11			
4	41,4	25,4	41,4	12			
5	42,2	25,5	42,2	13			
6	41,7	25,5	41,7	14			
7	41,3	25,7	41,3	15			
8	41,5	25,9	41,5	16			


Legend
1 = Transformer noise
2 = Background noise
3 = Transformer correct noise

Arithmetic/energy average : **41,81 dB** on 10 measure points

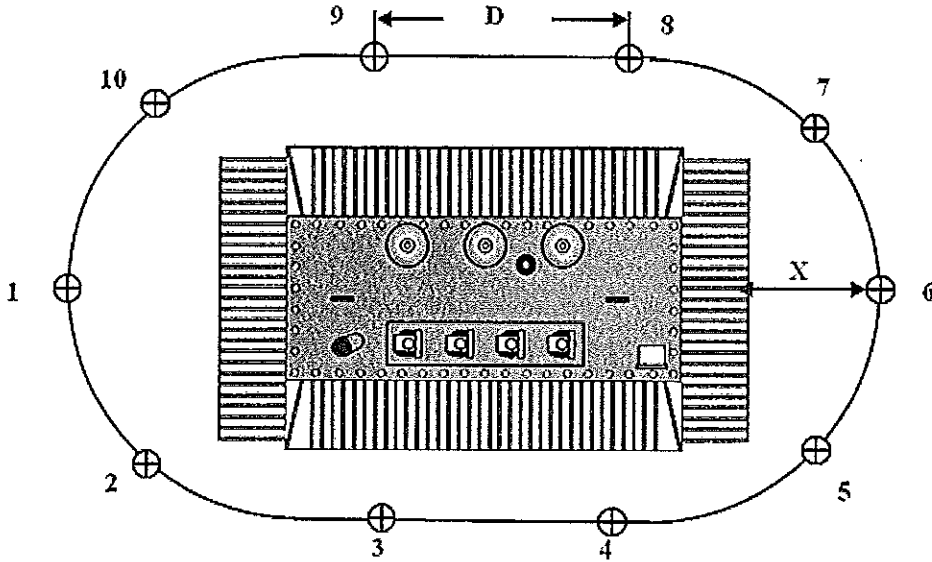
L_{pA}	40,77 dB
LWA	50,08 dB

Environmental correction K **1,071133**
Principal prescribed countur 8,5425 m²
Total area of the surface test room 122,16 m²

	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
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12. Testing scheme:



Distance X = 0.3m. Distance D = 0.67m. Microphone height from floor: 0,51m

13. Instruments used for the tests:

- Calibrator Sound Level Meter, serial nr.2651663
- Sound Level Meter, serial nr. 2684705
- Measuring Roulette, steel, serial nr. 51217

Notes:

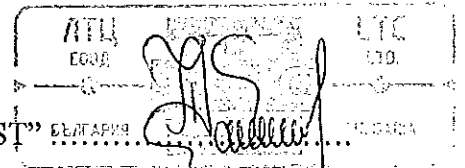
1. The results from the tests are referred for the tested product only.
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TESTED BY :

1. Oleg Tsvetanov:.....
(signature)

2. Vasil Vasilev:.....
(signature)

Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)



СПИСЪК НА ПРОВЕДЕНИТЕ ИЗПИТВАНИЯ

*Сертификат за акредитация
рег. №81ЛИИ валиден до 11.12.2018 г.
издаден от ИА "БСА", съгласно
изискванията на стандарт
EN ISO/IEC 17025:2006*

1. Трифазен маслен трансформатор, херметически затворен,
тип ТМ 250/20, фабричен №209591, година на производство - 2016.
2. Заявител на изпитанието: “Леми Трафо” ЕАД; гр.Перник, ул. Владайско въстание №1,
заявка № 0016/26.04.2016г.
3. Производител: “Леми Трафо” ЕАД; гр.Перник, ул. Владайско въстание №1.
4. Технически данни:

Обозначение		ТМ250/20
Номинална мощност (kVA)		250
Честота (Hz)		50
Номинално напрежение (V)	ВН	20000
	НН	400
Загуби на (W)	Празен ход	300
	Късо съединение към 75°C	3250
Напрежение на късо съединение - (%)		4
Схема и група на свързване		Dyn5
Регулационни отклонения на страна ВН		± 2 x 2.5%
Изоляционен клас	ВН	24 kV (50 kV rms / 125 kV peak)
	НН	1.1kV (3kV rms / - kV peak)
Охлаждане		ONAN , казан с ребра
Надморска височина		<1000 m

5. Дата на получаване на продукта за изпитване в лабораторията: 19.05.2016г.



6. Извършени изпитвания:

6.1. Рутинен тест:

- 6.1.1. Измерване на коефициента на трансформация и група на свързване - (IEC 60076-1:2011- cl.11.3);
- 6.1.2. Измерване на активното съпротивлението на намотките с постоянен ток - (IEC 60076-1:2011-т.11.2);
- 6.1.3. Измерване на загубите и тока на празен ход - (IEC 60076-1:2011-cl.11.5);
- 6.1.4. Измерване на загубите и напрежението на късо съединение - (IEC 60076-1:2011-cl.11.4);
- 6.1.5. Диелектрични изпитвания - (IEC 60076-3:2013)
 - 6.1.5.1. Изпитване на изолацията с напрежение, приложено от външен източник (IEC 60076-3:2013-т.10);
 - 6.1.5.2. Изпитване на изолацията с индуктирано напрежение - (IEC 60076-3:2013-т.11.2);

6.2. Типов тест:

- 6.2.1. Определяне на звуковото ниво - (IEC 60076-10:2005);

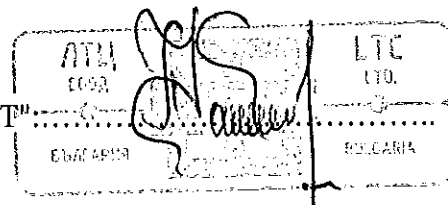
7. Период на изпитване: 20.05.2016г.

8. Резултат от изпитванията: **Продуктът „Трифазен маслен трансформатор, херметически затворен” тип ТМ 250/20, фабричен № 209591, премина успешно изпитанията.**


Резултати от изпитанията са включени в тестови протоколи: № 0019-1/20.05.2016;
№ 0019-2/20.05.2016;

9. Списъка от изпитванията съдържа 2 страници.

РЪКОВОДИТЕЛ НА "ЛТЦ-ТЕСТ"



инж. Катерина Райчева
(подпис и печат)

	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/7	
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TEST REPORT

№ 0019-1/20.05.2016

Certificate of accreditation

reg.№81JII valid until 11.12.2018

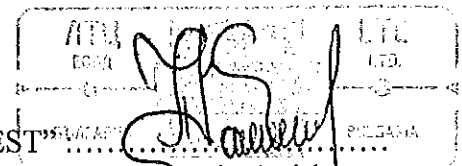
issued by Executive Agency "BAS",

According to the requirements of standard

EN ISO/IEC 17025:2006

1. Three phase oil-immersed transformer, hermetically sealed,
TM 250/20/0.4, Dyn5, №209591, 2016r.
2. Customer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
Order 0016/26.04.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-1:2011;
IEC 60076-3:2013;
5. Date on which the product was received in test room: 19.05.2016
6. Tests performed:
 - 6.1. Measurement of voltage ratio and check of phase displacement
(IEC 60076-1:2011- cl.11.3);
 - 6.2. Measurement of winding resistance (IEC 60076-1:2011-cl.11.2);
 - 6.3. Measurement of no-load losses and current (IEC 60076-1:2011-cl.11.5);
 - 6.4. Measurement of short circuit impedance and load losses
(IEC 60076-1:2011-cl.11.4);
 - 6.5. Dielectric routine tests (IEC 60076-3:2013)
 - 6.5.1. Separate source AC withstand voltage test (IEC 60076-3:2013-cl.10);
 - 6.5.2. Induced AC withstand voltage test (IEC 60076-3:2013-cl.11.2);
7. Test date: 20.05.2016
8. Test result: The product passed the tests
9. The report contains: 7 pages

Head of "LTC-TEST"



Eng. Katerina Raicheva



TEST LABORATORY "LTC - TEST"
TO "LTC" Ltd.

FC 5.10 – 1/7

ROUTINE TEST REPORT

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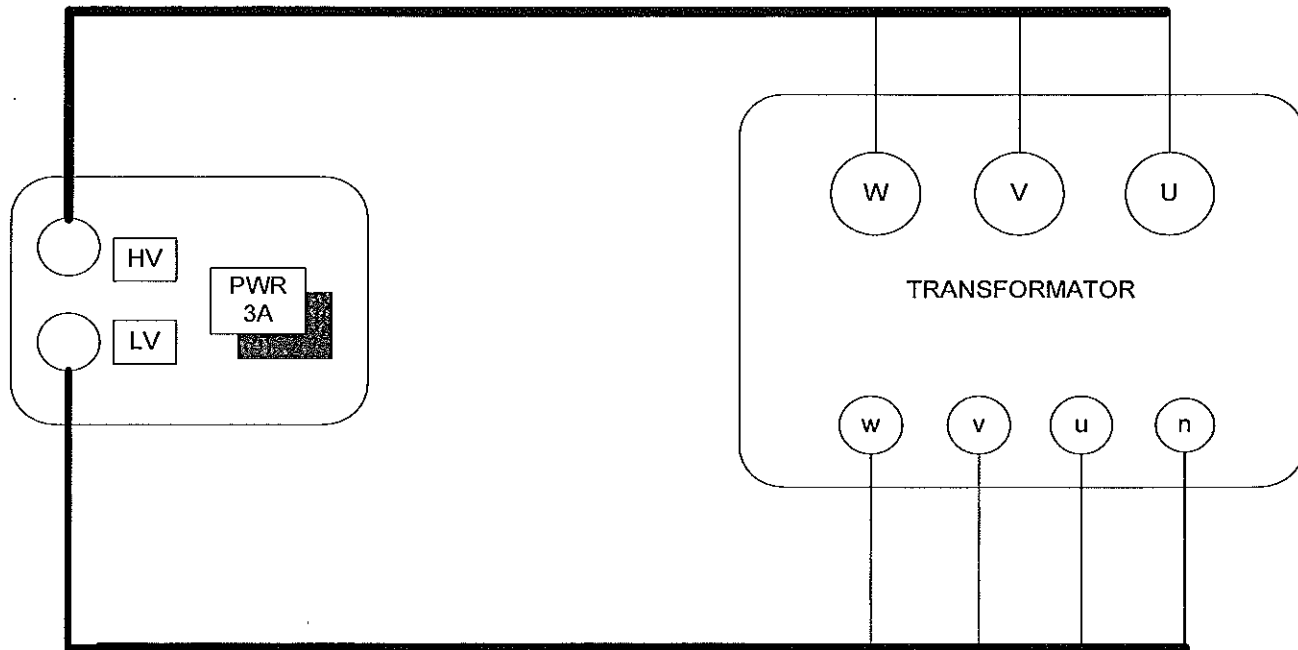
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10. Test results:

10.1. Measurement of voltage ratio (20000/400V) and check of phase displacement:



Tap changer position	Phase A	Transformation coefficient's error, %	Phase B	Transformation coefficient's error, %	Phase C	Transformation coefficient's error, %	Vector group
1	90,97	0,04	90,97	0,04	90,97	0,04	Dyn5
2	88,815	0,05	88,81	0,05	88,81	0,05	
3	86,625	0,03	86,68	0,09	86,65	0,05	
4	84,47	0,04	84,5	0,07	84,43	-0,01	
5	82,31	0,05	82,32	0,06	82,3	0,03	

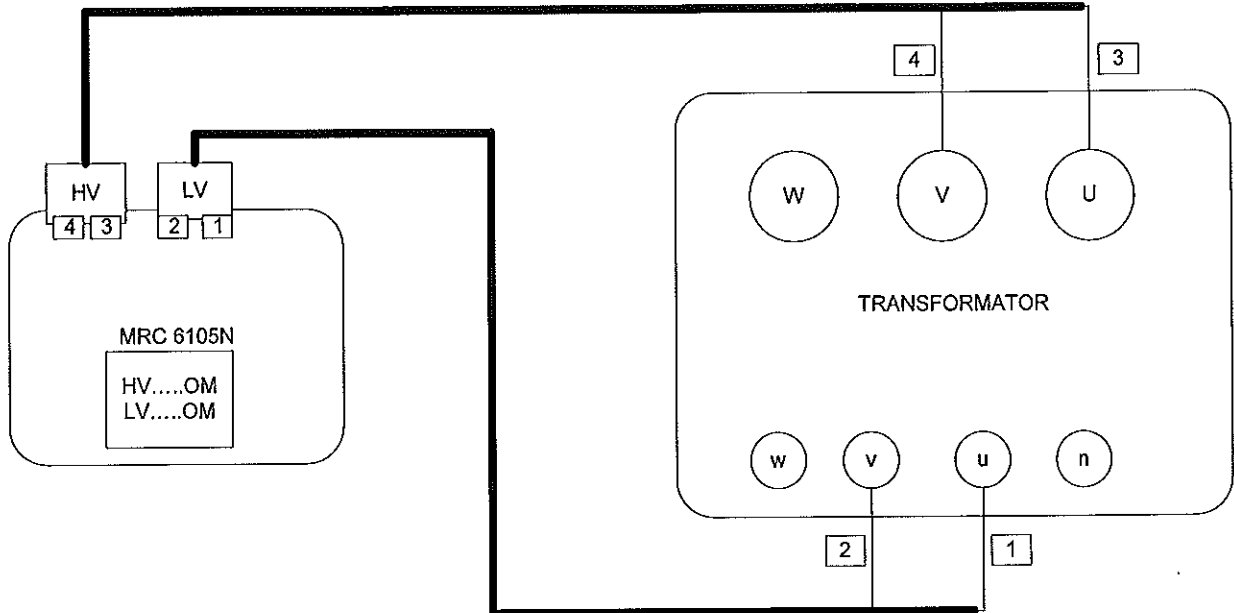
Measurements were performed with expanded uncertainty of 3% and the confidence level $P = 95\%$.

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10.2 Measurement of winding resistance:



Tap changer position	$R_{U,V}, \Omega$	$R_{U,w}, \Omega$	$R_{V,w}, \Omega$	Temperature during test 20°C	
				$R_{U,v}, \Omega$	R_{U-w}, Ω
1	-	-	-	0,005758	0,005802
2	-	-	-	0,00576	
3	14,934	14,93	14,934		
4	-	-	-		
5	-	-	-		

Measurements were performed with expanded uncertainty 0,5% and the confidence level $P = 95\%$.

10.3 Measurement of no-load losses and current:

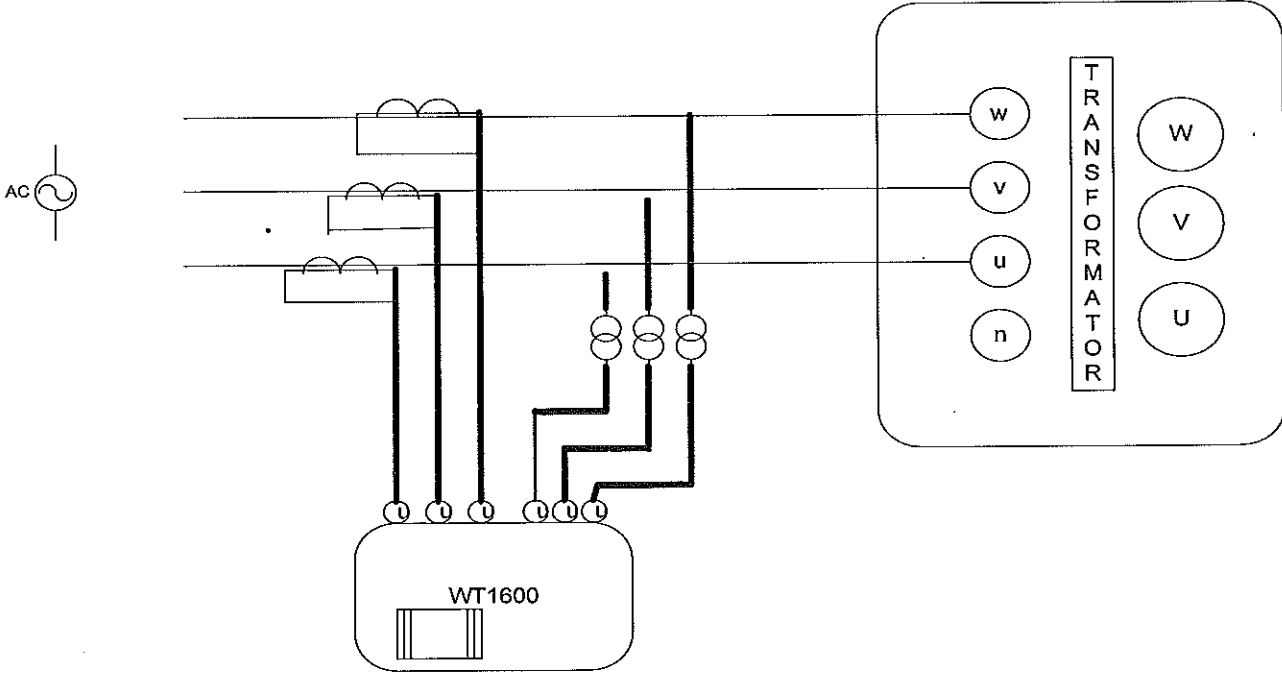
Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	398,55	400,46	401,01	0,6643	0,5563	0,4446	126,7	76,1	87,5

U _{av.} [V]	I _{av.} [A]	P _{tot.} [W]	I ₀ [%]
400,01	0,55507	290	0,15

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level $P = 95\%$.

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10.4 Measurement of short circuit impedance and load losses at temperature 20 °C:

Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	406,67	408,4	408,8	3,833	3,8343	3,8699	233,4	222	231,2

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level P = 95%.

U _{av} [V]	I _{av} [A]	ΣP [W]	P _k ^{75°C} [W]	U _k ^{75°C} [%]
407,927	3,8457	686,6	2891	3,88

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TO "LTC" Ltd.**

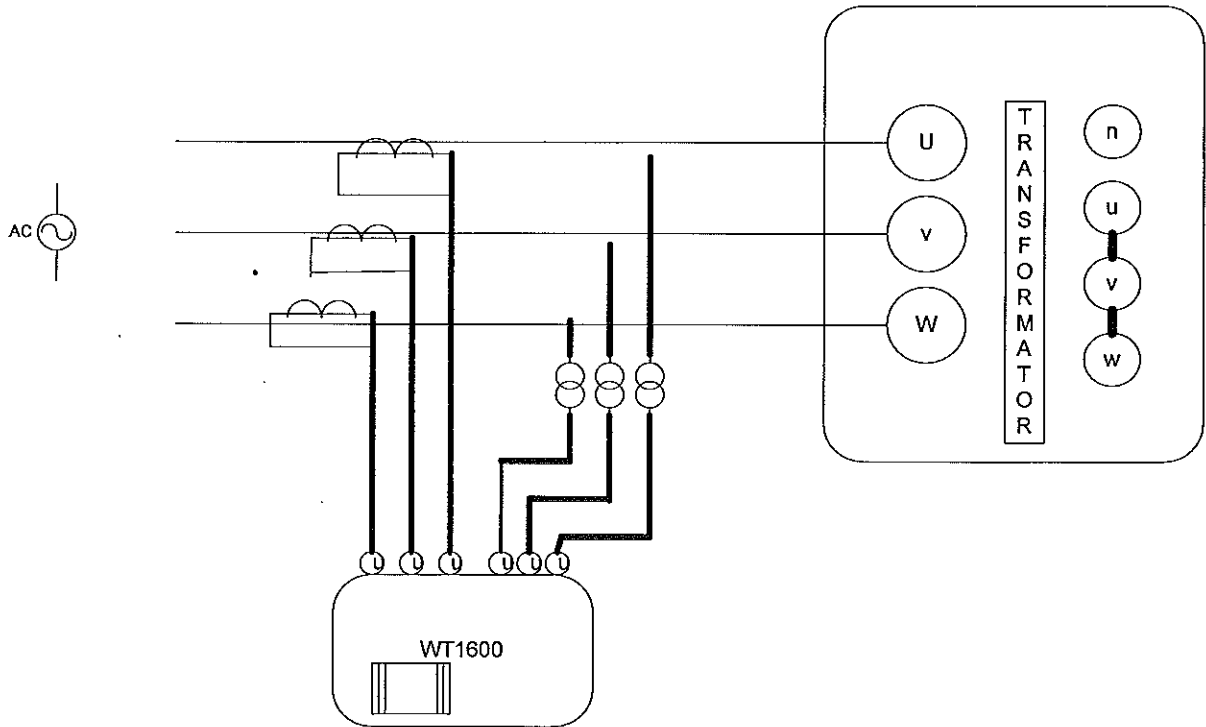
FC 5.10 - 1/7

ROUTINE TEST REPORT

Page 5

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Revision 0

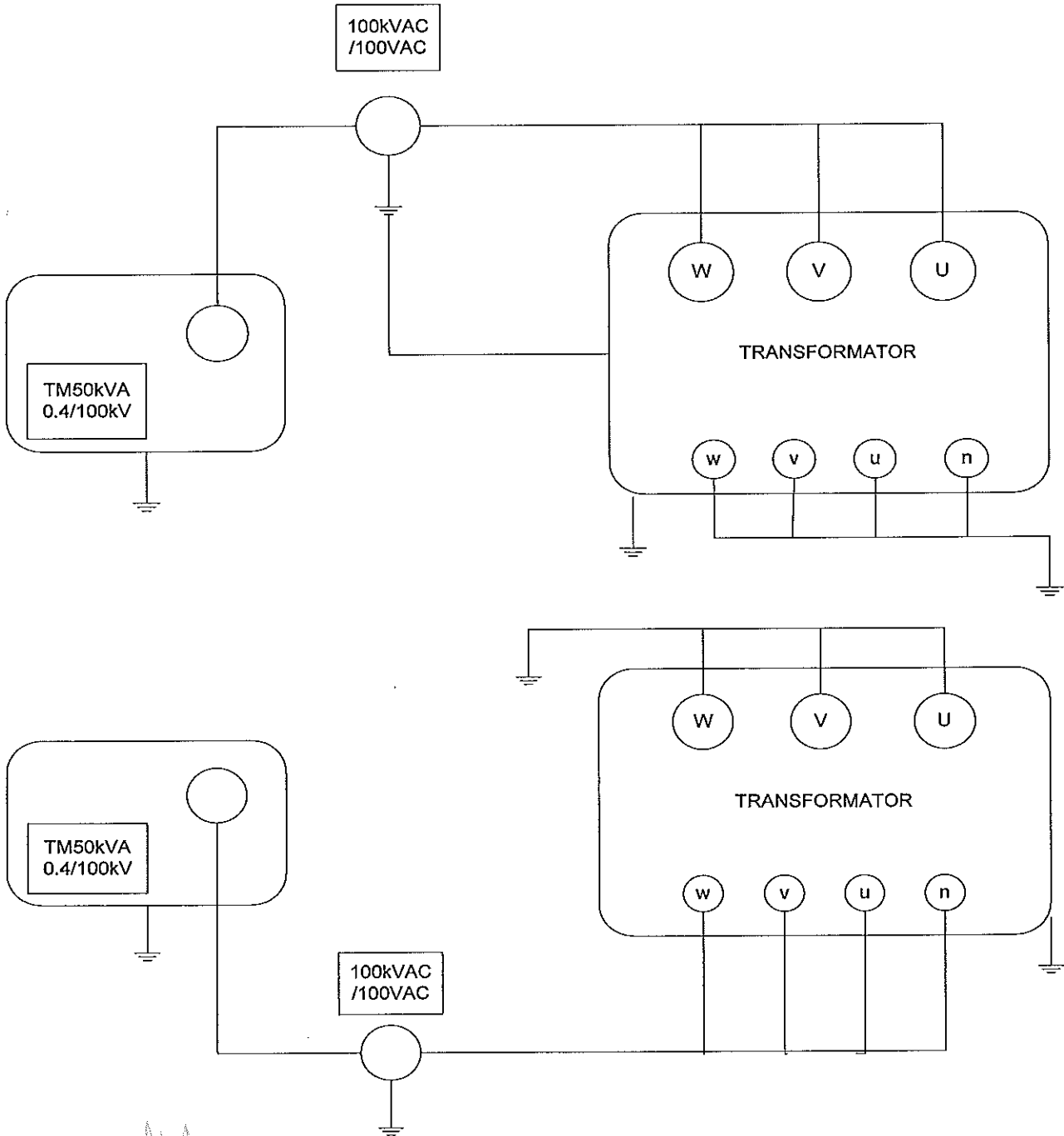


10.5 Dielectric routine tests:

10.5.1 Separate source AC withstand voltage test:

Winding	Earthing	Test voltage, [kV]	Frequency, [Hz]	Test time, [s]
High voltage	LV+tank	50	50	60
Low voltage	HV+tank	3	50	60


Measurements were performed with expanded uncertainty: 3,6% for voltage and the confidence level P = 95%.



10.5.2 Induced AC withstand voltage test:

Test voltage $2xU_n$, [V]	Frequency, [Hz]	Test time, [s]
800	150	40

Measurements were performed with expanded uncertainty: 2% for voltage, 0,0016% for frequency and the confidence level $P = 95\%$.

	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/7	
	ROUTINE TEST REPORT	Page 7	All pages 7
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11. Instruments used for the tests:

- Turn ratio meter PWR 3-A serial nr.0928-5305;
- Microohmmeter-MRC6105N-serial nr.0928-5306;
- Wattmeter " Yokogava"-WT1600 serial nr.91J702269;
- Cast resin VT Cl.3.6kV(1500-3000/100V)-VKM24/2/H-serial nr.:
- 345080101; 345080102; 345080103;
- Cast resin CT(25-300/5A)-AOS-serial nr.: 09195334; 09195335; 09195336;
- Capacitor divider(100V/100kV)- serial nr.1954
- Digital thermometer type HI 8757 serial nr.1203939
- Mechanical chronometer type Slava serial nr.0521682

Notes:

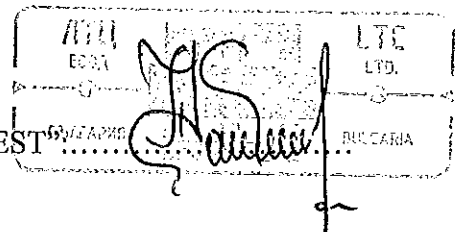
1. The results from the tests are referred for the tested product only.
2. Reproduction or copying of the contents of this report in any other form unless its complete photocopying is not allowed without written consent from LTC-TEST.

TESTED BY:

1. Oleg Tsvetanov:.....
(signature)
2. Vasil Vasilev:.....
(signature)




Head of "LTC-TEST".....



Eng. Katerina Raicheva
(signature and stamp)



	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 1	All pages 3
		Revision 0	

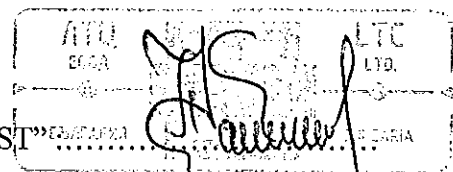
TEST REPORT

№ 0019-2/20.05.2016

*Certificate of accreditation
reg. №81JII valid until 11.12.2018
issued by Executive Agency "BAS",
according to the requirements of standard
EN ISO/IEC 17025:2006*


1. Three phase oil-immersed transformer, hermetically sealed,
TM 250/20/0.4, Dyn5, №209591, 2016
2. Customer : LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
order 0016/26.04.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-10:2003;
5. Date on which the product was received in test room: 19.05.2016
6. Tests performed:
6.1 Determination of sound levels - (IEC60076-10 cl.11.2)
7. Test date : 20.05.2016
8. Test result: The product passed the tests
9. The report contains: 3 pages
10. Site: Test Room "LTC-TEST", Pernik

Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)

A handwritten signature in black ink, appearing to be 'K. Raicheva', is written below the printed name and stamp.

	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 2	All pages 3
		Revision 0	

11. Test result:

Details of transformer

Serial № : 209591 kVA: 250 Voltage: 20000 ± 2x2,5%/ 400

Details of measuring instrument

Brand: Brüel & Kjær Type: 2238 Mediator Serial № : 2684705

Microphone type : 4188 Microphone serial № : 2690664

Test conditions

Feeding voltage: 400V Frequency: 50 Hz

A weighted sound pressure level LpA :

- Oil-immersed transformer - hermetically sealed
- Oil-immersed transformer - with conservator

Measuring position	dB 1	dB 2	dB 3	Measuring position	dB 1	dB 2	dB 3
1	37,9	25,8	37,9	9	37,8	25,9	37,8
2	37,4	26,2	37,4	10	37,5	26,0	37,5
3	37,7	25,9	37,7	11			
4	38,2	26,0	38,2	12			
5	37,5	25,7	37,5	13			
6	37,3	25,5	37,3	14			
7	37,6	25,8	37,6	15			
8	37,4	26,3	37,4	16			


Legend
 1 = Transformer noise
 2 = Background noise
 3 = Transformer correct noise

Arithmetic/energy average : 37,63 dB on 10 measure points

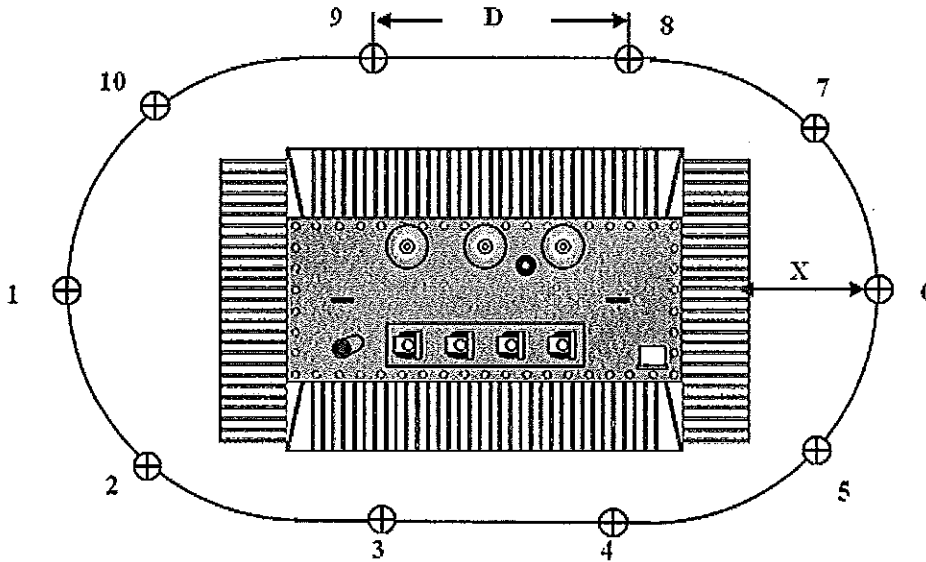
LpA	36,68 dB
LwA	45,46 dB

Environmental correction K 0,9587352
 Principal prescribed countur 7,544 m²
 Total area of the surface test room 122,16 m²




	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 3	All pages 3
		Revision 0	

12. Testing scheme:



Distance X = 0.3m. Distance D = 0.60m. Microphone height from floor: 0,46m

13. Instruments used for the tests:

- Calibrator Sound Level Meter, serial nr.2651663
- Sound Level Meter, serial nr. 2684705
- Measuring Roulette, steel, serial nr. 51217

Notes:

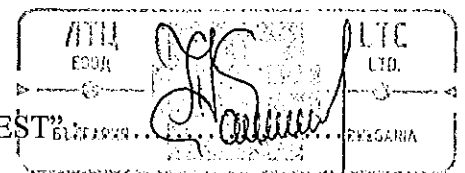
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2. Reproduction or copying of the contents of this report in any other form unless its complete photocopying is not allowed without written consent from LTC-TEST.

TESTED BY :

1. Oleg Tsvetanov:.....
(signature)

2. Vasil Vasilev:.....
(signature)

Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)



СПИСЪК НА ПРОВЕДЕНИТЕ ИЗПИТВАНИЯ

*Сертификат за акредитация
рег. №81ЛИ валиден до 11.12.2018 г.
издаден от ИА "БСА", съгласно
изискванията на стандарт
EN ISO/IEC 17025:2006*

1. Трифазен маслен трансформатор, херметически затворен,
тип ТМ 100/20, фабричен №209918, година на производство - 2016.
2. Заявител на изпитанието: "Леми Трафо" ЕАД; гр.Перник, ул. Владайско въстание №1,
заявка № 0020/28.05.2016г.
3. Производител: "Леми Трафо" ЕАД; гр.Перник, ул. Владайско въстание №1.
4. Технически данни:

Обозначение		ТМ100/20
Номинална мощност (kVA)		100
Честота (Hz)		50
Номинално напрежение (V)	ВН	20000
	НН	400
Загуби на (W)	Празен ход	145
	Късо съединение към 75°C	1750
Напрежение на късо съединение - (%)		4
Схема и група на свързване		Yzn5
Регулационни отклонения на страна ВН		± 2 x 2.5%
Изолационен клас	ВН	24 kV (50 kV rms / 125 kV peak)
	НН	1.1kV (3kV rms / - kV peak)
Охлаждане		ONAN, казан с ребра
Надморска височина		<1000 m

5. Дата на получаване на продукта за изпитване в лабораторията: 22.06.2016г.



6. Извършени изпитвания:

6.1. Рутинен тест:

- 6.1.1. Измерване на коефициента на трансформация и група на свързване - (IEC 60076-1:2011-cl.11.3);
- 6.1.2. Измерване на активното съпротивлението на намотките с постоянен ток - (IEC 60076-1:2011-t.11.2);
- 6.1.3. Измерване на загубите и тока на празен ход - (IEC 60076-1:2011-cl.11.5);
- 6.1.4. Измерване на загубите и напрежението на късо съединение - (IEC 60076-1:2011-cl.11.4);
- 6.1.5. Диелектрични изпитвания - (IEC 60076-3:2013)
 - 6.1.5.1. Изпитване на изолацията с напрежение, приложено от външен източник (IEC 60076-3:2013-t.10);
 - 6.1.5.2. Изпитване на изолацията с индуктирано напрежение - (IEC 60076-3:2013-t.11.2);

6.2. Типов тест:

- 6.2.1. Определяне на звуковото ниво - (IEC 60076-10:2005);

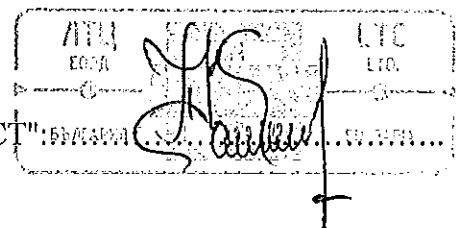
7. Период на изпитване: 23.06.2016г.

8. Резултат от изпитванията: **Продуктът „Трифазен маслен трансформатор, херметически затворен“ тип ТМ 100/20, фабричен № 209918, премина успешно изпитанията.**


Резултати от изпитанията са включени в тестови протоколи: № 0026-1/23.06.2016;
№ 0026-2/23.06.2016;

9. Списъка от изпитванията съдържа 2 страници.

РЪКОВОДИТЕЛ НА "ЛТЦ-ТЕСТ"



инж. Катерина Райчева
(подпис и печат)

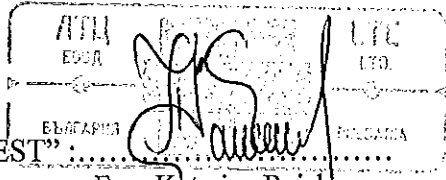
	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/7	
	ROUTINE TEST REPORT	Page 1	All pages 7
		Revision 0	

TEST REPORT

№ 0026-1/23.06.2016

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According to the requirements of standard
EN ISO/IEC 17025:2006*

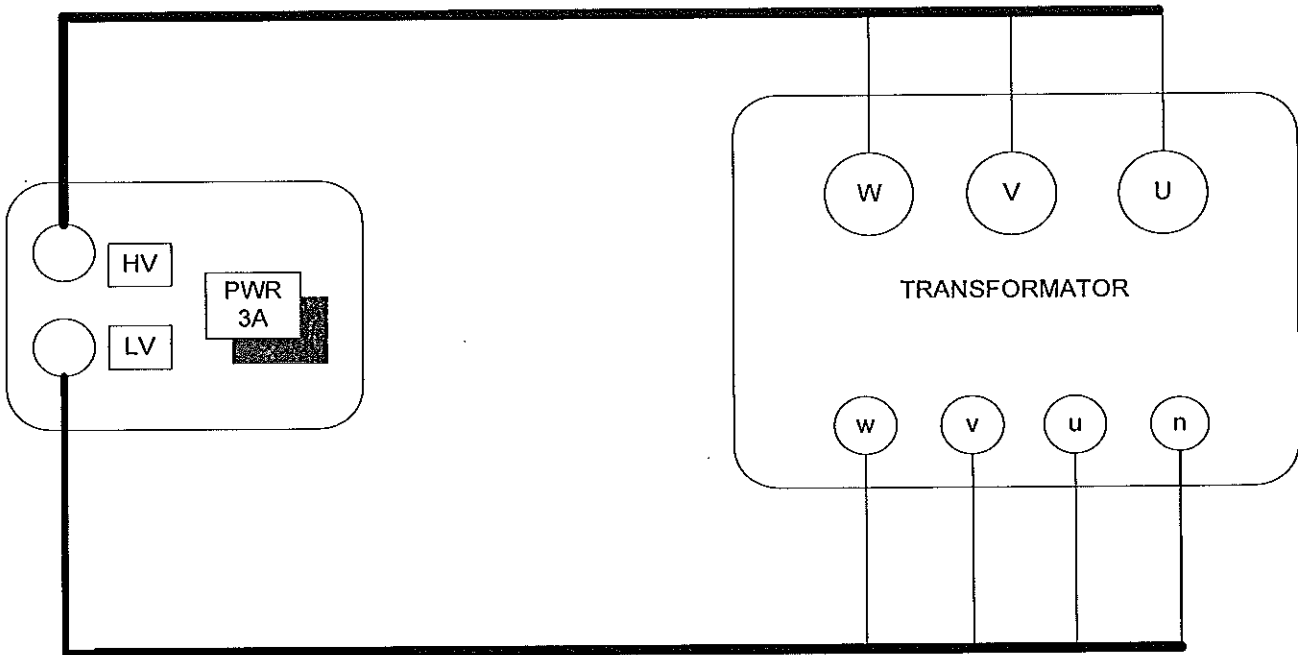
1. Three phase oil-immersed transformer, hermetically sealed,
TM 100/20/0.4, Yzn5, №209918, 2016r.
2. Customer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
Order 0020/28.05.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-1:2011;
IEC 60076-3:2013;
5. Date on which the product was received in test room: 22.06.2016
6. Tests performed:
 - 6.1. Measurement of voltage ratio and check of phase displacement
(IEC 60076-1:2011- cl.11.3);
 - 6.2. Measurement of winding resistance (IEC 60076-1:2011-cl.11.2);
 - 6.3. Measurement of no-load losses and current (IEC 60076-1:2011-cl.11.5);
 - 6.4. Measurement of short circuit impedance and load losses
(IEC 60076-1:2011-cl.11.4);
 - 6.5. Dielectric routine tests (IEC 60076-3:2013)
 - 6.5.1. Separate source AC withstand voltage test (IEC 60076-3:2013-cl.10);
 - 6.5.2. Induced AC withstand voltage test (IEC 60076-3:2013-cl.11.2);
7. Test date: 23.06.2016
8. Test result: The product passed the tests
9. The report contains: 7 pages


 Head of "LTC-TEST"
 Eng. Katerina Raicheva

(signature and stamp)

10. Test results:

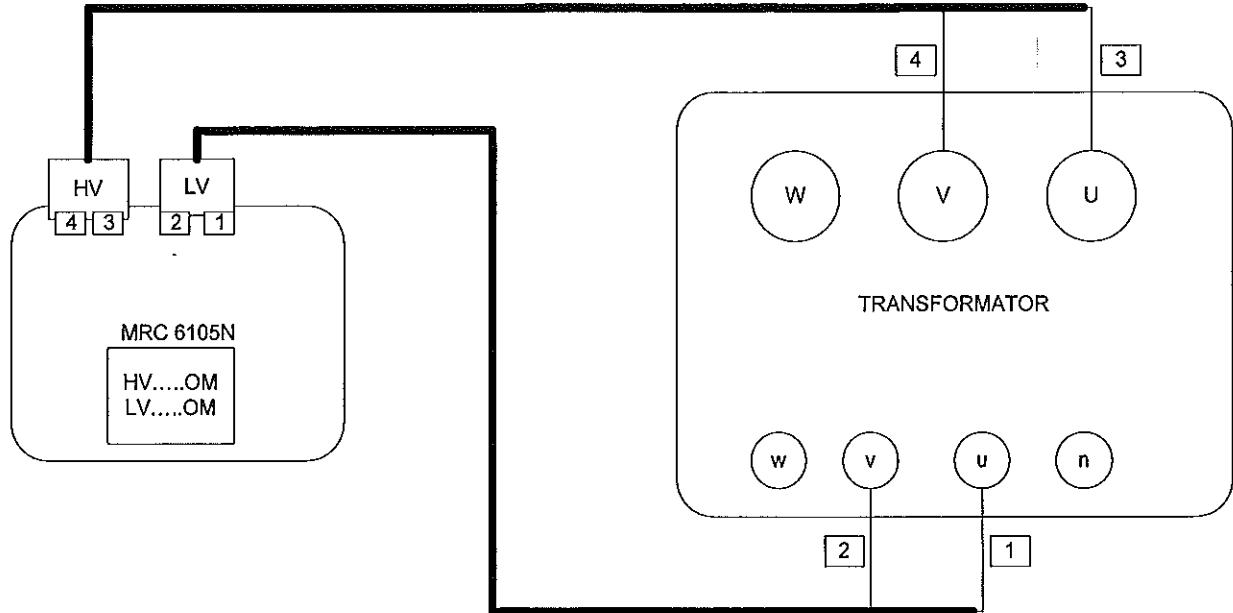
10.1. Measurement of voltage ratio (20000/400V) and check of phase displacement:



Tap changer position	Phase A	Transformation coefficient's error, %	Phase B	Transformation coefficient's error, %	Phase C	Transformation coefficient's error, %	Vector group
1	52,515	0,03	52,509	0,02	52,507	0,01	Yzn5
2	51,27	0,04	51,25	0,00	51,25	0,00	
3	50,02	0,04	50,013	0,03	50,011	0,02	
4	48,756	0,01	48,754	0,01	48,752	0,00	
5	47,512	0,03	47,511	0,02	47,51	0,02	

Measurements were performed with expanded uncertainty of 3% and the confidence level P = 95%.

10.2 Measurement of winding resistance:



Tap changer position	R_{U-V}, Ω	R_{U-w}, Ω	R_{v-w}, Ω	Temperature during test 28°C	
				1	-
2	-	-	-	$R_{U-w}; \Omega$	0,02372
3	45,7	45,75	45,73	$R_{v-w}; \Omega$	0,02382
4	-	-	-		
5	-	-	-		

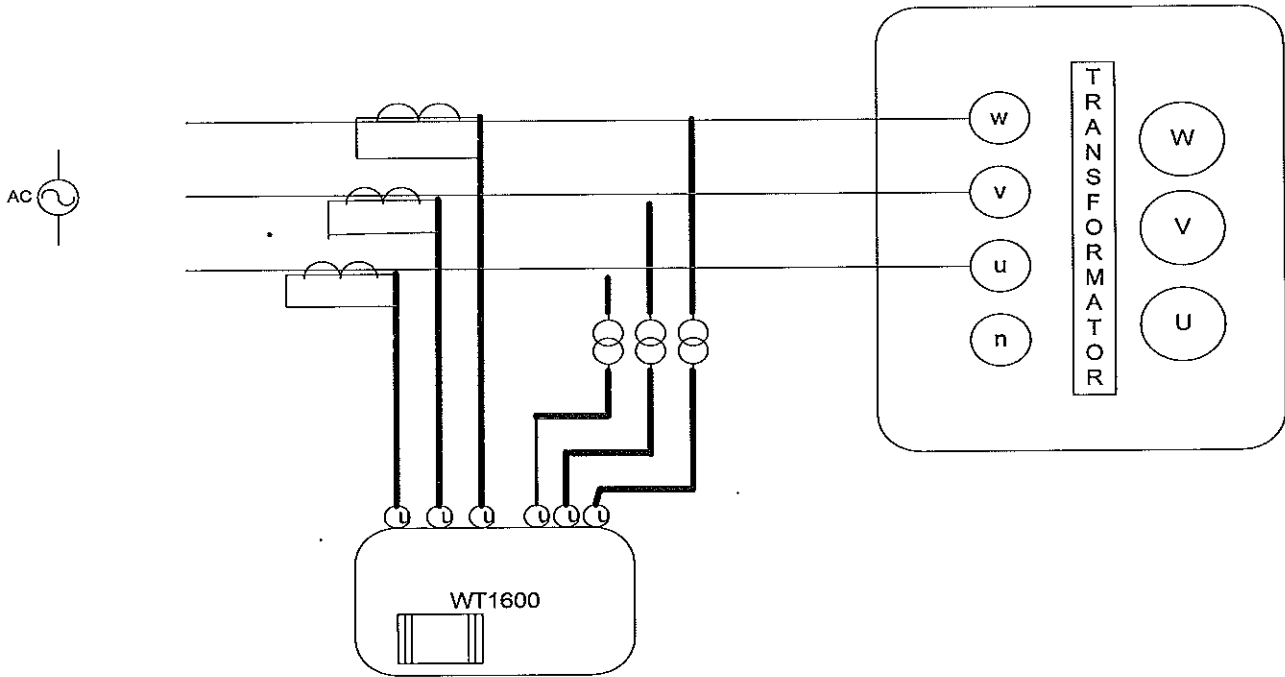
Measurements were performed with expanded uncertainty 0,5% and the confidence level $P = 95\%$.

10.3 Measurement of no-load losses and current:

Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	398,26	400,45	401,02	0,3609	0,2913	0,3591	47,2	34,1	62,1

U _{av.} [V]	I _{av.} [A]	P _{tot.} [W]	I ₀ [%]
399,91	0,3371	143	0,23

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level $P = 95\%$.



10.4 Measurement of short circuit impedance and load losses at temperature 28 °C:

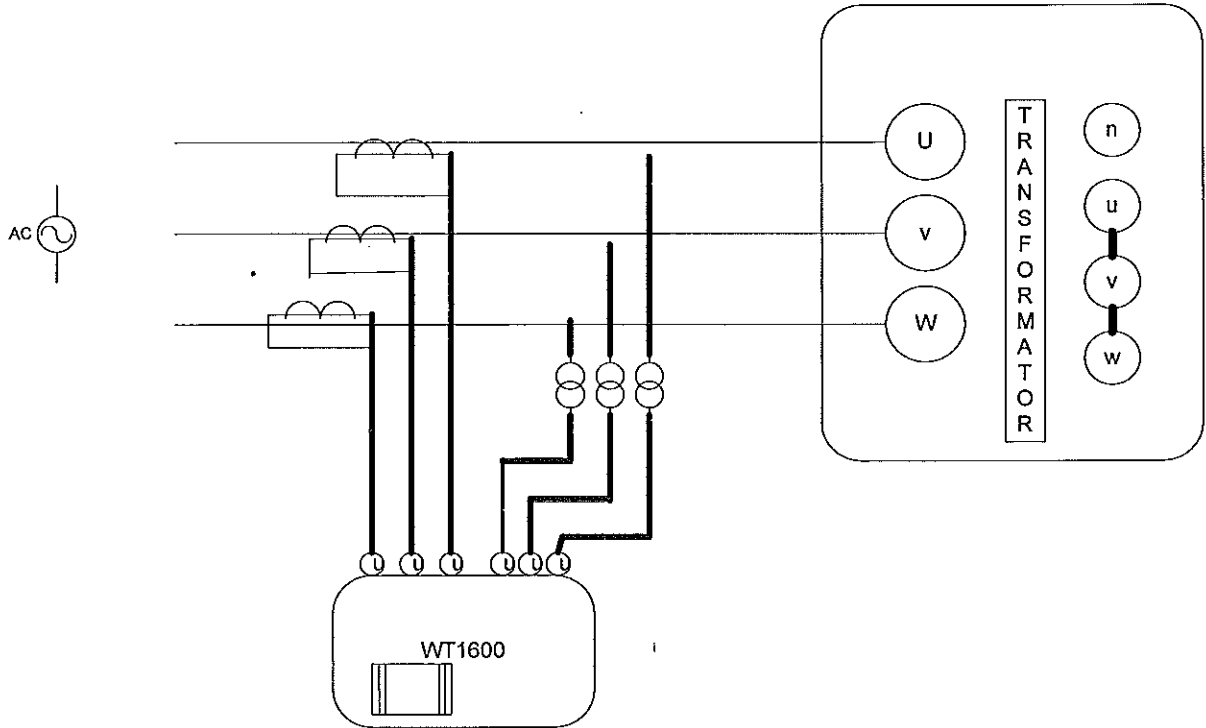
Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	419,24	421,9	422,2	1,5006	1,5148	1,5122	125,4	125,5	129,4

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level $P = 95\%$.

Uav. [V]	Iav. [A]	ΣP [W]	$PK^{75^{\circ}C}$ [W]	$Uk^{75^{\circ}C}$ [%]
421,087	1,5092	380,3	1624	4,11

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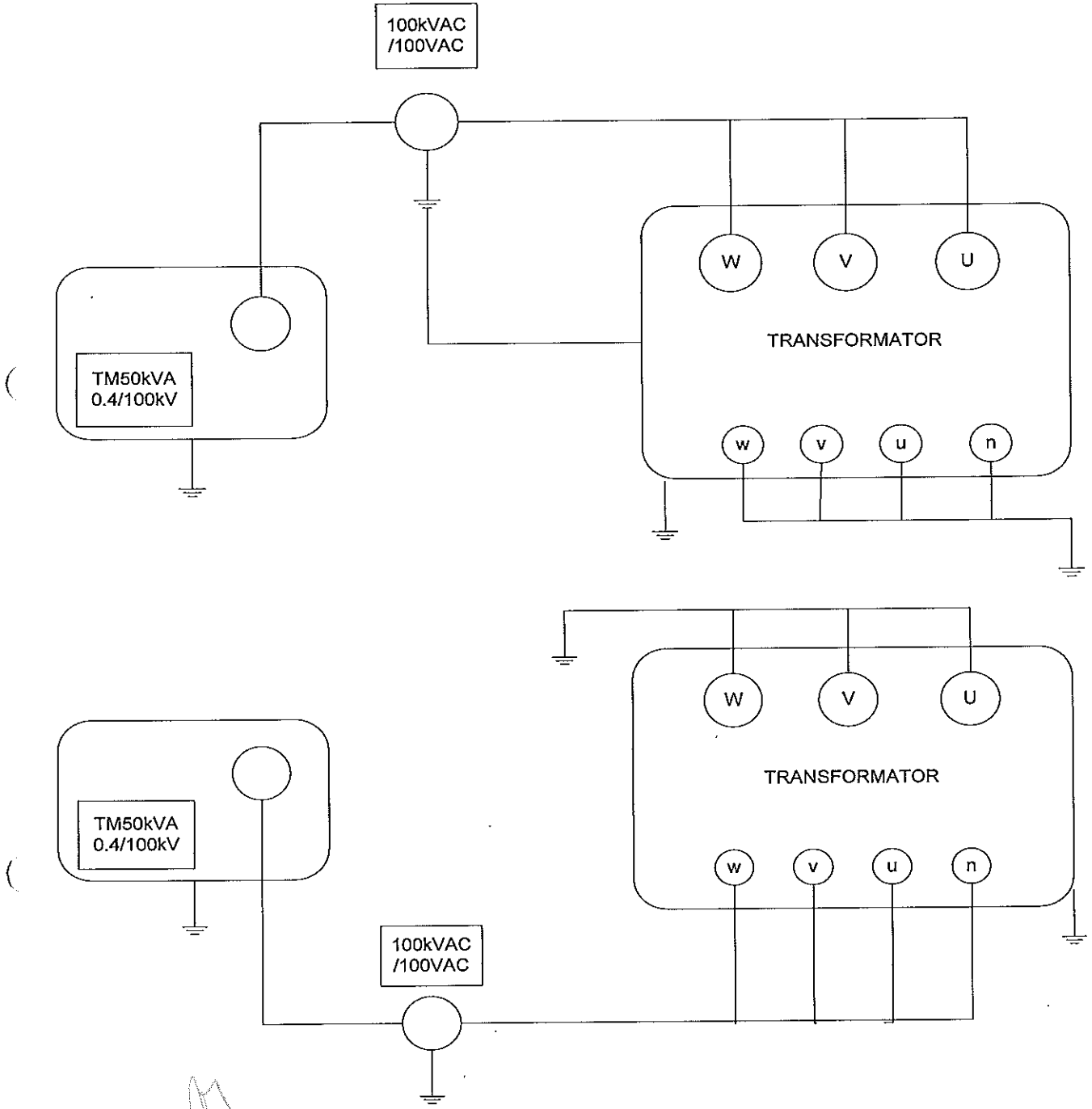


10.5 Dielectric routine tests:

10.5.1 Separate source AC withstand voltage test:

Winding	Earthing	Test voltage, [kV]	Frequency, [Hz]	Test time, [s]
High voltage	LV+tank	50	50	60
Low voltage	HV+tank	3	50	60

Measurements were performed with expanded uncertainty: 3,6% for voltage and the confidence level $P = 95\%$.




10.5.2 Induced AC withstand voltage test:

Test voltage $2xU_n$, [V]	Frequency, [Hz]	Test time, [s]
800	150	40

Measurements were performed with expanded uncertainty: 2% for voltage, 0,0016% for frequency and the confidence level $P = 95\%$.



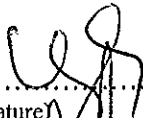
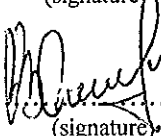
	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/7	
	ROUTINE TEST REPORT	Page 7	All pages 7
		Revision 0	

11. Instruments used for the tests:

- Turn ratio meter PWR 3-A serial nr.0928-5305;
- Microohmmeter-MRC6105N-serial nr.0928-5306;
- Wattmeter " Yokogava"-WT1600 serial nr.91J702269;
- Cast resin VT Cl.3.6kV(1500-3000/100V)-VKM24/2/H-serial nr.:
345080101; 345080102; 345080103;
- Cast resin CT(25-300/5A)-AOS-serial nr.: 09195334; 09195335; 09195336;
- Capacitor divider(100V/100kV)- serial nr.1954
- Digital thermometer type HI 8757 serial nr.1203939
- Mechanical chronometer type Slava serial nr.0521682

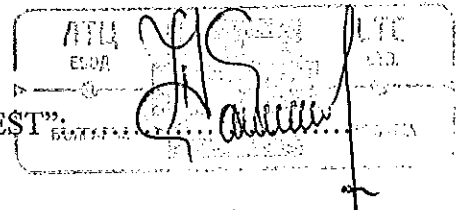
- Notes:**
1. The results from the tests are referred for the tested product only.
 2. Reproduction or copying of the contents of this report in any other form unless its complete photocopying is not allowed without written consent from LTC-TEST.

TESTED BY:

1. Oleg Tsvetanov:.....
(signature) 
2. Vasil Vasilev:.....
(signature) 




Head of "LTC-TEST".



Eng. Katerina Raicheva
(signature and stamp)



	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 1	All pages 3
		Revision 0	

TEST REPORT

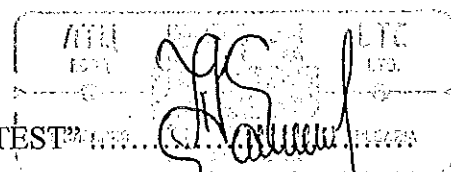
№ 0026-2/22.06.2016

*Certificate of accreditation
reg.№81JH valid until 11.12.2018
issued by Executive Agency "BAS",
according to the requirements of standard
EN ISO/IEC 17025:2006*

1. Three phase oil-immersed transformer, hermetically sealed,
TM 100/20/0.4, Yzn5, №209918, 2016
2. Customer : LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
order 0020/28.05.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-10:2003;
5. Date on which the product was received in test room: 22.06.2016
6. Tests performed:
6.1 Determination of sound levels - (IEC60076-10 cl.11.2)
7. Test date : 23.06.2016
8. Test result: The product passed the tests
9. The report contains: 3 pages
10. Site: Test Room "LTC-TEST", Pernik




Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)



	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.		FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT		Page 2	All pages 3
			Revision 0	

11. Test result:

Details of transformer

Serial № : 209918 KVA: 100 Voltage: 20000 ± 2x2,5%/ 400

Details of measuring instrument

Brand: Brüel & Kjær Type: 2238 Mediator Serial № : 2684705

Microphone type : 4188 Microphone serial № : 2690664

Test conditions

Feeding voltage: 400V Frequency: 50 Hz

A weighted sound pressure level LpA :

- Oil-immersed transformer - hermetically sealed
- Oil-immersed transformer - with conservator

Measuring position	dB 1	dB 2	dB 3	Measuring position	dB 1	dB 2	dB 3
1	33,4	26,2	32,4	9	33,7	26,2	32,7
2	33,8	26,2	32,8	10	33,3	26,1	32,3
3	33,3	26,0	32,3	11			
4	33,6	26,4	32,6	12			
5	33,2	26,3	32,2	13			
6	33,8	26,2	32,8	14			
7	33,5	26,2	32,5	15			
8	33,1	26,4	32,1	16			


Legend
1 = Transformer noise
2 = Background noise
3 = Transformer correct noise

Arithmetic/energy average : **33,47 dB** on 10 measure points

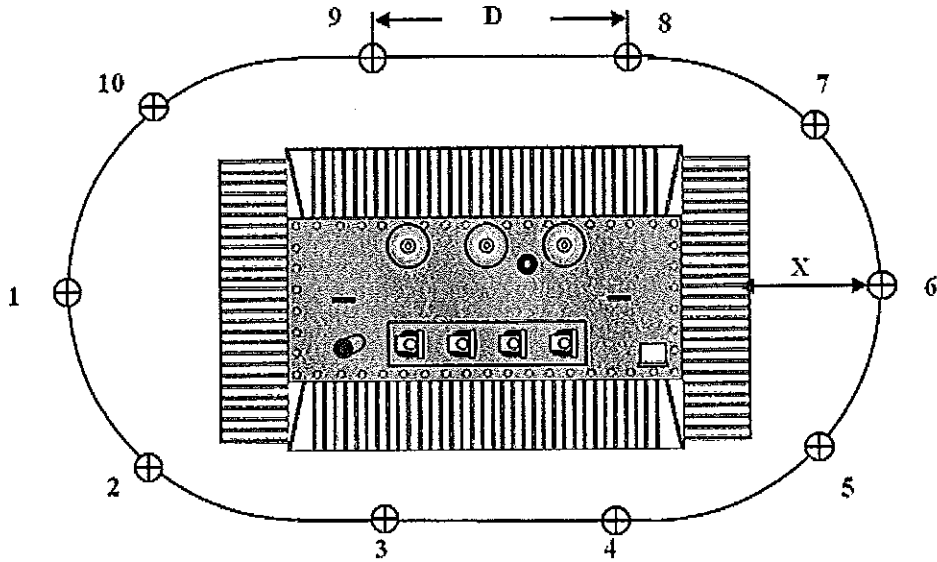
LpA	31,61 dB
LwA	39,91 dB

Environmental correction K **0,8681069**
Principal prescribed countur 6,7575 m²
Total area of the surface test room 122,16 m²




	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 3	All pages 3
		Revision 0	

12. Testing scheme:



Distance X = 0.3m. Distance D = 0.53m. Microphone height from floor: 0,51m

13. Instruments used for the tests:

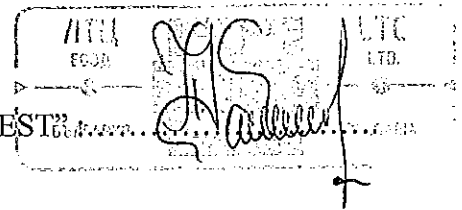
- Calibrator Sound Level Meter, serial nr.2651663
- Sound Level Meter, serial nr. 2684705
- Measuring Roulette, steel, serial nr. 51217

- Notes:**
1. The results from the tests are referred for the tested product only.
 2. Reproduction or copying of the contents of this report in any other form unless its complete photocopying is not allowed without written consent from LTC-TEST.

TESTED BY :

1. Oleg Tsvetanov:.....
(signature)
2. Vasil Vasilev:.....
(signature)

Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)



СПИСЪК НА ПРОВЕДЕНИТЕ ИЗПИТВАНИЯ

*Сертификат за акредитация
рег. №81ЛИ валиден до 11.12.2018 г.
издаден от ИА"БСА", съгласно
изискванията на стандарт
EN ISO/IEC 17025:2006*

1. Трифазен маслен трансформатор, херметически затворен,
тип ТМ 50/20, фабричен №209062, година на производство - 2016.
2. Заявител на изпитанието: “Леми Трафо” ЕАД; гр.Перник, ул. Владайско въстание №1,
заявка № 0017/10.05.2016г.
3. Производител: “Леми Трафо” ЕАД; гр.Перник, ул. Владайско въстание №1.
4. Технически данни:

Обозначение		ТМ50/20
Номинална мощност (kVA)		50
Честота (Hz)		50
Номинално напрежение (V)	ВН	20000
	НН	400
Загуби на (W)	Празен ход	90
	Късо съединение към 75°C	1100
Напрежение на късо съединение - (%)		4
Схема и група на свързване		Yzn5
Регулационни отклонения на страна ВН		± 2 x 2.5%
Изоляционен клас	ВН	24 kV (50 kV rms / 125 kV peak)
	НН	1.1kV (3kV rms / - kV peak)
Охлаждане		ONAN , казан с ребра
Надморска височина		<1000 m

5. Дата на получаване на продукта за изпитване в лабораторията: 08.06.2016г.



6. Извършени изпитвания:

6.1. Рутинен тест:

- 6.1.1. Измерване на коефициента на трансформация и група на свързване - (IEC 60076-1:2011- cl.11.3);
- 6.1.2. Измерване на активното съпротивлението на намотките с постоянен ток - (IEC 60076-1:2011-т.11.2);
- 6.1.3. Измерване на загубите и тока на празен ход - (IEC 60076-1:2011-cl.11.5);
- 6.1.4. Измерване на загубите и напрежението на късо съединение - (IEC 60076-1:2011-cl.11.4);
- 6.1.5. Диелектрични изпитвания - (IEC 60076-3:2013)
 - 6.1.5.1. Изпитване на изолацията с напрежение, приложено от външен източник (IEC 60076-3:2013-т.10);
 - 6.1.5.2. Изпитване на изолацията с индуктирано напрежение - (IEC 60076-3:2013-т.11.2);

6.2. Типов тест:

- 6.2.1. Определяне на звуковото ниво - (IEC 60076-10:2005);

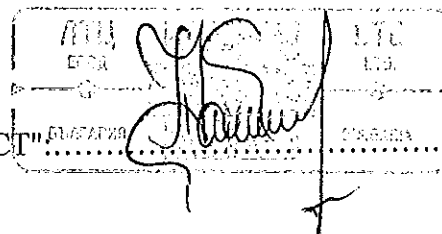
7. Период на изпитване: 09.06.2016г.

8. Резултат от изпитванията: **Продуктът „Трифазен маслен трансформатор, херметически затворен” тип ТМ 50/20, фабричен № 209062, премина успешно изпитанията.**


Резултати от изпитанията са включени в тестови протоколи: № 0023-1/09.06.2016;
№ 0023-2/09.06.2016;

9. Списъка от изпитванията съдържа 2 страници.

РЪКОВОДИТЕЛ НА "ЛТЦ-ТЕСТ"



инж. Катерина Райчева
(подпис и печат)

	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/7	
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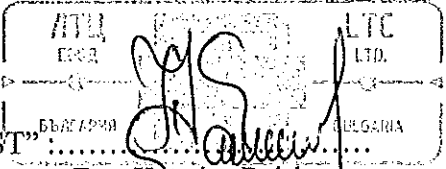
TEST REPORT

№ 0023-1/09.06.2016

*Certificate of accreditation
reg. № 81311 valid until 11.12.2018
issued by Executive Agency "BAS",
According to the requirements of standard
EN ISO/IEC 17025:2006*

1. Three phase oil-immersed transformer, hermetically sealed,
TM 50/20/0.4, Yzn5, №209062, 2016r.
2. Customer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
Order 0017/10.05.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-1:2011;
IEC 60076-3:2013;
5. Date on which the product was received in test room: 08.06.2016
6. Tests performed:
 - 6.1. Measurement of voltage ratio and check of phase displacement
(IEC 60076-1:2011- cl.11.3);
 - 6.2. Measurement of winding resistance (IEC 60076-1:2011-cl.11.2);
 - 6.3. Measurement of no-load losses and current (IEC 60076-1:2011-cl.11.5);
 - 6.4. Measurement of short circuit impedance and load losses
(IEC 60076-1:2011-cl.11.4);
 - 6.5. Dielectric routine tests (IEC 60076-3:2013)
 - 6.5.1. Separate source AC withstand voltage test (IEC 60076-3:2013-cl.10);
 - 6.5.2. Induced AC withstand voltage test (IEC 60076-3:2013-cl.11.2);
7. Test date: 09.06.2016
8. Test result: The product passed the tests
9. The report contains: 7 pages

Head of "LTC-TEST"
 Eng. Katerina Raicheva

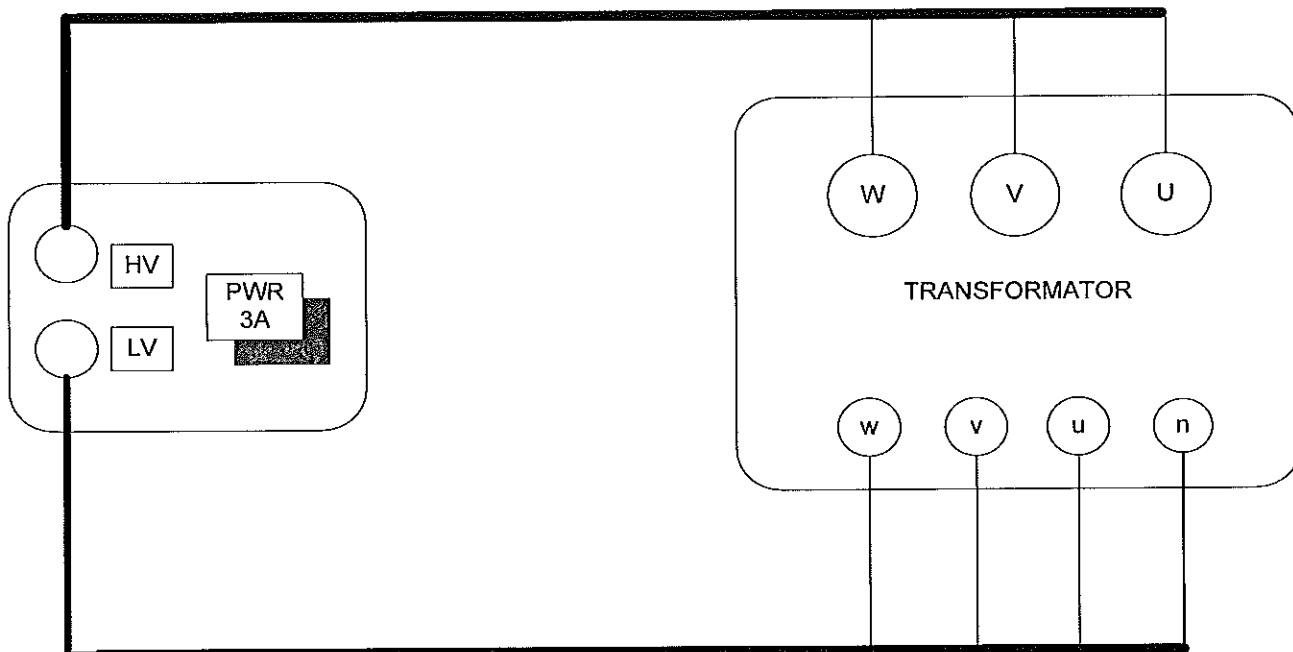




(signature and stamp)

10. Test results:

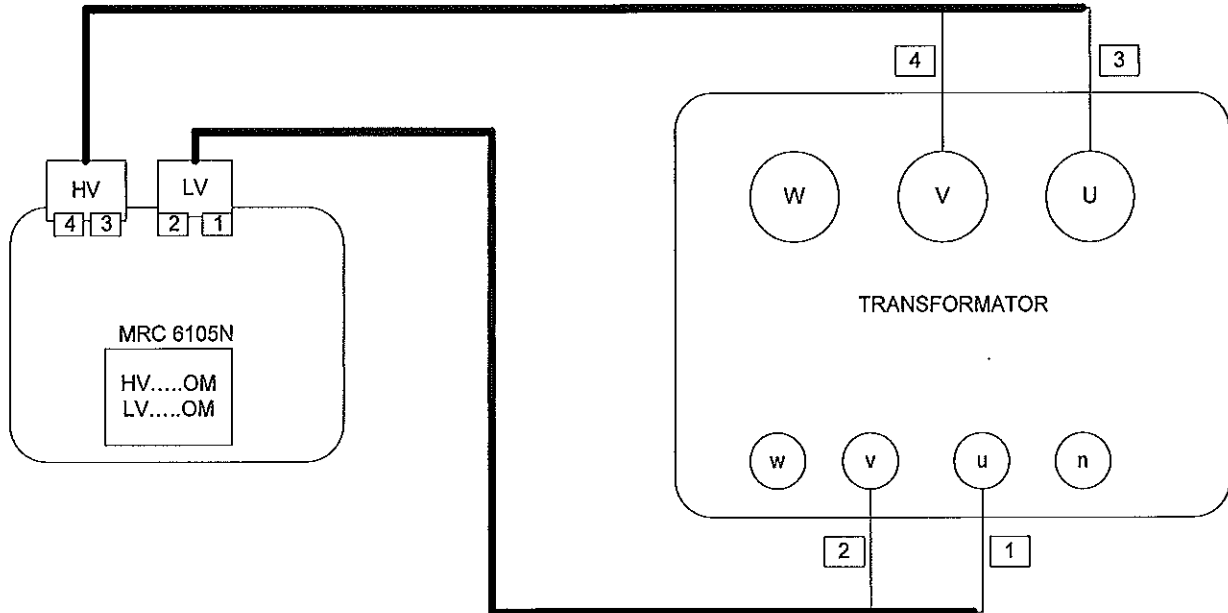
10.1. Measurement of voltage ratio (20000/400V) and check of phase displacement:



Tap changer position	Phase A	Transformation coefficient's error, %	Phase B	Transformation coefficient's error, %	Phase C	Transformation coefficient's error, %	Vector group
1	52,52	0,04	52,519	0,04	52,511	0,02	Yzn5
2	51,26	0,02	51,265	0,03	51,269	0,04	
3	50,02	0,04	49,993	-0,01	50,013	0,03	
4	48,764	0,03	48,755	0,01	48,795	0,09	
5	47,518	0,04	47,513	0,03	47,525	0,05	

Measurements were performed with expanded uncertainty of 3% and the confidence level $P = 95\%$.

10.2 Measurement of winding resistance:



Tap changer position	R_{U-V}, Ω	R_{U-W}, Ω	R_{V-W}, Ω	Temperature during test 23°C	
				1	-
2	-	-	-	R_{U-W}, Ω	0,04415
3	147,64	148	148,3	R_{V-W}, Ω	0,04423
4	-	-	-		
5	-	-	-		

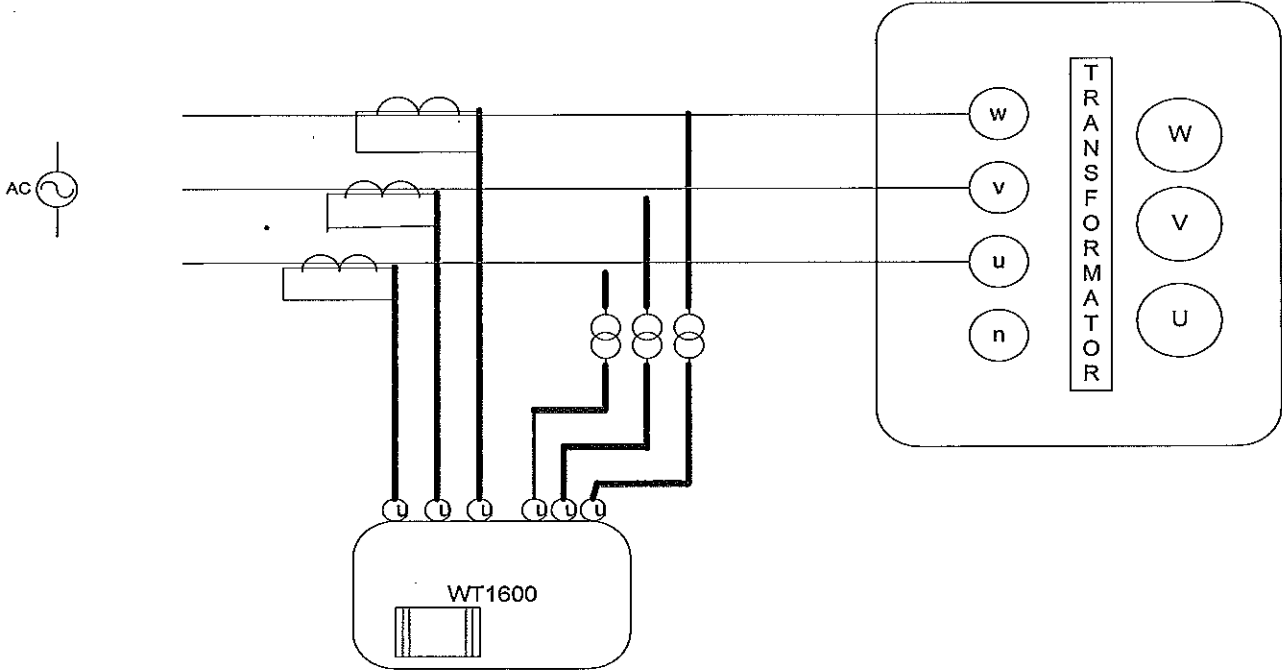
Measurements were performed with expanded uncertainty 0,5% and the confidence level $P = 95\%$.

10.3 Measurement of no-load losses and current:

Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	398,38	400,33	401,15	0,3631	0,3246	0,3558	27,8	19,9	35,2

U _{av.} [V]	I _{av.} [A]	P _{0 tot.} [W]	I ₀ [%]
399,95	0,34783	83	0,48

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level $P = 95\%$.



10.4 Measurement of short circuit impedance and load losses at temperature 23 °C:

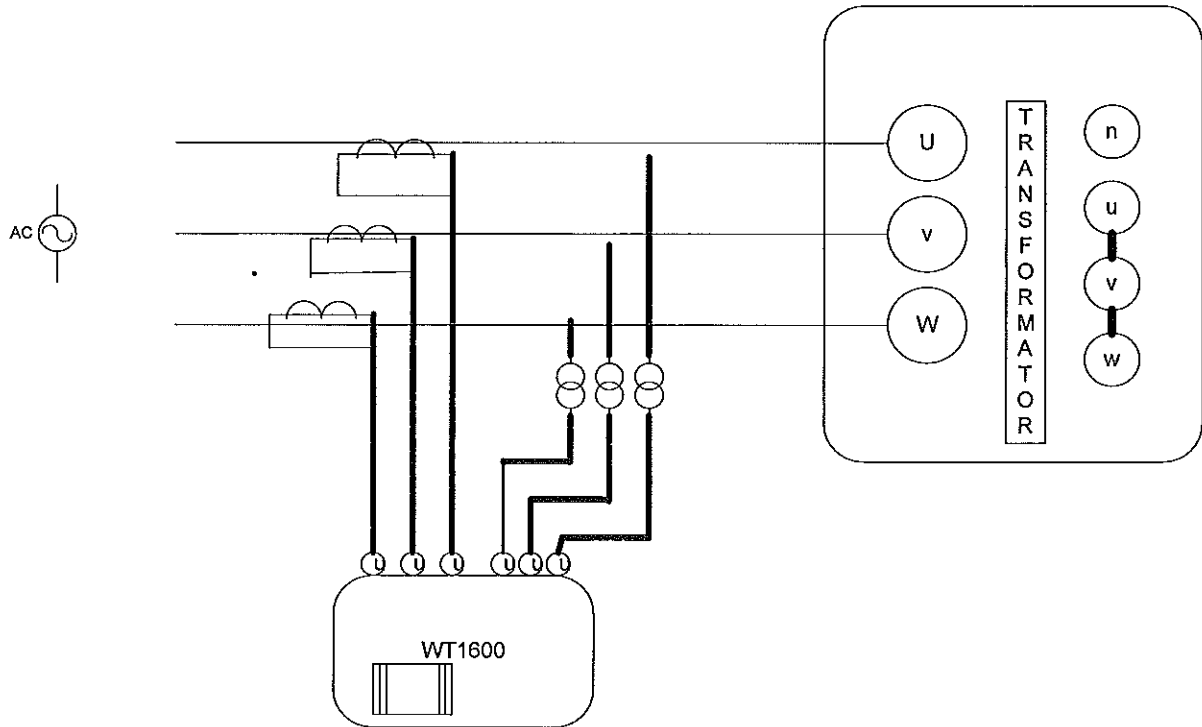
Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	401,72	403,6	404,2	0,7226	0,6944	0,7067	70	67,5	63,8

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level $P = 95\%$.

Uav. [V]	Iav. [A]	ΣP [W]	$P_k^{75^\circ C}$ [W]	$U_k^{75^\circ C}$ [%]
403,167	0,7079	201,3	995	4,25

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[Handwritten signature]



10.5 Dielectric routine tests:

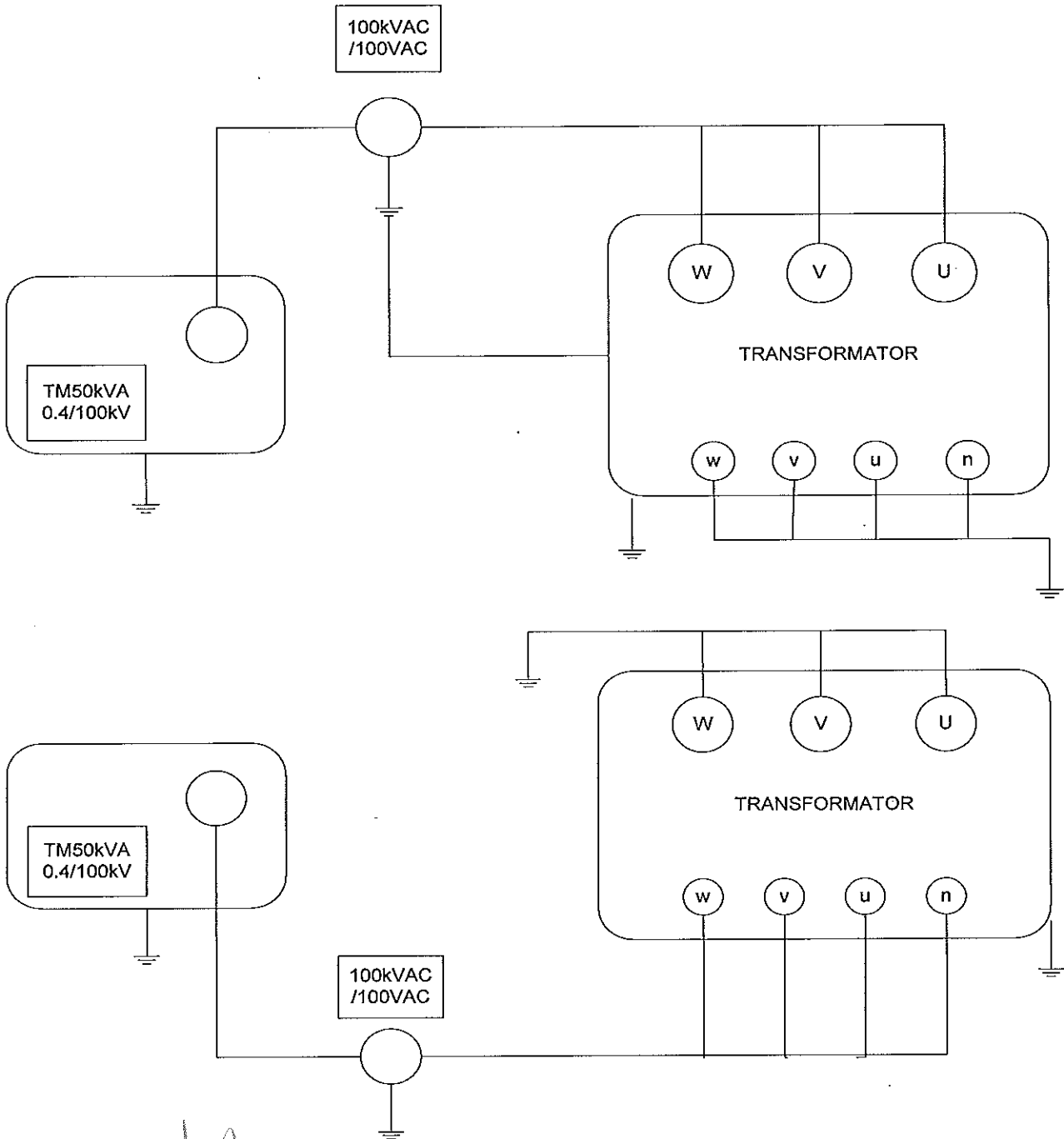
10.5.1 Separate source AC withstand voltage test:

Winding	Earthing	Test voltage, [kV]	Frequency, [Hz]	Test time, [s]
High voltage	LV+tank	50	50	60
Low voltage	HV+tank	3	50	60

Measurements were performed with expanded uncertainty: 3,6% for voltage and the confidence level $P = 95\%$.

M


[Signature]



10.5.2 Induced AC withstand voltage test:

Test voltage $2xU_n$, [V]	Frequency, [Hz]	Test time, [s]
800	150	40

Measurements were performed with expanded uncertainty: 2% for voltage, 0,0016% for frequency and the confidence level $P = 95\%$.

	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/7	
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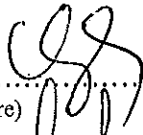
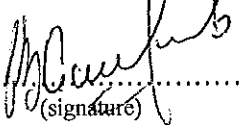
11. Instruments used for the tests:

- Turn ratio meter PWR 3-A serial nr.0928-5305;
- Microohmmeter-MRC6105N-serial nr.0928-5306;
- Wattmeter " Yokogava"-WT1600 serial nr.91J702269;
- Cast resin VT Cl.3.6kV(1500-3000/100V)-VKM24/2/H-serial nr.:
345080101; 345080102; 345080103;
- Cast resin CT(25-300/5A)-AOS-serial nr.: 09195334; 09195335; 09195336;
- Capacitor divider(100V/100kV)- serial nr.1954
- Digital thermometer type HI 8757 serial nr.1203939
- Mechanical chronometer type Slava serial nr.0521682

Notes:

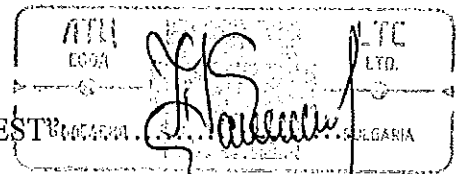
1. The results from the tests are referred for the tested product only.
2. Reproduction or copying of the contents of this report in any other form unless its complete photocopying is not allowed without written consent from LTC-TEST.

TESTED BY:

1. Oleg Tsvetanov:.....
(signature) 
2. Vasil Vasilev:.....
(signature) 




Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)



	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 1	All pages 3
		Revision 0	

TEST REPORT

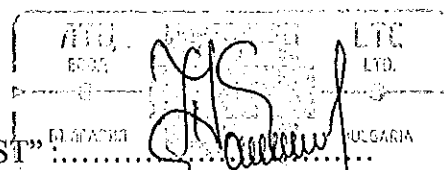
№ 0023-2/09.06.2016

*Certificate of accreditation
reg.№81JH valid until 11.12.2018
issued by Executive Agency "BAS",
according to the requirements of standard
EN ISO/IEC 17025:2006*


1. Three phase oil-immersed transformer, hermetically sealed,
TM 50/20/0.4, Yzn5, №209062, 2016
2. Customer : LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
order 0017/10.05.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-10:2003;
5. Date on which the product was received in test room: 08.06.2016
6. Tests performed:
6.1 Determination of sound levels - (IEC60076-10 cl.11.2)
7. Test date : 09.06.2016
8. Test result: The product passed the tests
9. The report contains: 3 pages
10. Site: Test Room "LTC-TEST", Pernik




Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)



	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 2	All pages 3
		Revision 0	

11. Test result:

Details of transformer

Serial № : 209062 kVA: 50 Voltage: 20000 ± 2x2,5%/ 400

Details of measuring instrument

Brand: Brüel & Kjær Type: 2238 Mediator Serial № : 2684705

Microphone type : 4188 Microphone serial № : 2690664

Test conditions

Feeding voltage: 400V Frequency: 50 Hz

A weighted sound pressure level L_{pA} :

- Oil-immersed transformer - hermetically sealed
- Oil-immersed transformer - with conservator

Measuring position	dB 1	dB 2	dB 3	Measuring position	dB 1	dB 2	dB 3
1	32,5	25,3	31,5	9	33,5	25,7	32,5
2	32,1	24,9	31,1	10	32,7	25,2	31,7
3	32,7	25,1	31,7	11			
4	32,6	25,0	31,6	12			
5	32,3	24,8	31,3	13			
6	32,8	25,2	31,8	14			
7	32,6	25,3	31,6	15			
8	32,2	25,5	31,2	16			


Legend
 1 = Transformer noise
 2 = Background noise
 3 = Transformer correct noise

Arithmetic/energy average : **32,60 dB** on 10 measure points

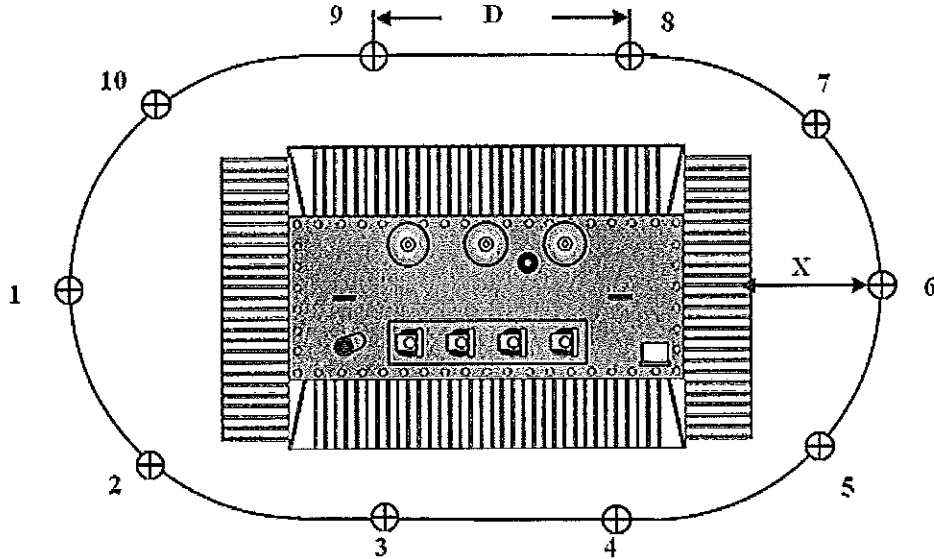
L_{pA}	30,94 dB
L_{wA}	38,04 dB

Environmental correction K **0,6729708**
 Principal prescribed countur 5,11875 m²
 Total area of the surface test room 122,16 m²




	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/10	
	SOUND LEVEL MEASUREMENT	Page 3	All pages 3
		Revision 0	

12. Testing scheme:



Distance X = 0.3m. Distance D = 0.55m. Microphone height from floor: 0,38m

13. Instruments used for the tests:

- Calibrator Sound Level Meter, serial nr.2651663
- Sound Level Meter, serial nr. 2684705
- Measuring Roulette, steel, serial nr. 51217

Notes:

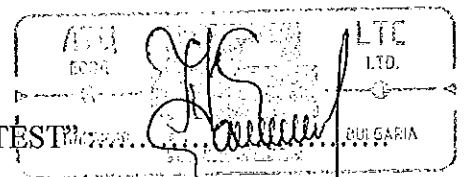
1. The results from the tests are referred for the tested product only.
2. Reproduction or copying of the contents of this report in any other form unless its complete photocopying is not allowed without written consent from LTC-TEST.

TESTED BY :

1. Oleg Tsvetanov:.....
(signature)

2. Vasil Vasilev:.....
(signature)

Head of "LTC-TEST".....



Eng. Katerina Raicheva
(signature and stamp)





СПИСЪК НА ПРОВЕДЕНИТЕ ИЗПИТВАНИЯ

*Сертификат за акредитация
рег.№81ЛН валиден до 11.12.2018 г.
издаден от ИА"БСА", съгласно
изискванията на стандарт
EN ISO/IEC 17025:2006*

- Трифазен маслен трансформатор, херметически затворен,
тип ТМ 250/10, фабричен №208814, година на производство - 2015.
- Заявител на изпитанието: "Леми Трафо" ЕАД; гр.Перник, ул. Владайско въстание №1,
заявка № 0007/14.03.2016г.
- Производител: "Леми Трафо" ЕАД; гр.Перник, ул. Владайско въстание №1.
- Технически данни:

Обозначение	ТМ250/10	
Номинална мощност (kVA)	250	
Честота (Hz)	50	
Номинално напрежение (V)	ВН	10000
	НН	400
Загуби на (W)	Празен ход	300
	Късо съединение към 75°C	3250
Напрежение на късо съединение - (%)	4	
Схема и група на свързване	Dyn5	
Регулационни отклонения на страна ВН	± 2 x 2.5%	
Изоляционен клас	ВН	12 kV (28 kV rms / 75 kV peak)
	НН	1.1kV (3kV rms / - kV peak)
Охлаждане	ONAN , казан с ребра	
Надморска височина	<1000 m	

- Дата на получаване на продукта за изпитване в лабораторията: 20.05.2016г.
- 
- 



6. Извършени изпитвания:

6.1. Рутинен тест:

- 6.1.1. Измерване на коефициента на трансформация и група на свързване - (IEC 60076-1:2011-cl.11.3);
- 6.1.2. Измерване на активното съпротивлението на намотките с постоянен ток - (IEC 60076-1:2011-т.11.2);
- 6.1.3. Измерване на загубите и тока на празен ход - (IEC 60076-1:2011-cl.11.5);
- 6.1.4. Измерване на загубите и напрежението на късо съединение - (IEC 60076-1:2011-cl.11.4);
- 6.1.5. Диелектрични изпитвания - (IEC 60076-3:2013)
 - 6.1.5.1. Изпитване на изолацията с напрежение, приложено от външен източник (IEC 60076-3:2013-т.10);
 - 6.1.5.2. Изпитване на изолацията с индуктирано напрежение - (IEC 60076-3:2013-т.11.2);

6.2. Типов тест:

- 6.2.1. Определяне на звуковото ниво - (IEC 60076-10:2005);

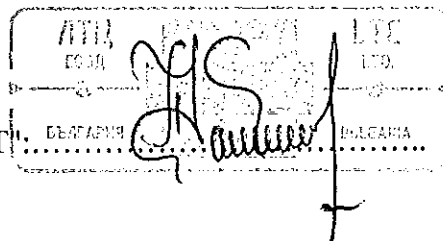
7. Период на изпитване: 06.04.2016г.

8. Резултат от изпитванията: **Продуктът „Трифазен маслен трансформатор, херметически затворен” тип ТМ 250/10, фабричен № 208814, премина успешно изпитанията.**


Резултати от изпитанията са включени в тестови протоколи: № 0013-1/06.04.2016;
№ 0013-2/06.04.2016;

9. Списъка от изпитванията съдържа 2 страници.

РЪКОВОДИТЕЛ НА "ЛТЦ-ТЕСТ"



инж. Катерина Райчева
(подпис и печат)

	TEST LABORATORY "LTC - TEST" TO "LTC" Ltd.	FC 5.10 – 1/7	
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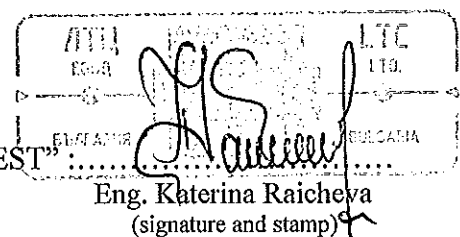
TEST REPORT

№ 0013-1/06.04.2016

*Certificate of accreditation
reg.№81JII valid until 11.12.2018
issued by Executive Agency "BAS",
According to the requirements of standard
EN ISO/IEC 17025:2006*

1. Three phase oil-immersed transformer, hermetically sealed,
TM 250/10/0.4, Dyn5, №208814, 2015r.
2. Customer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
Order 0007/14.03.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA, 1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-1:2011;
IEC 60076-3:2013;
5. Date on which the product was received in test room: 05.04.2016
6. Tests performed:
 - 6.1. Measurement of voltage ratio and check of phase displacement
(IEC 60076-1:2011- cl.11.3);
 - 6.2. Measurement of winding resistance (IEC 60076-1:2011-cl.11.2);
 - 6.3. Measurement of no-load losses and current (IEC 60076-1:2011-cl.11.5);
 - 6.4. Measurement of short circuit impedance and load losses
(IEC 60076-1:2011-cl.11.4);
 - 6.5. Dielectric routine tests (IEC 60076-3:2013)
 - 6.5.1. Separate source AC withstand voltage test (IEC 60076-3:2013-cl.10);
 - 6.5.2. Induced AC withstand voltage test (IEC 60076-3:2013-cl.11.2);
7. Test date: 06.04.2016
8. Test result: The product passed the tests
9. The report contains: 7 pages

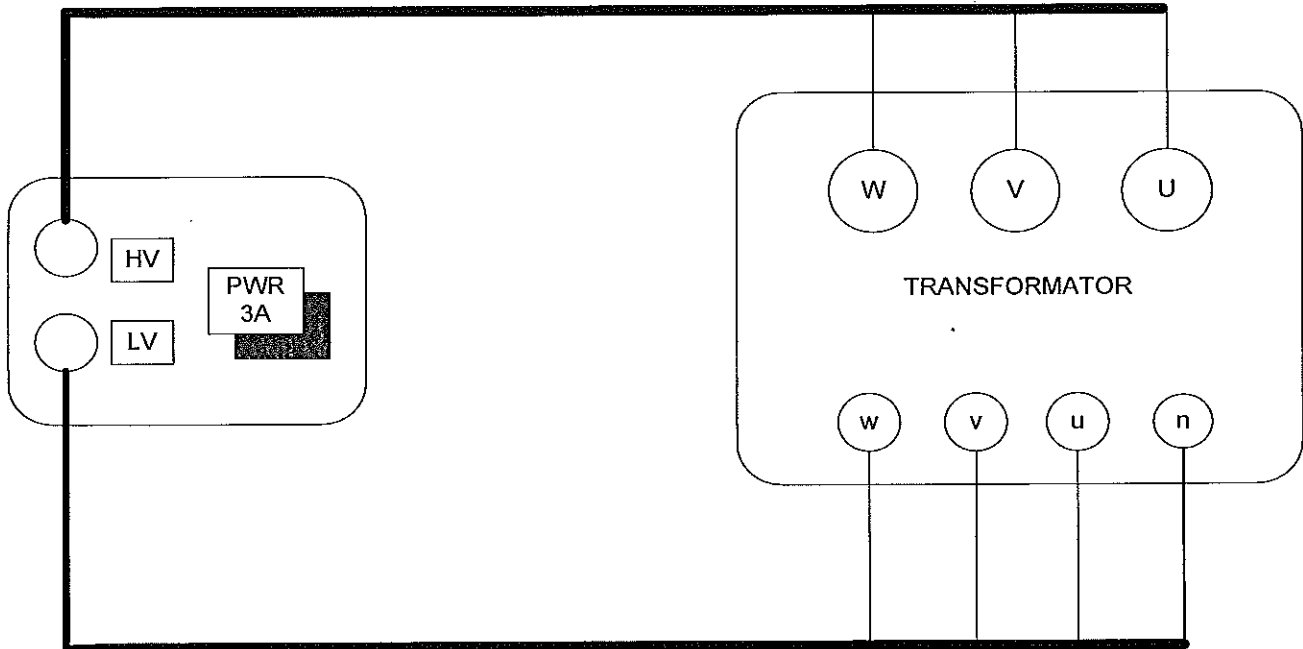
Head of "LTC-TEST"



 Eng. Katerina Raicheva
 (signature and stamp)

10. Test results:

10.1. Measurement of voltage ratio (10000/400V) and check of phase displacement:

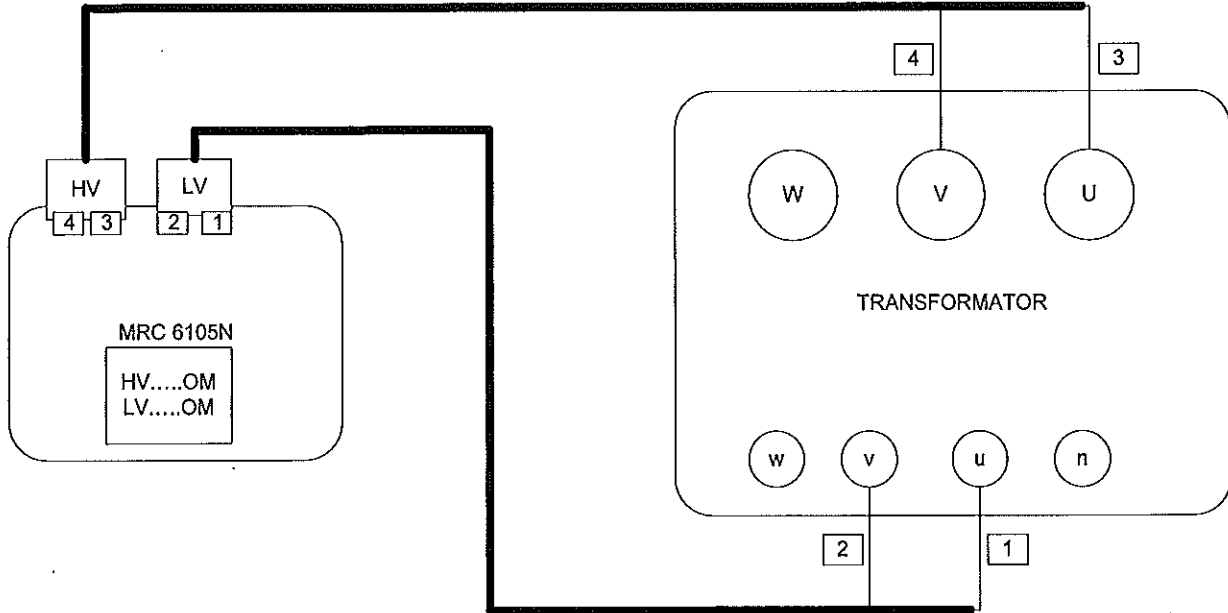


Tap changer position	Phase A	Transformation coefficient's error, %	Phase B	Transformation coefficient's error, %	Phase C	Transformation coefficient's error, %	Vector group
1	45,475	0,02	45,505	0,09	45,491	0,05	Dyn5
2	44,389	0,01	44,389	0,01	44,399	0,03	
3	43,311	0,02	43,289	-0,03	43,289	-0,03	
4	42,209	-0,02	42,203	-0,04	42,225	0,01	
5	41,181	0,11	41,193	0,14	41,181	0,11	

Measurements were performed with expanded uncertainty of 3% and the confidence level P = 95%.



10.2 Measurement of winding resistance:



Tap changer position	R_{U-V}, Ω	R_{U-w}, Ω	R_{v-w}, Ω	Temperature during test 18°C	
				R_{u-v}, Ω	
1	-	-	-	0,005776	
2	-	-	-	0,005816	
3	4,233	4,233	4,242	0,00578	
4	-	-	-		
5	-	-	-		

Measurements were performed with expanded uncertainty 0,5% and the confidence level $P = 95\%$.

10.3 Measurement of no-load losses and current:

Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	399,08	400,83	400,38	0,928	0,6532	0,9474	134,2	73	82,1

U _{av.} [V]	I _{av.} [A]	P _{o tot.} [W]	I _o [%]
400,1	0,84287	289	0,23

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level $P = 95\%$.



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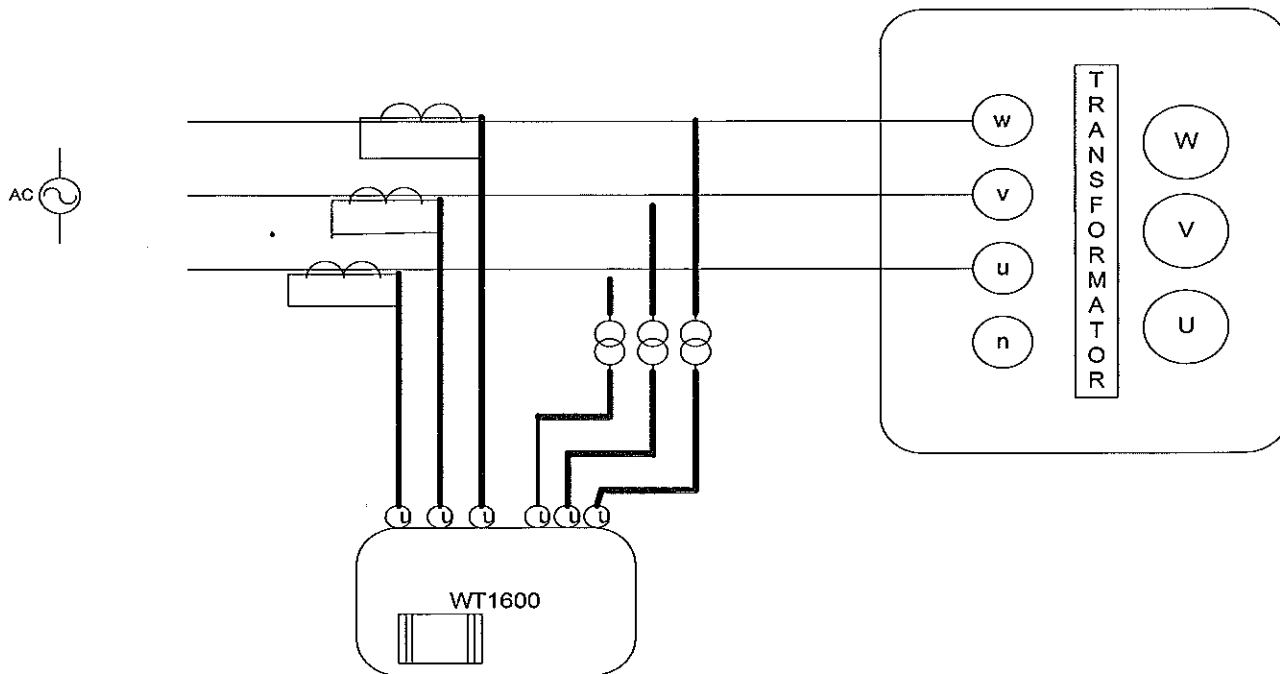
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10.4 Measurement of short circuit impedance and load losses at temperature 18 °C:

Tap changer position	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	P1 [W]	P1 [W]	P1 [W]
3	359,4	360,2	360,6	13,061	12,915	13,12	724	678	690

Measurements were performed with expanded uncertainty: 2% for voltage, 2,5% for current, 3% for power and the confidence level P = 95%.

Uav. [V]	Iav. [A]	ΣP [W]	Pk ^{75°C} [W]	Uk ^{75°C} [%]
360,067	13,032	2092	3099	4,05



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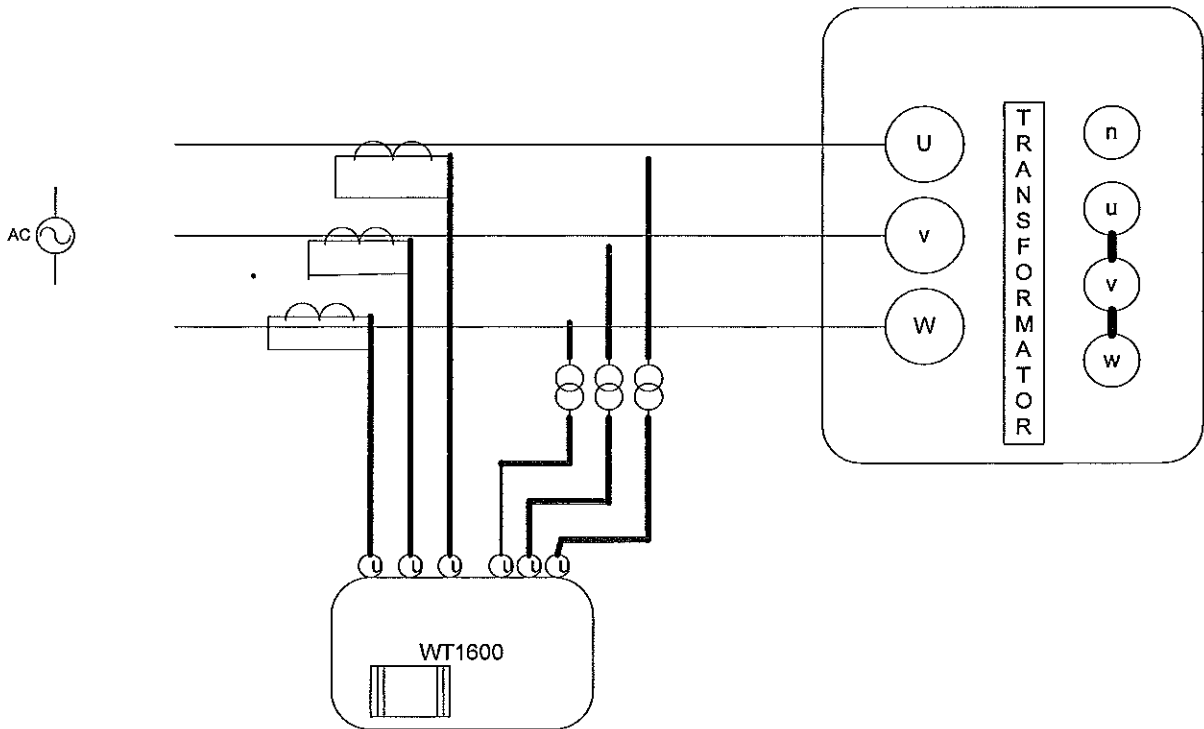
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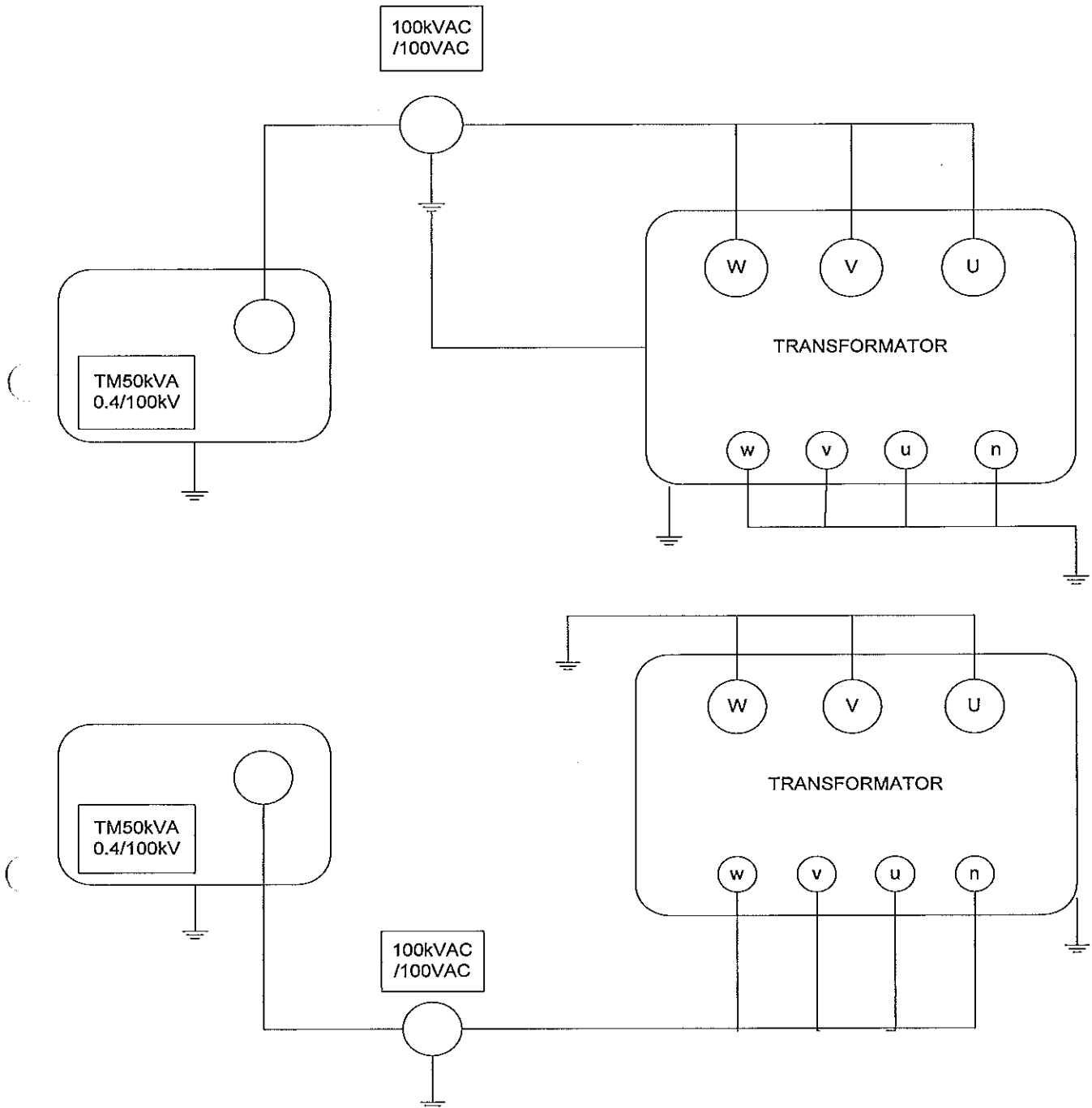


10.5 Dielectric routine tests:

10.5.1 Separate source AC withstand voltage test:

Winding	Earthing	Test voltage, [kV]	Frequency, [Hz]	Test time, [s]
High voltage	LV+tank	28	50	60
Low voltage	HV+tank	3	50	60


Measurements were performed with expanded uncertainty: 3,6% for voltage and the confidence level $P = 95\%$.



10.5.2 Induced AC withstand voltage test:

Test voltage $2xU_n$, [V]	Frequency, [Hz]	Test time, [s]
800	150	40

Measurements were performed with expanded uncertainty: 2% for voltage, 0,0016% for frequency and the confidence level $P = 95\%$.

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11. Instruments used for the tests:

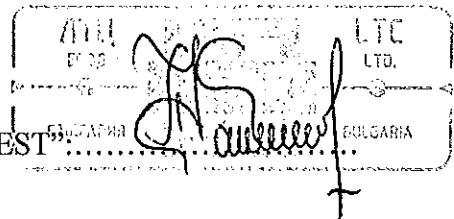
- Turn ratio meter PWR 3-A serial nr.0928-5305;
- Microohmmeter-MRC6105N-serial nr.0928-5306;
- Wattmeter " Yokogava"-WT1600 serial nr.91J702269;
- Cast resin VT Cl.3.6kV(1500-3000/100V)-VKM24/2/H-serial nr.:
345080101; 345080102; 345080103;
- Cast resin CT(25-300/5A)-AOS-serial nr.: 09195334; 09195335; 09195336;
- Capacitor divider(100V/100kV)- serial nr.1954
- Digital thermometer type HI 8757 serial nr.1203939
- Mechanical chronometer type Slava serial nr.0521682

- Notes:**
1. The results from the tests are referred for the tested product only.
 2. Reproduction or copying of the contents of this report in any other form unless its complete photocopying is not allowed without written consent from LTC-TEST.

TESTED BY:

1. Oleg Tsvetanov:.....
(signature)
2. Vasil Vasilev:.....
(signature)


Head of "LTC-TEST".....



Eng. Katerina Raicheva
(signature and stamp)

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	SOUND LEVEL MEASUREMENT	Page 1	All pages 3
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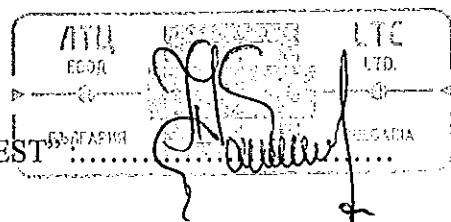
TEST REPORT

№ 0013-2/06.04.2016

*Certificate of accreditation
reg. №81JIII valid until 11.12.2018
issued by Executive Agency "BAS",
according to the requirements of standard
EN ISO/IEC 17025:2006*

1. Three phase oil-immersed transformer, hermetically sealed,
TM 250/10/0.4, Dyn5, №208814, 2015
2. Customer : LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
order 0007/14.03.2016
3. Manufacturer: LEMI TRAF0 JSC, 2304 Pernik, BULGARIA ,1 Vladaisko vastanie Street
4. Test methods used : IEC 60076-10:2003;
5. Date on which the product was received in test room: 05.04.2016
6. Tests performed:
6.1 Determination of sound levels - (IEC60076-10 cl.11.2)
7. Test date : 06.04.2016
8. Test result: The product passed the tests
9. The report contains: 3 pages
10. Site: Test Room "LTC-TEST", Pernik

Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)

11. Test result:

Details of transformer

Serial № : 208814 kVA: 250 Voltage: 10000 ± 2x2,5%/ 400

Details of measuring instrument

Brand: Brüel & Kjær Type: 2238 Mediator Serial № : 2684705

Microphone type : 4188 Microphone serial № : 2690664

Test conditions

Feeding voltage: 400V Frequency: 50 Hz

A weighted sound pressure level \overline{LpA} :

- Oil-immersed transformer - hermetically sealed
- Oil-immersed transformer - with conservator

Measuring position	dB 1	dB 2	dB 3	Measuring position	dB 1	dB 2	dB 3
1	38,2	25,2	38,2	9	38,3	25,6	38,3
2	38,6	25,2	38,6	10	38,9	25,3	38,9
3	38,7	25,4	38,7	11			
4	38,0	25,3	38,0	12			
5	38,4	25,2	38,4	13			
6	38,8	25,2	38,8	14			
7	38,6	25,1	38,6	15			
8	37,8	25,4	37,8	16			


Legend
 1 = Transformer noise
 2 = Background noise
 3 = Transformer correct noise

Arithmetic/energy average : **38,43 dB** on 10 measure points

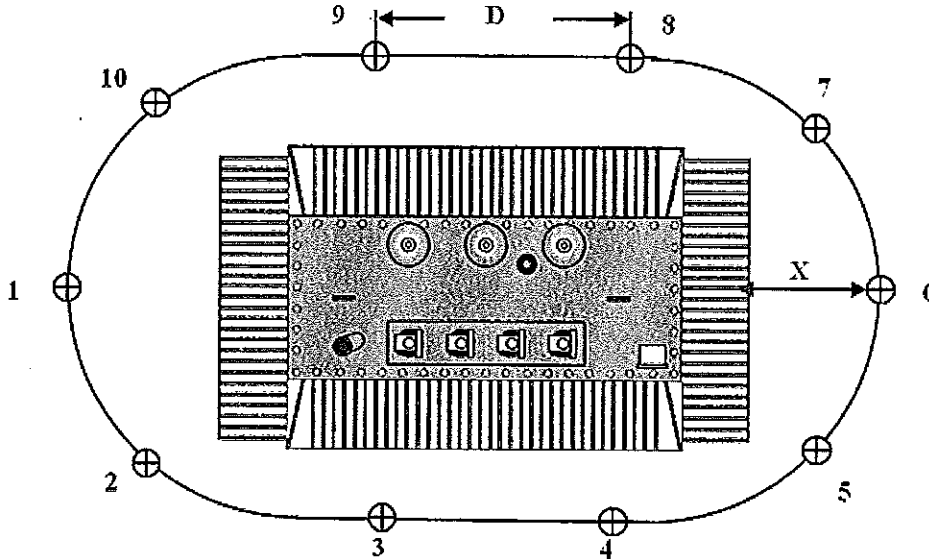
\overline{LpA}	37,56 dB
LwA	45,92 dB

Environmental correction K **0,8793289**
 Principal prescribed countur 6,854 m²
 Total area of the surface test room 122,16 m²




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12. Testing scheme:



Distance X = 0.3m. Distance D = 0.60m. Microphone height from floor: 0,46m

13. Instruments used for the tests:

- Calibrator Sound Level Meter, serial nr.2651663
- Sound Level Meter, serial nr. 2684705
- Measuring Roulette, steel, serial nr. 51217

Notes:

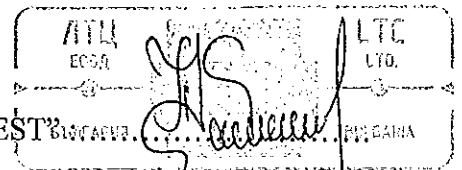
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TESTED BY :

1. Oleg Tsvetanov:.....
(signature)

2. Vasil Vasilev:.....
(signature)

Head of "LTC-TEST"



Eng. Katerina Raicheva
(signature and stamp)