LAMPIRAN-LAMPIRAN

LAMPIRAN 1. DATA SHEET ALAT PENGUJIAN MINYAK ISOLASI TRAFO

Heating mantle for flasks "Fibroman-C"

DUAL HEATING POWER.

With power heating switch selector

FEATURES

Two position isolated rocker switch heating control with power on indicator lamp.

TECHNICAL DESCRIPTION

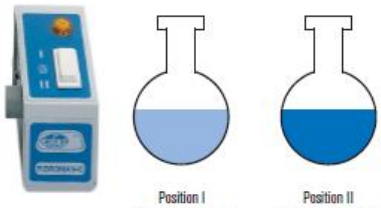
- DUR ALLOY aluminium exterior case with epoxy coating.
- Suspended mineral wool woven heating mantle.
- Heating element homogeneously distributed throughout the woven mantle.
- Thermally insulated case, mineral wool fibre insulation.
- Nickel connectors.
- Retort stand clamp at the back of the unit.
- To prevent breakage or spills a drain hole is provided at the bottom of the mantle.
- Safety earth connection.

MODELS

Part No.	Flask capacity ml	Flask Ø approx. mm	Ø / Height (exterior) cm		Power W	Weight Kg
3003141	100	65	16	11	130	1
3003142	250	83	18	11	130	1,1
3003145	500	102	20	12	270	1,2
3031410	1000	132	22	13,5	410	1,4
3031420	2000	170	26	14	530	2
3031430	3000	190	29	18	620	2,2
3031450	5000	222	33	19	840	3,2
3314100	10000	290	38	22	1400	4,7
3314200*	20000	365	48	26	2300	11

* The mantle part no. 3314200 supplied without the 2 position controller and switch. See Accessories on (page 230) and Regulators and controllers (pages 293 and 294).

CROSS SECTION OF HEATED FLASKS



Position I
50% power output.

Position II
100% power output.

ACCESSORY

Support bar Dur-Aluminium of 12 Ø x 700 mm long.
Part No. 6000270

FIBROMAN - C

OTS100AF, OTS80AF and OTS60AF
Laboratory oil testers

- **Laboratory instruments for measuring insulating oil breakdown voltage**
- **Lock in precision – oil vessel with lockable adjustment**
- **Bright 3.5" colour display visible out doors**
- **Suitable for mineral, ester and silicon oils**
- **Trip detection circuit with direct measurement of voltage and current**
- **Ultra fast (< 10 us) HV switch off time**

DESCRIPTION

Megger's automatic laboratory oil test sets perform accurate breakdown voltage tests on mineral, ester and silicon insulating liquids. Moulded test vessels give repeatable results with lock in precision electrode gap setting adjustment wheels. The transparent, shielded lid and large test chamber enable easy access to the test vessel.

All three laboratory models are fitted with a 12 key alpha-numeric keypad to facilitate entry of test ID, filenames, notes etc. Alpha characters are entered by repetitive pressing on a key, the same way as text is entered modern cellular telephones.

Test standards are preloaded in the instrument and new versions can be uploaded via USB flash drive. All laboratory models support the creation of user defined custom tests. Test results are identified either by a serial number or asset ID and are time and date stamped. Megger's asset and data management software, PowerDB Lite, is bundled at no extra cost providing an excellent tool for downloading and printing results.

An optional internal printer provides a hard copy of results. Ink based printouts ensures durability at all temperatures. USB interfaces (x3) support PC connection, USB flash drive, external USB printer and barcode scanner.

User safety is paramount and Megger have designed independent and dual redundant high voltage cut-off circuitry to ensure safety. During a test the operator can terminate by pressing any button on the keyboard which will remove high voltage immediately and abort the test. The transparent lid provides ample visibility within the chamber yet is protected and electrically shielded by a screen with multiple links to instrument ground.

FEATURES AND BENEFITS

- Test voltages : 60 kV, 80 kV and 100 kV
- Lock in precision oil vessel - lockable gap setting
- Flat electrode gap gauges that will not damage electrodes
- Automatic oil temperature measurement
- QVGA colour display with backlight visible in sunlight
- Large, easy clean test chamber with oil drain
- High visibility test chamber
- Safe operation with dual redundant micro switch
- Intuitive user interface

OPTIONAL FEATURES

- Internal printer
- Motorised lid impeller
- Voltage check unit (VCM100D)
- Transport case

APPLICATION

Monitoring and maintenance of oil quality is essential in ensuring the reliable operation of oil filled electrical equipment. Codes of practice have been established in many countries that include several different types of test on insulating oils.

One of the fundamental tests of oil quality is the breakdown voltage test, which is a measure of the oil's ability to withstand electric stress. A low breakdown voltage can indicate the presence of contaminants such as water or conducting particles.

Care should be taken to ensure the process of sampling oil and subsequent testing does not in any way contaminate it with foreign objects. Cleaning vessels between oil tests should be a rinse with the next sample, never clean with fibrous materials. To ensure an accurate reading set gap carefully and lock adjusting wheels.

MEGGER OTS 100 AF

SPECIFICATIONS

Test voltage

OTS60AF	-50 to +50 kVrms
OTS80AF	-60 to +60 kVrms
OTS100AF	-50 to +50 kVrms

Voltage resolution and accuracy
0.1 kV ±1% ±2 digits

Programmed test sequences
ASTM D 1816-04
ASTM D 877A-02
ASTM D 877B-02
IEC 60156-95

Vessels 400 ml (standard) 150 ml (option)
Nylon 12 chamber provides precision electrode alignment, adjustment wheels lock electrodes in position, option of 150 ml vessel for low volume oil samples

Temperature sensor resolution
1 °C

Power supply	Line voltage 85 to 265 VAC Line frequency 50/60 Hz
Interfaces	USB 2.0 compatible 2 x USB type-A (Flash drive, printer, other) 1 x USB type-B (PC)

Internal printer (option)
Matrix impact printer
Paper 57.5 mm wide

External printer	Any printer with USB interface and PCL5 driver
Protection	Dual safety micro switches on chamber cover
Display	320 x 240 QVGA colour display with backlight

Environment

Operating temperature	0 °C to +50 °C
Storage temperature	-50 °C to +65 °C
Humidity	80% RH at 40 °C operation 95% RH at 40 °C storage
Altitude	2000 m

Safety
Designed in accordance with IEC61010

EMC
Light industrial IEC 61326-1 Class B, CISPR 22, CISPR 16-1 and CISPR 16-2

Dimensions

All models	580 mm x 420 mm x 290 mm

Weight

All models	50 kg with printer option fitted

400 ml vessel assembly (with electrodes fitted)

VCM100D

MEGGER OTS 100 AF

-Seta Lovibond Color Comparator

LAMPIRAN 2. DATA SHEET MINYAK TRANSFORMATOR NYNAS NITRO LIBRA

STANDARD GRADE

Nytro Libra

Electrical insulating oil

Nytro Libra is an uninhibited transformer oil that conforms to IEC 60296 Edition 4.0. Developed and formulated to deliver solid resistance to oil degradation, Nytro Libra provides good oxidation stability thanks to its natural inhibitors. This increases the possibilities for a longer transformer life with less maintenance.

Designed for heavy duty

This product has been specially developed for use in oil-filled electrical equipment – including power and distribution transformers, rectifiers, circuit breakers and switchgears.

Performance and benefits

Good heat transfer. Thanks to low viscosity and viscosity index, this standard grade offers extremely good heat transfer characteristics, ensuring heat is efficiently removed from core and windings.

Reliable oxidation stability. Developed and formulated to deliver good resistance to oil degradation, this grade also provides good oxidation stability for enhanced transformer life and minimum maintenance.

Very good low temperature properties. Naphthenic characteristics allow the transformer to start at the lowest possible temperature – without using pour point depressants.

High dielectric strength. This insulating oil both meets and exceeds the toughest demands on dielectric strength – when stored and handled correctly.

Product description

Nytro Libra fulfils the requirements for IEC 60296 Edition 4.0 uninhibited oil. Nynas classify this product as a standard grade.

Nytro Libra is rigorously analysed and passes the following corrosion tests:
- ASTM D1275 method B
- IEC 62535
- DIN 51353

In accordance with IEC 60296 Edition 4.0, all additives are declared.

There's more to us than this

We're delighted you chose one of our transformer oils. If you have any questions about other products and services, get in touch with your local Nynas contact. Besides top quality oils, we offer a wide range of services, including rapid delivery worldwide, sample analysis, training, seminars and much more. All you have to do is ask. Find out more at www.nynas.com

PRODUCT DATA SHEET

Nytro Libra

PROPERTY	UNIT	TEST METHOD	SPECIFICATION LIMITS		TYPICAL DATA
			MIN	MAX	
1 - Function					
Viscosity, 40°C	mm^2/s	ISO 3104		12.0	9.5
Viscosity, -30°C	mm^2/s	ISO 3104		1800	1050
Pour point	°C	ISO 3016		-40	-51
Water content	mg/kg	IEC 60814		30	<20
Breakdown voltage					
- Before treatment	kV	IEC 60156	30		40-60
- After treatment	kV	IEC 60296	70		>70
Density, 20°C	kg/dm^3	ISO 12185		0.895	0.877
DDF at 90°C		IEC 60247		0.005	<0.001
2 - Refining/stability					
Appearance		IEC 60296	Clear, free from sediment		complies
Acidity	mg KOH/g	IEC 62021		0.01	<0.01
Interfacial tension	mN/m	EN 14210	40		48
Corrosive sulphur		DIN 51353	non-corrosive		non-corrosive
Potentially corrosive sulphur		IEC 62535	non-corrosive		non-corrosive
Corrosive sulphur		ASTM D 1275 B	non-corrosive		non-corrosive
DBDS	mg/kg	IEC 62697-1		not detectable	not detectable
Antioxidant	wt %	IEC 60666		not detectable	not detectable
Metal passivator additives	mg/kg	IEC 60666		not detectable	not detectable
2-Furfural and related compounds content	mg/kg	IEC 61198		0.05	<0.05
Aromatic content	%	IEC 60590			9
3 - Performance					
Oxidation stability at 120°C,164 h		IEC 61125 C			
Total acidity	mg KOH/g			1.2	0.57
Sludge	wt %			0.8	0.18
DDF at 90°C				0.500	0.063
4 - Health, safety and environment (HSE)					
Flash point, PM	°C	ISO 2719	135		150
PCA	wt %	IP 346		3	<3
PCB		IEC 61619	not detectable		not detectable

Nytro Libra is an uninhibited insulating oil, meeting IEC 60296 Ed.4 (2012) General specifications.

Severely Hydrotreated Insulating Oil
Issuing date: 30/09/2014

LAMPIRAN 3. HASIL DATA PENGUJIAN NILAI JENIS WARNA MINYAK TRANSFORMATOR

Laboratorium Teknologi Minyak Bumi Gas dan Batubara
DEPARTEMEN TEKNIK KIMIA FAKULTAS TEKNIK
UNIVERSITAS GADJAH MADA
Jalan Grafika No. 2 Yogyakarta Telp. 0274 - 6492171 0274 6492170 Fax. 0274 555320
E-Mail : departement@chemeng.ugm.ac.id ; http://chemeng.ugm.ac.id

Laporan Hasil pengujian dibuat untuk :	
Nama	: Sdr. Dimas Septe Ardianta, NIM. 20150120009
Alamat	: Mahasiswa S1 Jurusan Teknik Elektro Fakultas Teknik UMY Yogyakarta
Nomor sampel	: 011/TMBGB/2019
Nama Sampel	: Minyak Isolasi Trafo
Tgl terima sampel	: 8 Maret 2019
Tanggal pengujian	: 12 Maret 2019

LAPORAN HASIL UJI

Nomor : 011/H. 1.17/TK/TMBGB/PM/2019

No.	Jenis Pemeriksaan	Satuan	Hasil Pemeriksaan Minyak Isolasi Trafo	Metode Pemeriksaan
1.	Color ASTM	-	D 8.0	ASTM D 1500
2.	Water Content	% vol	Trace	ASTM D 95

Yogyakarta, 18 Maret 2019

Mengetahui :
Ketua Departemen Teknik Kimia FT UGM

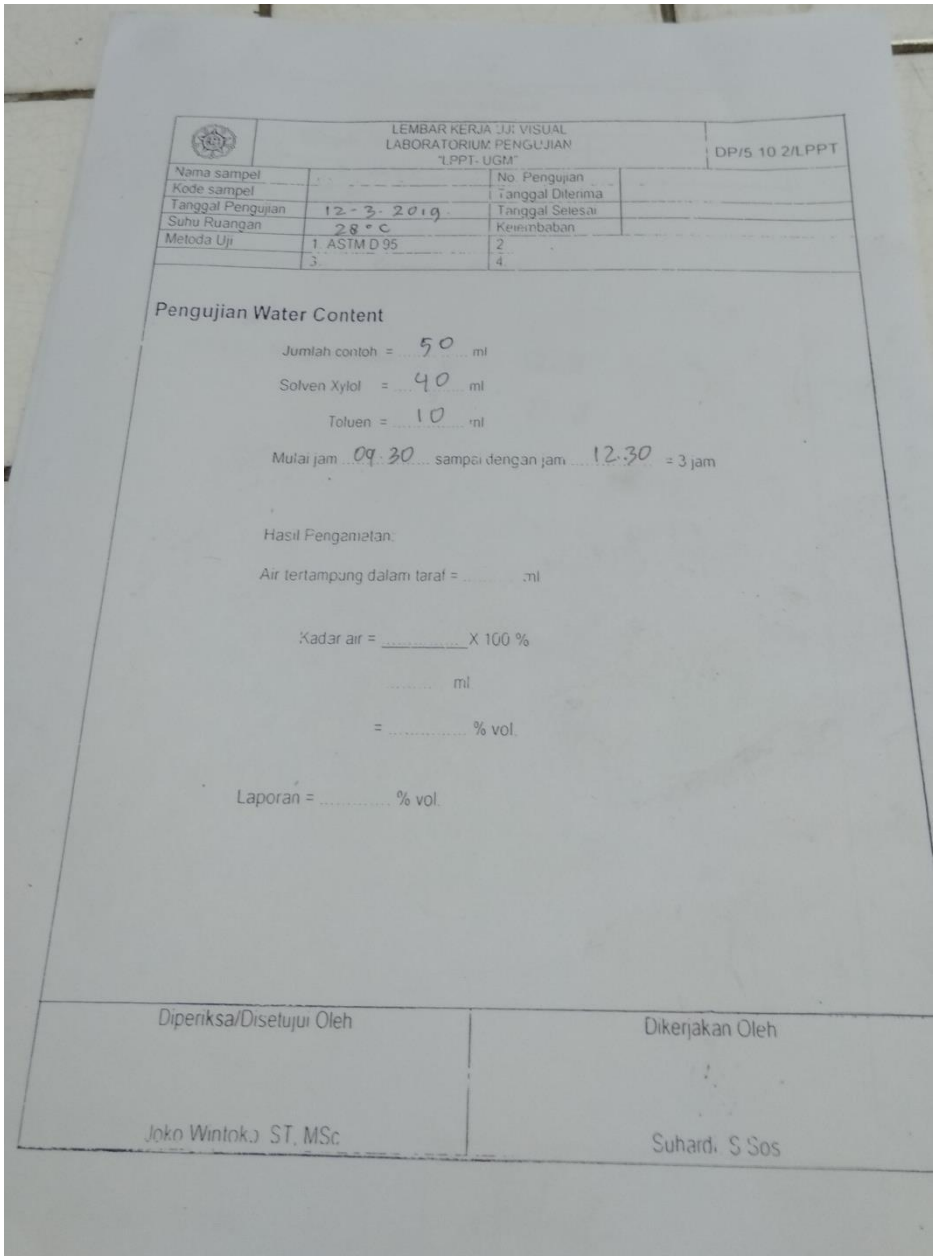
Ir. Moh. Fahrurrozi, M.Sc, Ph.D.
NIP. 19650918 199103 1 002

Kepala,

Muhammad Mufti Azis, S.T. M.Sc. Ph.D
NIP. 19831228 201803 1 001

Hasil pengujian hanya berlaku untuk contoh yang diterima Laboratorium Teknologi Minyak Bumi Gas dan Batubara Departemen Teknik Kimia Fakultas Teknik Universitas Gadjah Mada Yogyakarta

LAMPIRAN 4. HASIL DATA PENGUJIAN KANDUNGAN AIR MINYAK TRANSFORMATOR



LEMBAR KERJA UJI VISUAL
LABORATORIUM PENGUJIAN
"LPPT- UGM"

DP/5 10 2/LPPT

Nama sampel		No. Pengujian	
Kode sampel		Tanggal Diterima	
Tanggal Pengujian	12-3-2019	Tanggal Selesai	
Suhu Ruangan	28°C	Kelembaban	
Metoda Uji	1. ASTM D 95	2	
	3	4	

Pengujian Water Content

Jumlah contoh = 50 ml

Solven Xylol = 40 ml

Toluen = 10 ml

Mulai jam 09.30 sampai dengan jam 12.30 = 3 jam

Hasil Pengamatan:

Air tertampung dalam taraf = ... ml

Kadar air = ... X 100 %

..... ml

= ..... % vol.

Laporan = ... % vol.

Diperiksa/Disetujui Oleh	Dikerjakan Oleh
Joko Wintoko ST. MSc	Suhardi. S Sos

LAMPIRAN 5. HASIL DATA PENGUJIAN TEGANGAN TEMBUS MINYAK TRANSFORMATOR

Megger
OTS100AF
101204306

F/W Version: 1.15
Std. Lib. Version: 0.09

Test Id: OLTC TRF 2

Date: 02/26/2019
Time: 11:19

IEC 60156-95

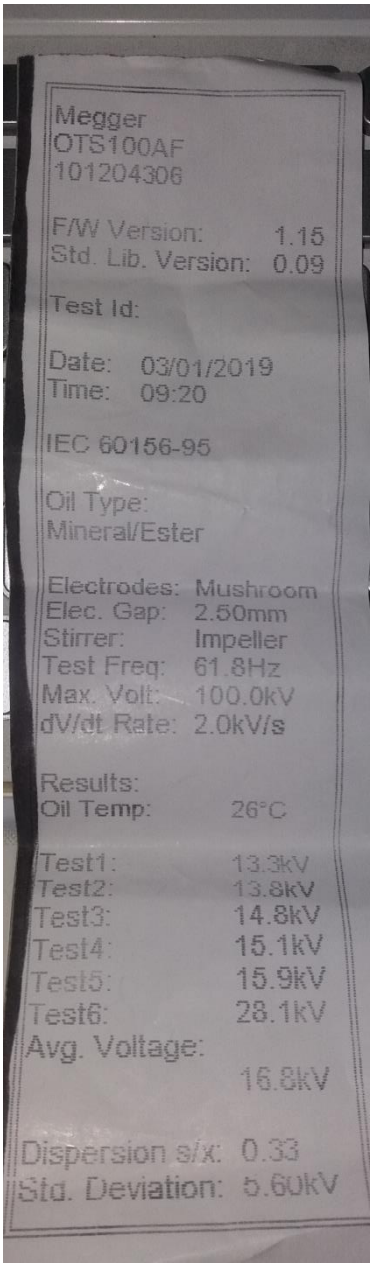
Oil Type:
Mineral/Ester

Electrodes: Mushroom
Elec. Gap: 2.50mm
Stirrer: Impeller
Test Freq: 61.8Hz
Max. Volt: 100.0kV
dV/dt Rate: 2.0kV/s

Results:
Oil Temp: 32°C

Test1: 61.8kV
Test2: 64.9kV
Test3: 69.0kV
Test4: 67.3kV
Test5: 74.1kV
Test6: 65.6kV
Avg. Voltage: 67.1kV

Dispersion s/x: 0.06
Std Deviation: 4.20kV



Megger
OTS100AF
101204306

F/W Version: 1.15
Std. Lib. Version: 0.09

Test Id:

Date: 03/01/2019
Time: 09:20

IEC 60156-95

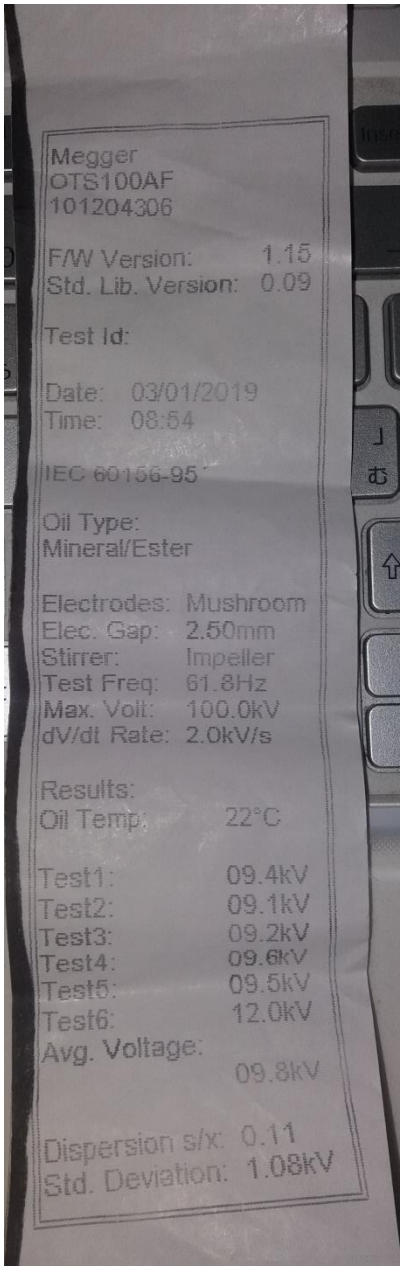
Oil Type:
Mineral/Ester

Electrodes: Mushroom
Elec. Gap: 2.50mm
Stirrer: Impeller
Test Freq: 61.8Hz
Max. Volt: 100.0kV
dV/dt Rate: 2.0kV/s

Results:
Oil Temp: 26°C

Test1: 13.3kV
Test2: 13.8kV
Test3: 14.8kV
Test4: 15.1kV
Test5: 15.9kV
Test6: 28.1kV
Avg. Voltage: 16.8kV

Dispersion s/x: 0.33
Std. Deviation: 5.60kV



Megger
OTS100AF
101204306

F/W Version: 1.15
Std. Lib. Version: 0.09

Test Id:

Date: 03/01/2019
Time: 08:54

IEC 60156-95

Oil Type:
Mineral/Ester

Electrodes: Mushroom
Elec. Gap: 2.50mm
Stirrer: Impeller
Test Freq: 61.8Hz
Max. Volt: 100.0kV
dV/dt Rate: 2.0kV/s

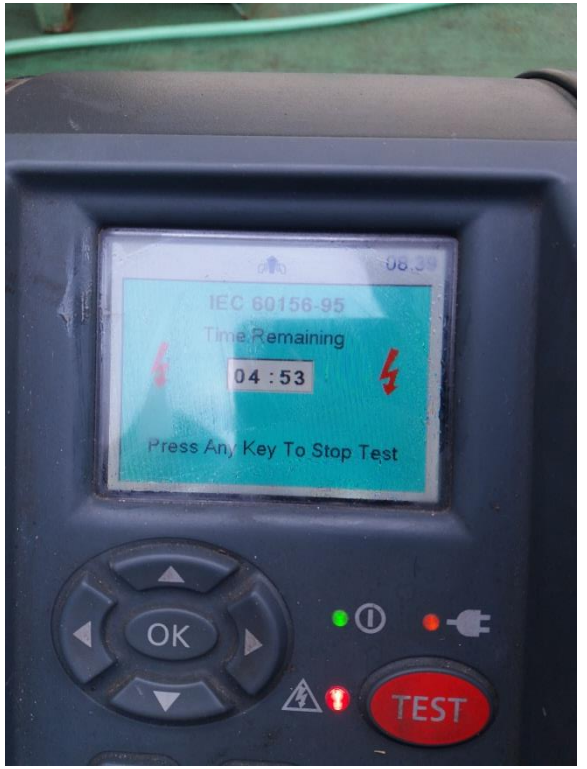
Results:
Oil Temp: 22°C

Test1: 09.4kV
Test2: 09.1kV
Test3: 09.2kV
Test4: 09.6kV
Test5: 09.5kV
Test6: 12.0kV
Avg. Voltage: 09.8kV

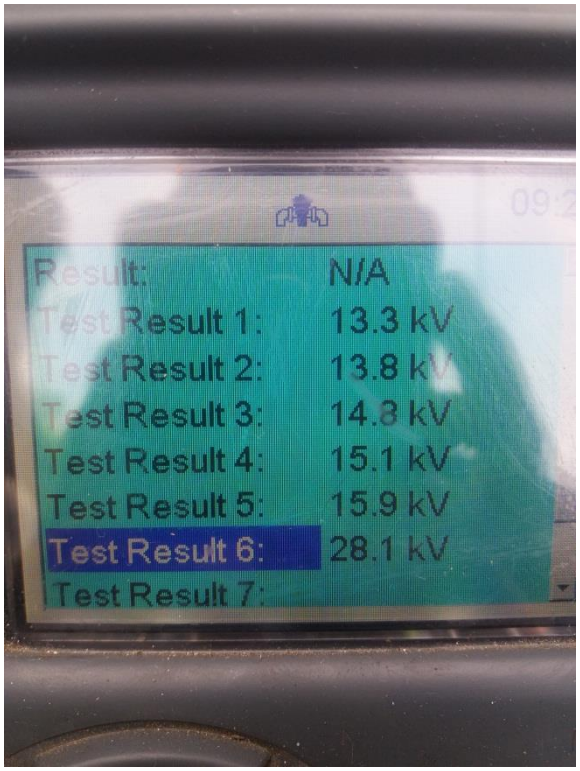
Dispersion s/x: 0.11
Std. Deviation: 1.08kV

Print Out Hasil Pengujian Tegangan Tembus Minyak Transformator Nynas Nitro Libra

LAMPIRAN 6. DOKUMENTASI



Pengujian Tegangan Tembus Minyak Isolasi Bekas Transformator



Tampilan Layar Megger Saat Pengujian Tegangan Tembus

Penyerahan Sampel Minyak Bekas



Pengujian Jenis Warna Minyak Isolasi Bekas Transformator


Pengujian Kandungan Air Minyak Isolasi Bekas Transformator

LAMPIRAN 7. SURAT-SURAT

PLN (Persero)
UNIT INDUK TRANSMISI JAWA BAGIAN TENGAH
UNIT PELAKSANA TRANSMISI SALATIGA
PLN
Jl. Diponegoro 149, Salatiga 50714
Telepon : (0298)323167
Facsimile : (0298)323169
Web : www.pln.co.id

Nomor : 009 /SDM.04.09/UPT SLT/2019
Surat Sdr No : -
Lampiran : 2 (dua) lembar
Sifat : Biasa
Perihal : Persetujuan Ijin Pengambilan Data

20 Februari 2019

KEPADA :
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA
FAKULTAS TEKNIK – JURUSAN TEKNIK ELEKTRO
Jl. Lingkar Selatan, Tamantirto, Kasihan Bantul
YOGYAKARTA 55183

Menjawab surat Saudara No.011/D.2-II/TA-TE/I/2019 tanggal 21 Januari 2019, No.024/D2-II/TA-TE/II/2019 tanggal 6 Februari 2019, No.005/D.2-II/TA-TE/II/2019 tanggal 8 Februari 2019 dan No. 0261/D.2-II/TA-TE/I/2019 tanggal 9 Februari 2019 perihal Permohonan Ijin Penelitian dan Pengambilan Data untuk Tugas Akhir, dengan ini kami beritahukan bahwa pada prinsipnya kami dapat menerima permohonan tersebut untuk melaksanakan Pengambilan Data di Kantor PT PLN (Persero) Unit Induk Transmisi Jawa Bagian Tengah Unit Pelaksana Transmisi Salatiga (penempatan dan jadwal terlampir).

Selama melaksanakan Pengambilan Data Penelitian dimohon untuk mengikuti aturan yang berlaku di PT PLN (Persero) Unit Induk Transmisi Jawa Bagian Tengah Unit Pelaksana Transmisi Salatiga sesuai dengan informasi untuk peserta penelitian (terlampir).

Demikian kami sampaikan, atas perhatiannya diucapkan terima kasih.

PT PLN UNIT INDUK TRANSMISI JAWA BAGIAN TENGAH UNIT PELAKSANA TRANSMISI SALATIGA PERSERO

MANAGER

ANDHY DHARMA SETYAWAN

Model 1001

DAFTAR PENEMPATAN DAN PELAKSANAAN
PENGAMBILAN DATA PENELITIAN
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA FAKULTAS TEKNIK ELEKTRO
DI PT PLN (PERSERO) UNIT INDUK TRANSMISI JAWA BAGIAN TENGAH
UNIT PELAKSANA TRANSMISI SALATIGA

NO	NAMA	NIM	JUDUL	LOKASI PENELITIAN	JADWAL
1	Muhammad Abduh Dahlan	20150120140	Studi Analisa Koordinasi Proteksi Rele Differential dan Rele Overcurrent pada Transformator untuk Menghindari Proteksi Fuilure dengan Menggunakan Software Etap 12.6	GI Bantul	25 Februari – 01 Maret 2019
2	Arief Rahmat Hidayat	20150120135	Analisis Tahanan Isolasi Transformator di Gardu Induk 150 kV Bantul Berdasarkan Hasil Uji Indeks Polarisasi, Tangen Delta, Ratio Tegangan dan Break Down Voltage	GI Bantul	25 Februari – 01 Maret 2019
3	Dimas Septe Ardianta	20150120009	Analisis Pengujian Kadar Kualitas Minyak sebagai Isolasi pada Transformator Berumur 20 Tahun di Gardu Induk Bantul 150 kV	GI Bantul	25 Februari – 01 Maret 2019
4	Akbar Kurbana	20150120080	Analisis Thermovisi untuk Menemukan Hot Point pada Gardu Induk 150 kV Pedan dengan Menggunakan C#	GI Pedan	25 Februari – 01 Maret 2019
5	Dwiki Rachmanto	20150120029	Analisi Nilai Tegangan Sentuh dan Tegangan Langkah pada Gardu Induk 150 kV Kentungan	GI Kentungan	25 Februari – 01 Maret 2019

UMY UNIVERSITAS MUHAMMADIYAH YOGYAKARTA Unggul & Islami | TEKNIK ELEKTRO

Nomor : 026/D.2-II/TA-TE/II/2019
Lamp : -
Hal : **Permohonan Ijin Penelitian dan Pengambilan Data untuk Tugas Akhir**

Kepada Yth

Manager PT. PLN (Persero) UIT JBT UPT Salatiga
Jl. Diponegoro 149 Salatiga, Jawa Tengah

Assalamu'alaikum warahmatullaahi wabarakaatuhu

Dengan hormat,
Sebagai salah satu syarat untuk menyelesaikan studi jenjang S1 di Fakultas Teknik Universitas Muhammadiyah Yogyakarta, setiap mahasiswa diwajibkan melaksanakan Tugas Akhir / Skripsi.

Sehubungan dengan hal tersebut, maka kami selaku Pimpinan Program Studi S1 Teknik Elektro mengajukan permohonan ijin Penelitian Tugas Akhir di PT. PLN (Persero) UIT JBT UPT Salatiga untuk mahasiswa berikut :

Nama Mahasiswa	: **Dimas Septe Ardianta**
Nomor Mahasiswa	: **20150120009**
Program Studi	: S1 Teknik Elektro
Judul TA / Skripsi	: Analisis Pengujian Kadar Kualitas Minyak Sebagai Isolasi Pada Transformator Berumur 20 Tahun Di Gardu Induk Bantul 150 KV

Dosen Pembimbing I : Dr. Ramadoni Syahputra, S.T., M.T.
Dosen Pembimbing II : Muhamad Yusvin Mustar, S.T., M.Eng.

Adapun pelaksanaannya kami harapkan atau pada waktu lain yang sesuai dengan kebijaksanaan Instansi/Perusahaan yang Bapak/Ibu pimpin.

Demikian permohonan ini kami sampaikan, atas perhatian dan perkenannya kami ucapkan terima kasih.

Wassalamu'alaikum warahmatullaahi wabarakaatuhu

Yogyakarta, 9 Februari 2019
Ketua Program Studi

UNIVERSITAS MUHAMMADIYAH YOGYAKARTA FAKULTAS TEKNIK

Dr. Ramadoni Syahputra, S.T., M.T.

Tembusan :
1. Arsip TU
2. Dosen Pembimbing
3. Mahasiswa ybs

ADDRESS
Gedung F.3 Lt. 2 Kampus Terpadu UMY
Jl. Lingkar Selatan, Tamantirto,
Kasihan, Bantul,
Daerah Istimewa Yogyakarta 55183

CONTACT
Phone : +62 274 - 387656 ext.211 (Ruang Pengurus), ext.230 (Lab. & Ruang Dosen)
Fax : +62 274 - 387646
Email : elektro@umy.ac.id