



Penilaian Bahan/Barangan Elektrik: Pematuhan kepada Standard, Spesifikasi & FAT Bahan/Barangan (Tambahan) 11kV Dry-Type Distribution Transformer



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Unit Pensijilan Bahan & Standard
6 Oktober 2020***

Types of Transformers

- Based on insulation and cooling medium:

- ✓ **Oil immersed transformers**

- i. Sealed type transformer

- Hermetically Sealed Totally Oil Filled
 - Sealed type with gas (N₂) cushion

- ii. Breathing type with conservator

- **Oil Immersed Transformer** - use oil as cooling and insulation medium



- ✓ **Dry type transformers**

- i. **Cast Resin**

- ii. Encapsulated Resin

- iii. Vacuum Pressure Impregnated (VPI)

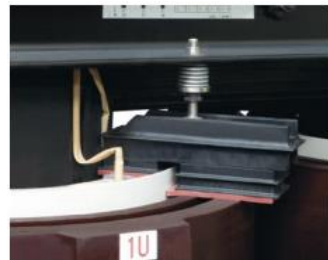
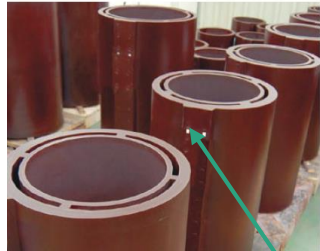
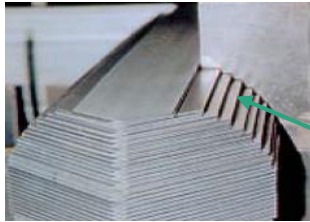
- **Dry Type Transformer** - use air as cooling medium



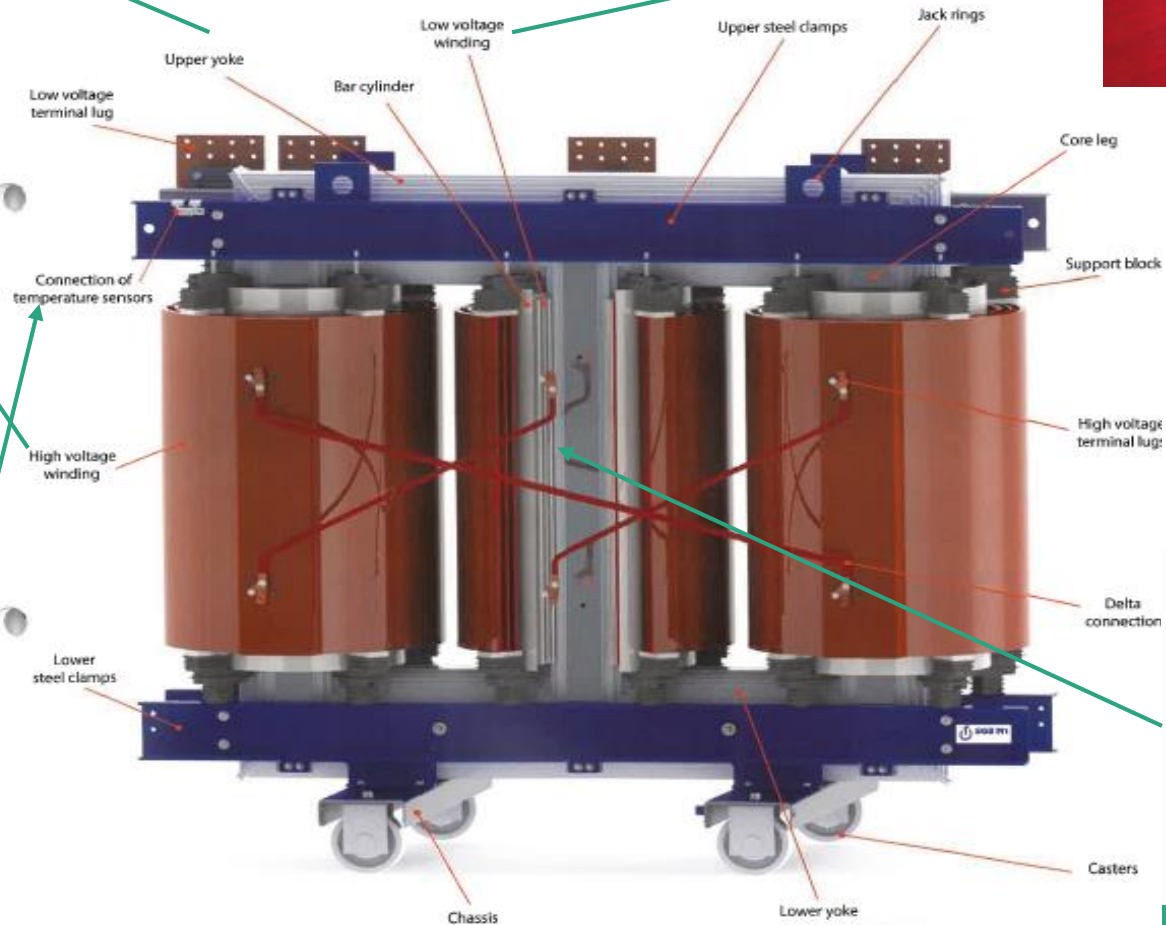
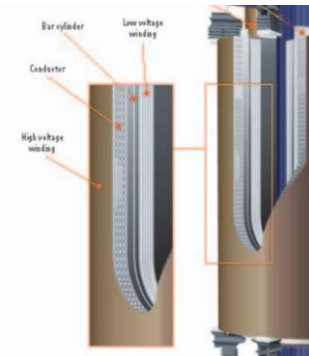
11kV Dry-Type Distribution Transformer

CAST RESIN TRANSFORMER

- KEY COMPONENTS



PTC/PT100 thermo sensor



Standards

- ❑ MS 60076 – 1 : General
- ❑ IEC 60076 – 1 : General
- ❑ IEC 60076 – 2 : Temperature rise
- ❑ IEC 60076 – 3 : Insulation levels, dielectric tests and external clearances in air
- ❑ IEC 60076 – 5 : Ability to withstand short circuit
- ❑ IEC 60076 – 10 : Determination of sound levels
- ❑ MS 60076 – 11 : Dry – type transformers
- ❑ IEC 60076 – 11 : Dry – type transformers

JKR Specification

❑ L-S17 : Specification for 11kV Dry-type Distribution Transformer (JKR Spec.)

Description	Requirement
Electrical system	11kV, 3-phase, 50Hz
Type of transformer	Dry-type cast resin and suitable only for indoor installation
Service condition	<ul style="list-style-type: none">- Minimum E2, C1 and F1 for environmental, climatic and fire behaviour- Maximum ambient temperature at 40°C- Maximum altitude of 1000m above sea level
Voltage ratio	11000/433V
Winding connection and vector group	<ul style="list-style-type: none">- High-Voltage (HV) Winding – Delta-connected- Low-Voltage (LV) Winding – Star-connected with neutral brought out- Vector Group - Dyn11

JKR Specification

Description	Requirement
Losses	The tolerance allows +10% on total losses, and +15% on no-load and load losses, provided that the tolerance for total losses is not exceeded. (Refer to Table 1)
Tapping	Tapping shall be provided on the HV winding by + 5 %, + 2.5 %, 0 %, - 2.5 % and - 5 %.
Insulation levels	<ul style="list-style-type: none">- Test for LV and HV windings shall be applied at three (3) kV and 28 kV respectively.- The Rated Impulse Withstand Voltage test for HV winding shall be applied at 75 kV.
Short-circuit impedance	The short circuit impedance referred to the Tap 3 at a reference temperature of 120 °C shall be in accordance with Table 2 and with tolerance of ± 10 %.
Fault conditions	The transformer shall be designed to carry the full short circuit current of the system, 20 kA for three (3) seconds when operating at full load and the maximum average temperature 350 °C

JKR Specification

Description	Requirement
Temperature rise	Not exceed 100° C
Core and core structure	<ul style="list-style-type: none">- Non-aging cold rolled grain-oriented (CGRO) silicone steel laminations or amorphous steel- Core laminations shall be insulated from each other with a material having high-interlamination insulation resistance- Flux density in the core shall not be more than 1.65 Tesla
Insulation materials	<ul style="list-style-type: none">- Min. insulation system temperature is 155° C (Class F)- HV and LV windings shall be reinforced with glass fiber or quartz powder.
Winding insulation	Winding insulation temperature shall be min.155°C (Class F)
HV windings	<ul style="list-style-type: none">- Conductor material shall be either enamelled copper wire or copper foil.
HV windings	<ul style="list-style-type: none">- Conductor material shall be either copper wire or copper foil.

JKR Specification

Description	Requirement
Cooling channel and coil surfaces	Cooling channels shall be arranged in a vertical manner and all coils shall have an even and smooth surface to minimize any dust accumulation and to give the maximum cooling efficiency.
HV and LV terminals	Located on opposite sides of the upper press beams of the transformer
Earthing terminals	<ul style="list-style-type: none">- Two (2) earthing terminals shall be provided preferably located diagonally opposite on either side of the undercarriage.- Both terminals shall be made from stainless steel and have minimum M10 threads.
Undercarriage	Each transformer shall be equipped with four (4) bi-directional wheels
Rating plate fitted to the transformer	The rating plate shall be made of weatherproof material, fitted in a visible position. The entries on the plate shall be indelibly marked by either engraving, etching, stamping or by a photo-chemical process.

JKR Specification

Description	Requirement
Rating plate fitted to the transformer	<ul style="list-style-type: none">- Each transformer enclosure shall be provided with a rating plate of weatherproof material, fitted in a visible position.- The entries on the plate shall be indelibly marked by either engraving, etching, stamping or by a photo-chemical process.
Overload protection	The transformer shall be equipped with the temperature monitoring devices which are an Overload Protection Sensors and Digital Temperature Controller.
Overload protection sensors	The temperature of each winding shall be determined by one set of measurements (alarm, trip and fan) per phase by means of Platinum Thermal Resistance Sensor, PT 100.
Digital temperature controller	The digital temperature controller shall provide maximum temperature memory, remote alarm connection, trip relay, and manual or automatic fan controls. It shall be provided with remote monitoring on alarm, trip and fan status.

JKR Specification

Description

Enclosures

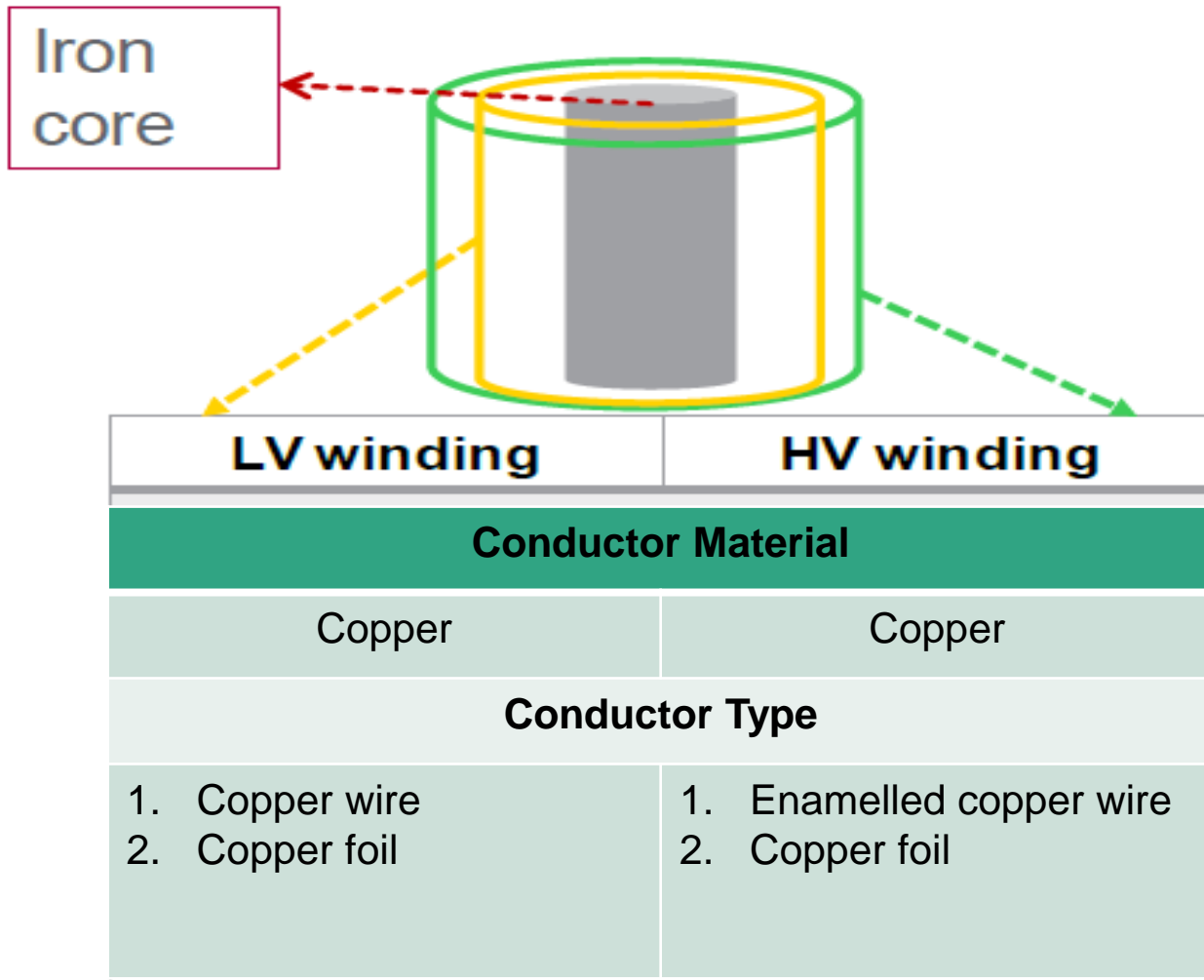


Requirement

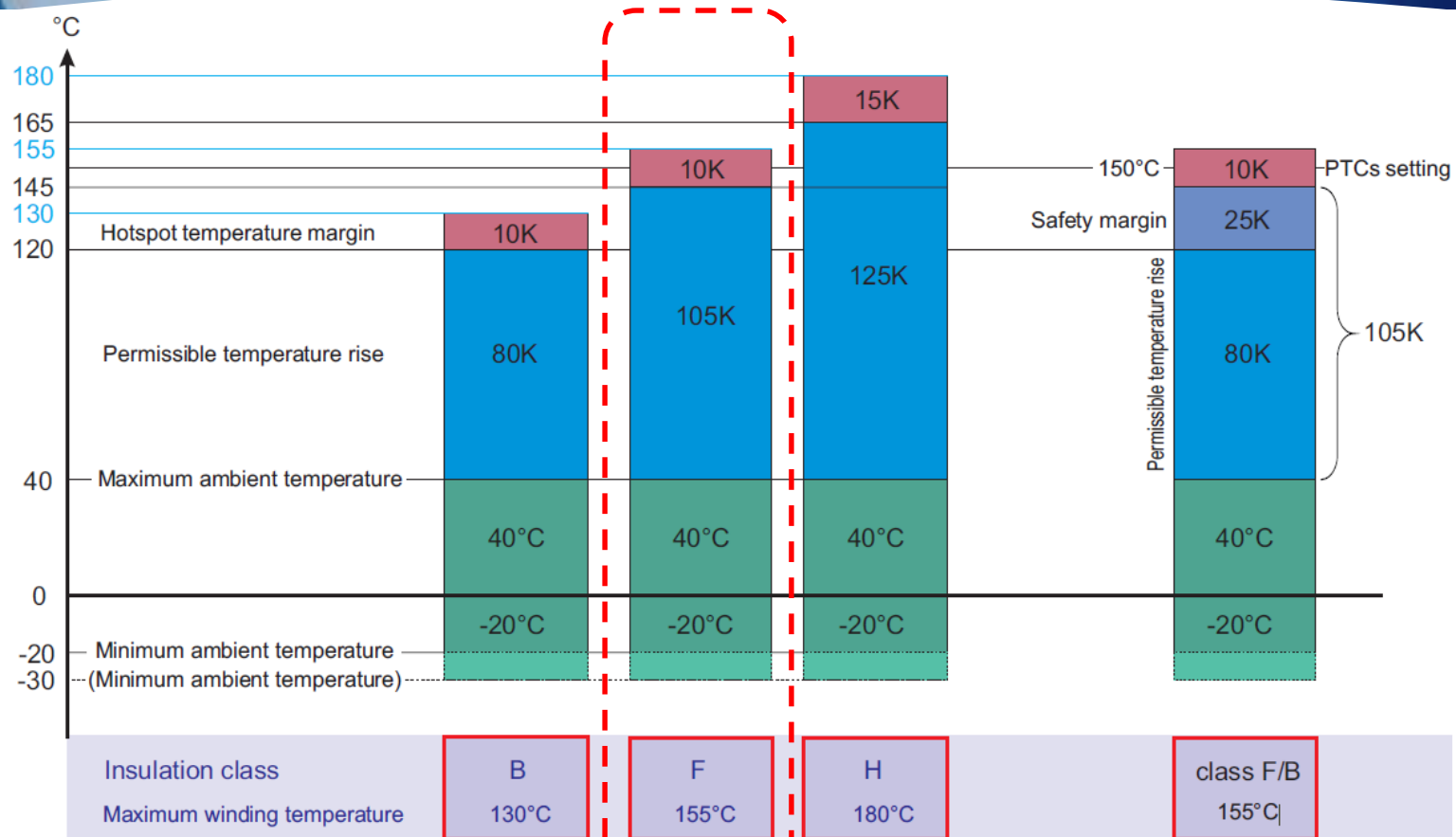
- Fabricated from electrogalvanised sheet steel and finished with epoxy oven baked, naturally ventilated, with a minimum degree of protection of IP 20.
- The enclosures shall be supplied by the transformer manufacturer or the approved fabricator.
- The enclosure shall be fitted with removable panels, for easy reconnection of HV tapplings and assembling of cables.
- Inspection windows of 300 mm x 300 mm with minimum three (3) mm thickness made of transparent polycarbonate material, two (2) numbers on every sides of the enclosure shall be provided.
- The complete assembly of enclosure shall be securely mounted on transformer base frame.
- When the transformers are equipped with enclosures to IP 23 or higher IP, de-rating in accordance with the manufacturer's recommendation shall be applied.
- The minimum clearances between live parts and enclosure shall be 200 mm to prevent flashover.

HV & LV Winding

Windings



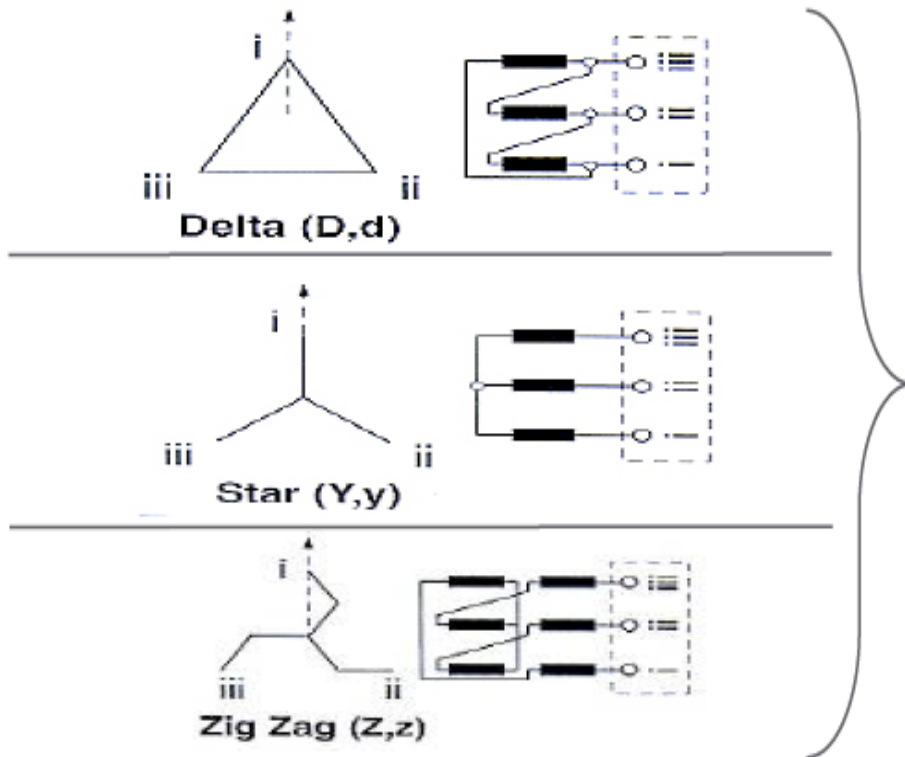
Insulation Materials & Winding Insulation



Minimum

Vector Group

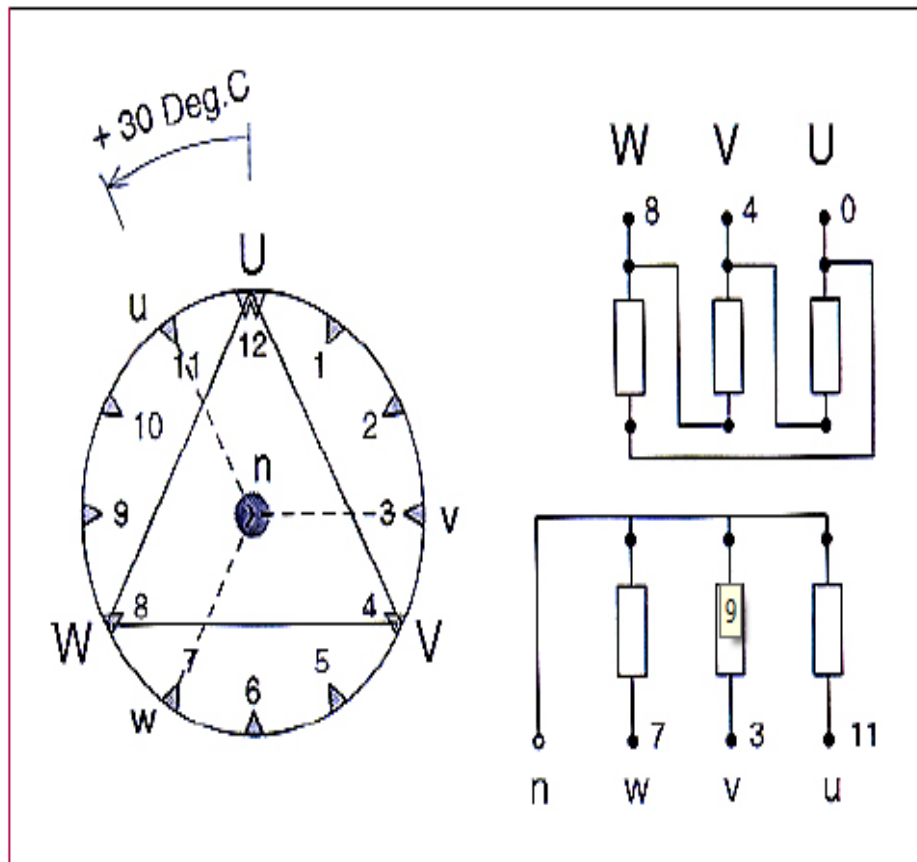
The vector group of a transformer defines the connection of the HV and LV windings



- **1st letters group**: CAPITAL letters
⇒ the higher voltage
if the neutral is brought out : YN or ZN
- **2nd letters group**: small letters
⇒ the lower voltage
if the neutral is brought out : yn or zn
- **3rd letters group**: number
⇒ clock-hour figure, indicating phase displacement between HV and LV windings

JKR Spec. = Dyn11

Vector Group



Dyn11

HV : Delta

LV : Star

Phase Angle = $11 \times 30^\circ = 330^\circ$

Rating Plate fitted to the Transformer

The rating plate shall be made weatherproof material, fitted in a visible position.

The entries on the plate shall be indelibly marked by engraved, etching, stamping or by a photo-chemical process.

The rating plate shall indicate the following;

- Number and year of IEC 60076
- Manufacturer's name
- Manufacturer's serial number
- Year of manufacturer
- Insulation system temperature for each winding.

The first letter shall refer to the HV winding,
the second letter shall refer to LV winding.

- Number of phases
- Rated power for each kind of cooling
- Rated frequency
- Rated voltage including tapping voltages
- Rated current for each kind of cooling
- Connection symbol
- Short-circuit impedance at rated current and at 120 °C
- Type of cooling
- Total mass
- Insulation level
- Degree of protection
- Environmental class
- Climatic Class
- Fire behavior class

AM SGB SDN.BHD.
Arab-Malaysian Industrial Park
71800 Nilai
Negeri Sembilan, Malaysia

Three-phase transformer

INDOOR - DRY TYPE

Type	DTTHIL 2500/10	Serial No	4001338	IEC 60076-11
Rated power	kVA	2500	Year of manufacture	2015
Turn ratio	1	11550	Rated frequency	Hz 50 Hz
	2	11275	Conn. symbol	Dyn 11
	3	11000	Type Cooling	ANAF
	4	10725	Protection class	IP 00
	5	10450	Weight	kg 5520
Rated current	A	131.22 3333.4	Winding Material HV/LV	Cu/Cu
Um	kV	12 1.1	Sound power LwA	dB 71
Insulation level	LI / AC kV	75/28 -/3	Sound press LpA	dB 56
Impedance	%	5.93	Environment class	E2 Climate class C2
Short-Circuit duration max	s		Ins. class HV/LV	F/F Fire class F1
Short-circuit current	kA			

M214301

Types of Testing

☐ Routine test

- i. Measurement of winding resistance
- ii. Measurement of voltage ratio and check of phase displacement
- iii. Measurement of short-circuit impedance and load loss
- iv. Measurement of no-load loss and current
- v. Separate source AC withstand voltage test
- vi. Induce AC withstand voltage test
- vii. Partial discharge measurement

Types of Testing

☐ **Type test**

- i. Lightning impulse test
- ii. Temperature rise test

☐ **Special test**

- i. Measurement of sound level
- ii. Short - circuit test
- iii. Climatic test
- iv. Environmental test
- v. Fire Behaviour test
- vi. Measurement of d.c insulation resistance each winding to earth and between windings

Accredited Laboratory

- ❑ **KEMA = Keuring Elektrotechnische Materialen Arnhem (Dutch: Electrical Testing Materials Arnhem; Arnhem, Netherlands)**
- ❑ **CESI = Centro Elettrotecnico Sperimentale Italiano (Italy)**
- ❑ **KERI = Korea Electrotechnology Research Institute (Korea)**

Test Report

□ Routine test

i. Measurement of winding resistance

Standard and date

Standard

IEC 60076-1, clause 11.1.2

Test date

7 July 2017

Transformer in same condition.

Environmental conditions

Ambient temperature

20 °C

Ambient air pressure

1013 hPa

Humidity

12 g/m³

8.1 Measurement of winding resistance

DC-winding resistances at 19,6 °C					
HV winding (Ω)				LV winding (mΩ)	
Terminals	Tap position			Terminals	
	1	3	5		
A-B	0,2544	0,2414	0,2286	a-b	0,3071
A-C	0,2546	0,2415	0,2287	a-c	0,3100
B-C	0,2545	0,2414	0,2286	b-c	0,3066
Average	0,2545	0,2414	0,2286	Average	0,3079

Requirement

None.

Result

The results are for information only.

$$R = \frac{V}{I}$$

Test Report

- ii. Measurement of voltage ratio and check of phase displacement

8.2 Measurement of voltage ratio and check of phase displacement

Ratio for Dyn11					
Tap position	1	2	3	4	5
Declared ratio	46,20	45,10	44,00	42,90	41,80
Phase 1	46,18	45,09	44,00	42,90	41,82
Phase 2	46,20	45,10	44,01	42,92	41,83
Phase 3	46,28	45,19	44,09	43,00	41,91
Average	46,22	45,13	44,03	42,94	41,85
Deviation from declared ratio (%)	0,04	0,06	0,07	0,09	0,12

Requirement

IEC 60076-1, table 1: for the principal tapping: $\pm 0,5\%$ of declared ratio or $\pm 1/10$ of actual percentage impedance on the principal tapping, whichever is smaller.

$$\text{Deviation} = \frac{(\text{measured turn ratio}) - (\text{expected turn ratio})}{\text{expected turn ratio}} \cdot \%100$$

Result

The measured average voltage ratio on the principal tapping is within the tolerances.
Vector group has been verified and determined Dyn11.

Test Report

- iii. Measurement of short-circuit impedance and load loss

8.3 Measurement of short-circuit impedance and load loss

Load loss and characteristics at θ_{ref} of 120 °C				
Tap position		1	3	5
Load-losses	kW	11,06	11,33	11,63
R_K	Ω	0,37	0,34	0,32
U_R	%	0,55	0,57	0,58
X_K	Ω	3,91	3,49	3,11
U_X	%	5,86	5,77	5,70
Z_K	Ω	3,92	3,51	3,13
U_K	%	5,88	5,79	5,73

Requirement

None.

Result

The results are used for further calculations and are for information only.

Test Report

iv. Measurement of no-load loss and current

8.4 Measurement of no-load loss and current

No-load losses and currents at 110% of rated voltage in tap position: 3						
Phase	U _{rms} V	U' V	I A	I/I _n x 100 %	P W	Po W
a	479,9	477,2	9,10	0,34	1601	-
b	479,5	477,0	7,07	0,27	918	-
c	479,4	476,8	9,47	0,36	1202	-
Average	479,6	477,0	8,55	0,32	-	-
Total					3721	3701

No-load losses and currents at 100% of rated voltage in tap position: 3						
Phase	U _{rms} V	U' V	I A	I/I _n x 100 %	P W	Po W
a	435,1	433,0	4,52	0,17	1041	-
b	434,8	432,3	3,27	0,12	649	-
c	435,1	433,0	4,79	0,18	905	-
Average	435,0	432,8	4,19	0,16	-	-
Total					2596	2582

No-load losses and currents at 90% of rated voltage in tap position: 3						
Phase	U _{rms} V	U' V	I A	I/I _n x 100 %	P W	Po W
a	390,9	389,5	3,78	0,14	810	-
b	390,8	389,2	2,64	0,10	513	-
c	391,1	389,7	3,86	0,14	689	-
Average	390,9	389,5	3,43	0,13	-	-
Total					2011	2004

Note: The no-load losses are calculated with the formula $P_0 = P \left[1 + \frac{U' - U_{RMS}}{U'} \right]$ where $U' = 1,11 \times U_{mean}$

Requirement

None.

Result

The results are for information only.

$$P_0 = P_m \times (1 + d)$$

$$d = \frac{U' - U}{U'} \text{ usually } < 0$$

Test Report

- v. Separate source AC withstand voltage test

8.5 Dielectric routine tests

8.5.1 Applied voltage test (AV)

Tap position	Winding	Applied voltage kV	Duration min	Frequency Hz
3	HV	35	1	50
	LV	3,0	1	50

Requirement

No collapse of the test voltage shall occur.

Result

The object passed the tests.

Test Report

VI. Induce AC withstand voltage test

8.5.2 Induced voltage withstand test (IVW)

Tap position	Winding	Induced voltage phase-to-phase V	Duration min	Frequency Hz
3	LV	866	1	100

Requirement

No collapse of the test voltage shall occur.

Result

The object passed the test.

$$test\ duration\ [s] = 120 \cdot \frac{rated\ frequency}{test\ frequency}$$

Test Report

vii. Partial discharge measurement

8.6 Partial discharge measurement before short-circuit tests

Standard and date

Standard

IEC 60076-11, clause 22.4.1.1

Test date

10 July 2017

Transformer in same condition.

Environmental conditions

Ambient temperature

19 °C

Ambient air pressure

1007 hPa

Temperature of test object

20 °C

Humidity

11 g/m³

Characteristic test data

Calibration

5 pC

Noise level

0,8 pC

Coupling capacitors

2600 pF

Bandwidth

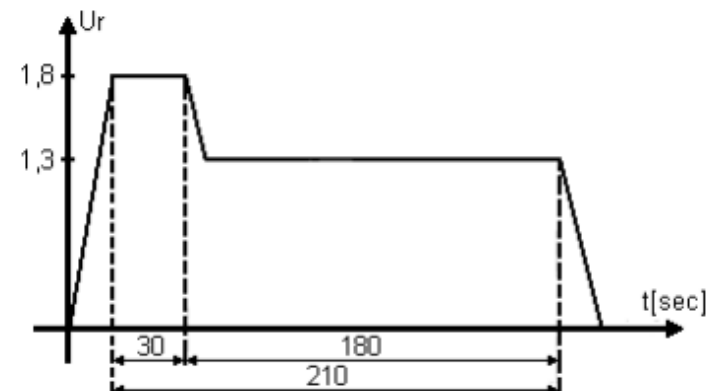
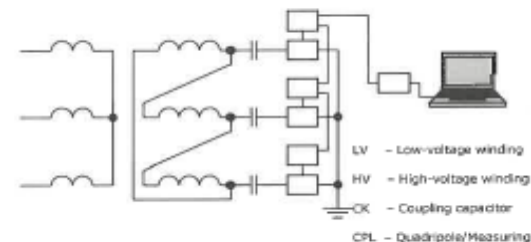
300 kHz

Test frequency

100 Hz

Rated voltage (U_r)

11,0 kV



Phase	Voltage application ¹⁾		Duration s	Partial discharge level pC	Inception		Extinction		Result
	$\dots \times U_r / \sqrt{3}$	Phase-to-earth voltage kV			kV	pC	kV	pC	
A	2,0	12,7	60	N/A	-	N/A	-	N/A	-
	1,3	8,3	180 ²⁾	2	-	2,3	-	2,3	passed
B	2,0	12,7	60	N/A	-	N/A	-	N/A	-
	1,3	8,3	180 ²⁾	3	-	3,0	-	3,0	passed
C	2,0	12,7	60	N/A	-	N/A	-	N/A	-
	1,3	8,3	180 ²⁾	2	-	2,0	-	2,0	passed

¹⁾ The transformer was supplied with a three-phase voltage on the LV winding.

²⁾ The partial discharge value was measured at the end of the 180 seconds.

Requirement

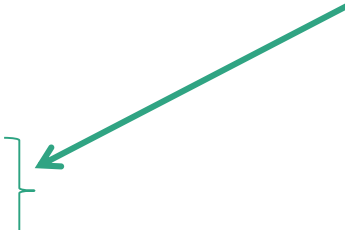
The partial discharge levels at 1,3 U_r shall not exceed 10 pC.

Result

The object passed the test.

Factory Acceptance Test (FAT)

Requirements

- i. FAT shall be made at the manufacturer factory (as per EMAL registration)
 - ii. Approved shop drawing
 - iii. Calibration cert. for equipment
 - iv. Mill cert. (if required)
 - v. Country of Origin Cert. (*shipping document for imported product*)
 - vi. Custom cert. (*imported product*)
 - vii. Existing test result from manufacturer
 - viii. Visual inspection
 - Name plate
 - dimension
 - All parameter according to L-S17
 - etc.
 - iv. Routine test
 - v. Type test (if required)
 - vi. Special test (if required)
- 

- Type tests shall be performed on a prototype of transformer only. Unless otherwise specified in the BQs, these tests shall be performed at the manufacturer's factory or at an approved laboratory/factory.
- Special tests shall be performed when it is specified in the BQs. These tests shall be performed at the manufacturer's factory or at an approved laboratory/factory.

Routine Test

No	Test Item	Objective	Acceptance Criteria
Routine Test			
1	Measurement of winding resistance	To measure the resistance of HV and LV windings. Resistance values will be used for load loss calculation and as reference for future measurements	Standard gives no acceptance criteria, however a deviation from average of 3 phases of 0.5% for HV and 5% for LV could serve as practical guideline.
2	Measurement of voltage ratio and check of phase displacement	To measure the voltage turn ratio and vector group of the transformer.	The voltage ratio error shall be within $\pm 0.5\%$ for each tap.
3	Measurement of short circuit impedance and load loss	To measure the load loss (copper loss) and the % of impedance voltage. The load loss and impedance shall be derived and corrected to reference temperature of 120°C.	Not exceed +15% of specification for load loss provided that the tolerance for total losses is not exceeded +10%. Not exceed $\pm 10\%$ of specification for short circuit impedance.

Routine Test

No	Test Item	Objective	Acceptance Criteria
Routine Test			
4	Measurement of no-load loss and no-load current	To measure the no-load loss (core loss/iron loss) and the no-load current (excitation current). The excitation current is a composite of the energy which is lost due to eddy currents in the magnetic material (steel core) as well as hysteresis losses of the material.	Not exceed +15% of specification for no-load loss provided that the tolerance for total losses is not exceeded +10%. Not exceed +30% of the design value for no-load current.
5	Separate source AC withstand voltage test (Applied voltage test – AV)	To check the insulation strength between the windings and core	No collapse of the test voltage occurs
6	Induced AC withstand voltage test (Induced voltage withstand test – IVW)	To check the insulation both between phases and between turns of the windings and also the insulation between the input terminals of the insulation windings and earth	No collapse of the test voltage occurs

Routine Test

No	Test Item	Objective	Acceptance Criteria
Routine Test			
7	Partial discharge (corona) measurement	To measure the partial discharges which may occur in the transformer insulation structure. These discharges may occur in air bubbles left in the insulating media, gaps in the solid materials or at the surfaces of two different insulators. Although these discharges have small (weak) energy, the thermal energies due to these discharges can cause aging, deformation and tear of the insulating material.	The maximum level of partial discharge shall be of 10 pC

Special Test

No	Test Item	Objective	Acceptance Criteria
Special Test			
1	Measurement of d.c. insulation resistance each winding to earth and between windings	To form a reference for future measurements. For comparison they have to be at the same temperature (e.g. 20 °C reference temperature). The test voltage is “direct voltage” and can be between 1000 Vd.c. and 5000 Vd.c	Minimum measured insulation resistance of 1 kΩ/V

Example of FAT

CAST RESIN TRANSFORMER				Type : DTTHIL 1600/10		
Routine Test Report				Year of manufacture : 2014		
				Order No. : 432000491		
Pst Test <input type="checkbox"/>				Accept Test <input checked="" type="checkbox"/>		
Serial No. : 728450				Standard : IEC 60076-11		
Vector group : Dyn11						
Rated Power : 1600 kVA		Freq. (cps) : 50		Duty cycle: S1		
Rated Voltage in [V] (HV / LV) :		Protection Class : IP20		Guaranteed Data		
11000 +- 2 x 2.5 % 433		Insul.-Class : F		Po in [W] : 2300 (Po = 1.05 Po)		
Rated Current in [A] (HV / LV) :		Cooling : AN		PL (120°C) in [W] : 8800		
83.98 2133.4		Sh. circ. cur. [kA] max		ez (120°C) in % : 6.00		
		Sh. circ. dur [s] max		Is in % : n.a		
		Total Weight [kg] 4260		Tolerance : <input checked="" type="checkbox"/> standard		
				<input type="checkbox"/> non standard (specified)		
MEASUREMENT OF NO-LOAD LOSSES				Feed at: LV		
Phase		Read [V]	Average [V]	Read [A]	Average [A]	
2u - 2v	433.73	433.07	5.738	4.978	Read [W] Total [W] Is in %	
2v - 2w	435.02		4.191		889 2499	
2w - 2u	431.47		5.003		612 997	
MEASUREMENT OF LOAD LOSSES AT TAP 3				Feed at: HV		
Phase		Read [V]	Average [V]	Read [A]	Average [A]	
1U - 1V	337.54	337.15	41.663	42.087	Read [W] Total [W]	
1V - 1W	336.78		42.35		633 1906	
1W - 1U	337.15		42.249		718 554	
Temp [°C] : 28.6		Losses in Watts [W] at 120°C		Rated Imp. Voltage in % at 120°C		
Losses [W] at 120°C		P2 1157	I²2R 8115	PL 9273	ez 6.12 ez 6.38 ez 6.10	
MEASUREMENT OF RESISTANCE AT TAP 3						
Connection/Position		1U - 1V	1V - 1W	1W - 1U	Average	
11 kV / 3	0.3303909 Ohm	0.3295739 Ohm	0.330911 Ohm	0.3302916 Ohm		
433 V / -	0.0003677 Ohm	0.0003669 Ohm	0.0003774 Ohm	0.0003706 Ohm		
MEASUREMENT OF VOLTAGE-RATIO AND VECTOR GROUP						
Connection		Ratio Deviation in % (< +/- 0.5%)				
Primary to Secondary	1	2	3	4	5	
1U - 1V -> 2u - 2v	-0.04	0.03	0.10	0.13	0.30	
1V - 1W -> 2v - 2w	-0.04	0.03	0.10	0.13	0.31	
1W - 1U -> 2w - 2u	-0.07	0	0.05	0.09	0.17	
Rated Value	46.20	45.10	44.00	42.90	41.80	
DIELECTRIC TEST AT TAP 1						
Separate Source Test	(kV)	(cps)	Dur.			
HV	28	50	1min			
LV	3	50	1min			
Ind. Overvoltage test	0.866	200	30s			
REMARKS:						
Tolerance : standard : Component loss <15% . Total loss <10%						
Impedance voltage (ez%) < 4-10%						
non standard : specified below						
<div> <div>AM SGB SDN. BHD. WITNESS BY:</div> <div> Name : <u>TS</u> Company : <u>TS</u> Date : <u>15/12/14</u> </div> </div> <div> <div>TS PASSED</div> </div>						
ADDITIONAL TEST						
Insulation Resistance:		HV -> LV		[M-Ohm]		
at 2.5kV D.C		HV-E -> LV		145000		
(> 1kV/V)		LV-E -> HV		25600		
		PTC -> LV		90000		
		PTC -> Core		36300		
RH [%] :		68		1640		
PTC		COLOUR		Temp. (°C) Resist. (Ohm)		
FAN :		Red / Red		100 198.7		
ALARM :		Grey / Grey		120 186.5		
TRIP :		White / Blue		140 223		
PT - 100		Red / White		- 111.8		
Test Date :		15-Dec-14		Verified by :		
				AM SGB SDN. BHD.		

Example of FAT

Cast Resin Transformer		Type: DTTHIL 1600M10	
Partial Discharge Measurement		Year of Mfg: 2014	
Test Report (Routine Test)		Order No.: 432000481	
Customer: XXXXXXXXXX		Serial No.: 728450	
		Standard: IEC 60076-11	
		Vector Group: Dyn11	
Rated Power (kVA): 1600		Frequency (Hz): 50	
Rated voltage (kV): 11/0.433		System voltage (kV): 12	
Measuring Device :			
Measuring name : MPE Me - Prof - EMV		Measuring Freq.: 500 Hz	
Coupling capacitor (Ck) : 1039pF		Detection Impedance : 180 ohm	
Calibration discharge value (qp) : 50 pC		Test frequency : 125 Hz	
Calibration of complete test circuit (with test object)			
Scale factor (Terminal/Tap) :	1U / 3	1V / 3	1W / 3
K = qp/q (e.g. 50 : q)	(50 /) = 2.73	(50 /) = 2.73	(50 /) = 2.73
Test Circuit : transformer (test object)		Test cycle :	
Ck - Coupling capacitor ; pc - Partial discharge meter qo - PO Calibrator ; 2m - Detection Impedance			
Test Voltage :			
Test criteria	30sec.	Volt.(V)	180sec.
	1.8xU _{LV}	778	1.3xU _{LV}
			563
Test result (pC)			
After(sec)	1U	1V	1W
90	0.9	0.9	0.9
150	0.9	0.9	0.9
210	0.9	0.9	0.9
Guaranteed value during 3 minutes time : PD =< 10pC			


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Pengumuman

Kepada semua pengguna EMAL: Tuan/puan disarankan untuk mendapat PERAKUAN BERTULIS daripada pembekal berdaftar bahawa bahan/barangan yang dibekalkan adalah TULEN dan MENEPATI kualiti seperti pendaftaran dengan CKE, JKR. Sekian, Harap maklum.

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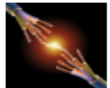
Admin

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Pengenalan



EMAL adalah laman web yang memaparkan senarai bahan/barangan elektrik yang diluluskan oleh Jawatankuasa Kelulusan Bahan, Cawangan Kejuruteraan Elektrik JKR Malaysia. Senarai bahan/barangan elektrik tersebut adalah digunakan oleh Cawangan Kejuruteraan Elektrik JKR sahaja dan tidak boleh digunakan untuk apa jua pengiklanan atau apa jua tujuan lain.

SENARAI KATEGORI

Displaying 1-26 of 26 results.

No	Kumpulan	Nama Kategori	Nama Sub kumpulan	
1	EE01100	CABLES	KABEL DAN AKSESORI PENDAWAIAAN	
2	EE01110	G.S CONDUITS & HIGH IMPACT PVC CONDUITS	KABEL DAN AKSESORI PENDAWAIAAN	
3	EE01120	BUSDUCT TRUNKING SYSTEM / CABLE MANAGEMENT SYSTEM	KABEL DAN AKSESORI PENDAWAIAAN	
4	EE01130	SWITCHES	KABEL DAN AKSESORI PENDAWAIAAN	
5	EE01180	EARTHING SYSTEM & ACCESSORIES	KABEL DAN AKSESORI PENDAWAIAAN	
6	EE01170	LIGHTNING PROTECTION SYSTEM	KABEL DAN AKSESORI PENDAWAIAAN	
7	EE01171	SOCKET OUTLETS	KABEL DAN AKSESORI PENDAWAIAAN	
8	EE02160	FLUORESCENT LUMINAIRES	KELENGKAPAN ELEKTRIK	
9	EE02170	EMERGENCY LIGHT & LUMINOUS SIGN	KELENGKAPAN ELEKTRIK	
10	EE02180	FANS	KELENGKAPAN ELEKTRIK	
11	EE02200	OUTDOOR LUMINAIRES	KELENGKAPAN ELEKTRIK	
12	EE02210	INDOOR LUMINAIRES (LED)	KELENGKAPAN ELEKTRIK	
13	EE02212	TRAFFIC LIGHT SYSTEM	KELENGKAPAN ELEKTRIK	
14	EE03100	L.V. SWITCHBOARD/CONSUMER UNIT	SUIS GEAR DAN PAPAN SUIS	
15	EE03110	SURGE PROTECTIVE DEVICE (SPD)	SUIS GEAR DAN PAPAN SUIS	
16	EE03120	PROTECTION RELAYS	SUIS GEAR DAN PAPAN SUIS	
17	EE03130	POWER FACTOR CORRECTION	SUIS GEAR DAN PAPAN SUIS	
18	EE03140	CIRCUIT BREAKER (ACB, MCCB & MCB)	SUIS GEAR DAN PAPAN SUIS	
19	EE03150	RESIDUAL CURRENT DEVICE (RCD)	SUIS GEAR DAN PAPAN SUIS	
20	EE03160	FUSE SWITCHGEARS	SUIS GEAR DAN PAPAN SUIS	
21	EE03170	ISOLATORS	SUIS GEAR DAN PAPAN SUIS	
22	EE03180	CONTACTORS	SUIS GEAR DAN PAPAN SUIS	
23	EE03190	11KV METAL-ENCLOSED SWITCHGEAR	SUIS GEAR DAN PAPAN SUIS	
24	EE04100	GENERATORS SETS	PERALATAN MESIN ELEKTRIK	
25	EE04110	TRANSFORMER	PERALATAN MESIN ELEKTRIK	
26	ET01100	STRUCTURED CABLING SYSTEM C/W ACCESSORIES	KABEL DAN AKSESORI PENDAWAIAAN ICT	

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Pengumuman

Adalah dimaklumkan bahawa Cawangan Kejuruteraan Elektrik telah membuat ketetapan bagi pendaftaran bahan/barangan Structure Cabling System C/W Accessories bagi komponen Horizontal Cabling hendaklah merangkumi perkakasan hujung ke hujung (end-to-end solution) untuk setiap jenis/kategori kabel dan

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DETAIL BAHAN/BARANGAN YANG DILULUSKAN

Displaying 1-8 of 8 results.

No	Kod Barang	Nama Barang	Nama Pengeluar	Jenama	Negara Pengeluar	
1	EE041101.ME3.A3	11 KV DRY-TYPE DISTRIBUTION TRANSFORMER	GBE DISTRIBUTION SDN BHD	JSHP	CHINA	
2	EE041101.ME17.A15	11 KV DRY-TYPE DISTRIBUTION TRANSFORMER	SGB MY SDN. BHD. (Formerly known as AM SGB SDN BHD)	SGB	MALAYSIA	
3	EE041101.ME37.A114	11 KV DRY-TYPE DISTRIBUTION TRANSFORMER	ABB MALAYSIA SDN. BHD.	ABB	KOREA	
4	EE041101.ME278.A285	11 KV DRY-TYPE DISTRIBUTION TRANSFORMER	KENTRITZ CORPORATION SDN. BHD.	SEA	ITALI	
5	EE041101.ME361.A321	11 KV DRY-TYPE DISTRIBUTION TRANSFORMER	SUNTEN ELEKTRIK (MALAYSIA) SDN. BHD.	SUNTEN	CHINA	
6	EE041101.ME362.A117	11 KV DRY-TYPE DISTRIBUTION TRANSFORMER	ABLECON POWER SYSTEM SDN. BHD.	SCHNEIDER ELECTRIC	TURKI	
7	EE041101.ME376.A334	11 KV DRY-TYPE DISTRIBUTION TRANSFORMER	SAREL SWITCHGEAR SDN. BHD.	TESAR	ITALI	
8	EE041101.ME472.A175	11 KV DRY-TYPE DISTRIBUTION TRANSFORMER	SUN POWER SYSTEM SDN BHD	SANIL	KOREA	

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MAKLUMAT BAHAN/BARANGAN YANG DILULUSKAN

Keterangan Barangan	11 KV DRY-TYPE DISTRIBUTION TRANSFORMER
Kod Barangan	EE041101.ME472.A175
Nama Syarikat	SUN POWER SYSTEM SDN.BHD
Status Syarikat	PENGEDAR
Alamat	LOT 1554, KAMPUNG JAYA INDUSTRIAL AREA 47000 SUNGAI BULOH SELANGOR
No Telefon	0361577555
No Fax	0361577666
Email	sunpower.general@sunpowerberhad.com.my
Website	www.sunpowerholdings.com.my
Jenama	SANIL
No Laporan	SIJIL UJIAN KEMA : 22-09 NO. LAPORAN CESI : B2028388, B2030548, B2034882
Tarikh Tamat	15-10-2021
Rujukan	IEC 60076-11:2004
Catatan	PENGILANG ENCLOSURE : TEMFAB ELECTRICAL SDN BHD TYPE : CAST RESIN KADARAN : 11000V/433V, Dyn11, 50Hz TOLERANCE : +10% OF TOTAL LOSSES
Negara	KOREA

Bil	MODEL	KADARAN KUASA (kVA)	NO-LOAD LOSS (W)	LOAD LOSS (at 120C)(W)	TOTAL LOSSES (W)	IMPEDANCE (at 120C)(%)	Gambar
1	SMT-3H500KD	500	840	5350	6190	4	
2	SMT-3H800KD	800	1420	5500	6920	5	
3	SMT-3H1000KD	1000	1580	6650	8230	5	
4	SMT-3H1250KD	1250	1880	8170	10050	5	
5	SMT-3H1600KD	1600	2290	9650	11940	6	
6	SMT-3H2000KD	2000	2860	12940	15800	6	

The background of the slide features a photograph of a person's hands typing on a laptop keyboard. The image is heavily stylized with a blue color overlay and a semi-transparent grid pattern. Binary code (0s and 1s) is visible in the background, giving it a digital or technological feel. The text 'Thank You !' is superimposed over the center of this image.

Thank You !

mzamrir@jkr.gov.my