

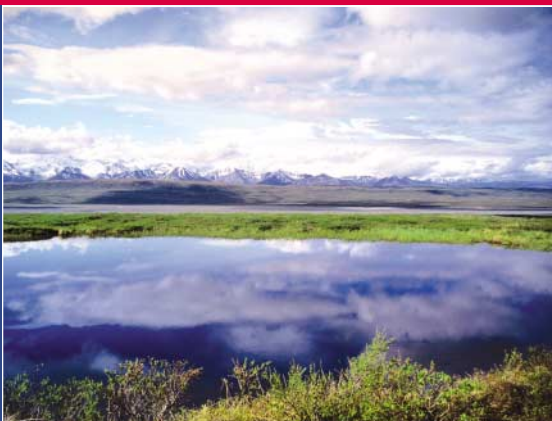
Technical Performance

LS Cast Resin Transformers

50kVA Through 15,000kVA
Primary Voltage: 2.3kV Through 36kV
Secondary Voltage: 120V Through 24kV



Power Transmission & Distribution





LS Cast Resin Transformer

Introduction

Great progress has been made in the development and improvement of distribution transformers over the last decades.

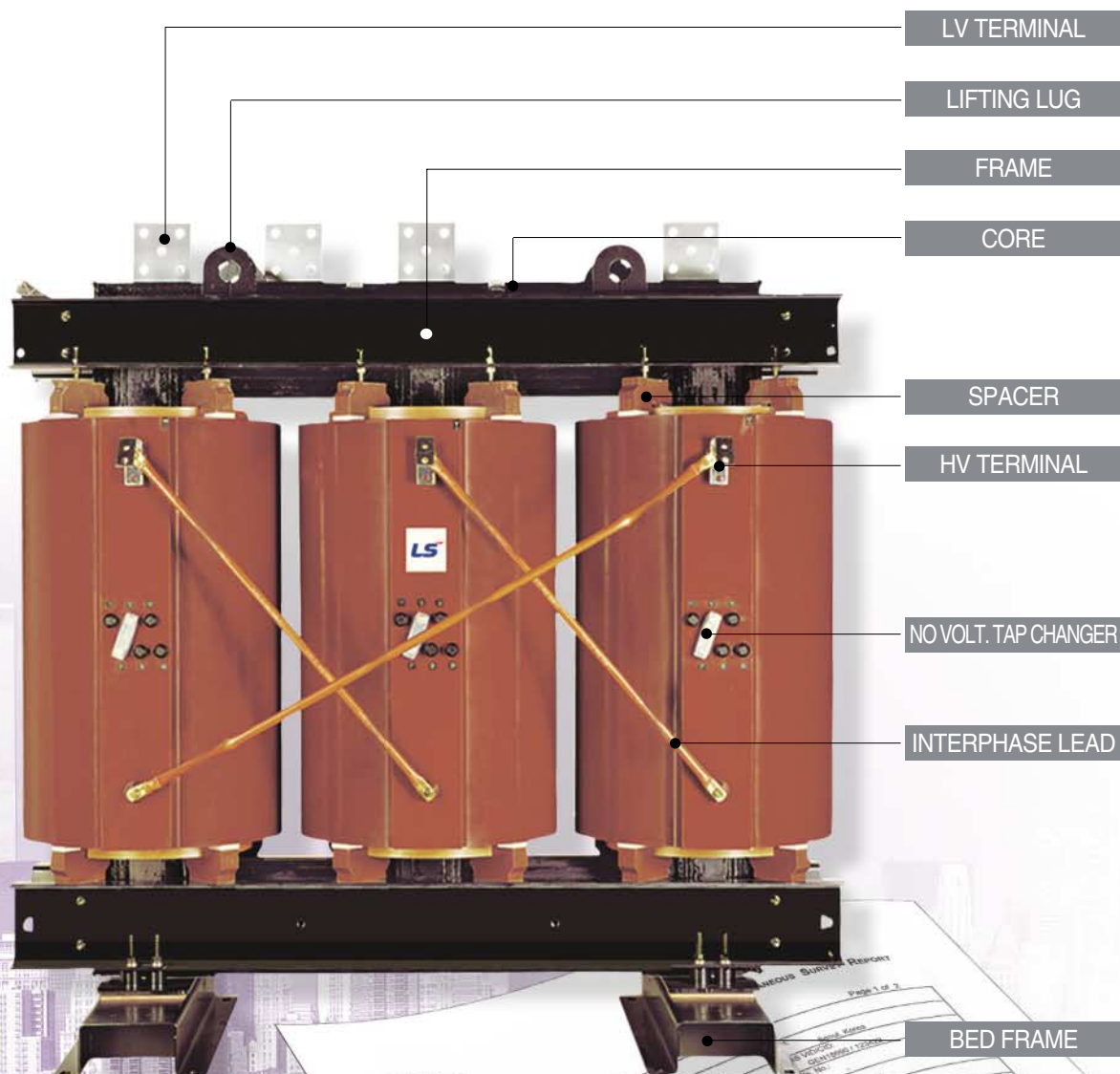
The application of high quality insulation material and suitable selection of the coil structure for high stress have contribute to the development of LS CAST RESIN Transformers.

The LS CAST RESIN Transformer has succeeded in combining the advantage of oil-filled and conventional dry type transformers, which are fabricated with an epoxy resin. The windings are completely embeded under vacuum conditions. This casting method makes it possible to assure void-free epoxy penetration of both the inner layer and turn to turn insulation.



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ABS

SURVEY OF: TRANSFORMER

Report No. 315592403 Date: 11 October 2007

Vessel's Name: -

Manufacturer: LS Industrial Systems Co., Ltd.

Purchaser: Bunker & T. -

Location: Cheongju, Korea

Serial Number: 20922502

Material Test Report No. -

Task No.: 277386

Date Accepted: 01 October 2007

Service Use: -

Engineer's Signature: -

ABS Report No. -

Page 1 of 2

THIS IS TO CERTIFY that the undersigned surveyor in this Bureau attested for the stores survey and reports as follows:

One(1) set of three(3) phase dry type transformer

Capacity: 300 KVA

Rated voltage & Frequency: 440/220, 60Hz

Insulation: Class "F"

The following tests were carried out and considered satisfactory:

1. Voltage ratio test, phase relation and polarity test
2. Dielectric strength test
 - Primary windings(3 000V x 60Hz for 60 seconds)
 - Secondary windings(2 000V x 60Hz for 60 seconds)
3. Induced high voltage test and winding resistance measurements
4. Insulation resistance test and winding voltage measurement
5. No load test, load test & impedance voltage measurement
6. Reviewed Temperature rise test report

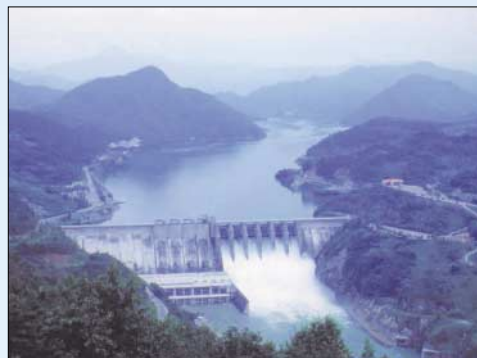
K.Y. Tu, Surveyor, American Bureau of Shipping

ABS 113

Applications

LS CAST RESIN Transformers can be used in various fields.
Here are just a few possible applications.

- Indoor and outdoor unit substations
- Off-shore platforms
- Commercial buildings
- Hospitals
- Shopping centers
- Water supplies
- Traction systems
- SCR Power supplies



Environmentally safe

LS CAST RESIN Transformers will not emit oil or toxic gases into the atmosphere. Therefore, they do not pollute the environment and are strongly recommended as a replacement for askarel(PCB)-filled transformers.

Moisture proof

The complete casting of coils under vacuum prevents the penetration of moisture into the winding.

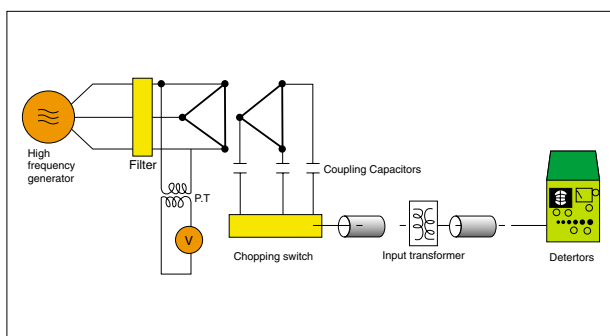
Therefore, it is suitable for both storage and operation in harsh environment and is capable of being switched on immediately after such storage without pre-drying.

No partial discharge

There is no possibility of partial discharge in LS CAST RESIN Transformers.

Whole core & coil is tested to guarantee the life expectancy of the insulation system.

LS CAST RESIN Transformers are free of partial discharge at least up to 1.3 times of the rated voltage.



Low noise

The coating of the core with an epoxy resin have lead to an appreciable noise reduction. Noise is also reduced due to the sound suppressing effect of the step lap cutting.

High overload capability

Based on the high thermal time constant factor of the windings, LS CAST RESIN Transformers can be overloaded for a short duration considerably higher than oil-immersed transformers. It has a greater capability to withstand sudden high overloads such as might be encountered in heavy traction applications.

High impulse strength

LS CAST RESIN Transformers are very resistant to impulse voltage.

Impulse withstand levels to 200kV are available because of careful design and special structure.

Maintenance free

Maintenance is almost completely eliminated. No checking of liquid level and no dielectric test for moisture absorption is required.

Due to the smooth coil surface, heavy dirt and dust build up is eliminated even under the worst circumstances.

The recommended routine maintenance is an occasional visual inspection.

Fire resistant

LS CAST RESIN Transformers have a very excellent characteristic of self fire-extinguishing and fire resistance.

So there would be no fear of spread of fire even if fire took place around the electricity room.

LS CAST RESIN Transformers take pride in the ability to offer a wide variety of designs and configurations necessary to satisfy customer needs. Computer and CAD/CAM systems are used for quick and accurate design and manufacture to meet specific customer requirements.

CORE & FRAME

The core is made of highest quality, cold rolled, grain-oriented, silicon steel and step lap joint.

Three legs of the core are arranged in a single plane and interconnected with a yoke.

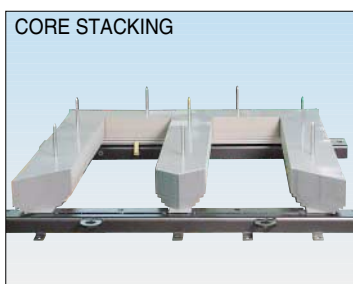
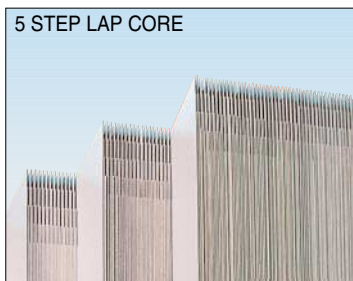
The legs are circular structure and are carefully interlaced with stepwise arranged yokes.

The core is mitred at a 45 degree angle and care-fully stacked and pressed to obtain low loss, exciting current and noise.

The core is insulated on both side of each lamination and protected against corrosion by a resin coating and grounded in frame.

The frame consists of upper and lower steel channels. It holds the core and coil together.

To protect against corrosion, all steel parts are coated with epoxy paint.



HV & LV Coils

● HV COIL (Vacuum Cast type)

- HV COIL Vacuum Cast in epoxy with a mold.
- Aluminum / Copper conductor.



● LV COIL (Encapsulated Cast type)- standard

- LV COIL Encapsulat- ed after winding with prepreg layer insu-lation.
- Aluminum / Copper conductor.



● LV COIL (Vacuum Cast type)- optional

- LV COIL Vacuum Cast in epoxy with a mold.
- Aluminum / Copper conductor.



Conductor insulated with a high grade is used in the winding construction.

Turns are arranged in multiple sections and layers in order to decrease transient maximum voltages. High voltage windings are cast in a mold under vacuum, using a computer controlled mixing and vacuum casting process.

So there is no void in the coils. The windings are fiberglass reinforced to provide additional mechanical strength.

After assembly, all HV coils are partial discharge tested to verify void free in the coils.

Specification Data

LS CAST RESIN Transformers are normally available with specification as follows:

- **Rated voltage**
HV COIL : up to 36kV
LV COIL : up to 600V
* Dual High voltage coils can also be supplied.
- **Standard Tapping range** : $\pm 2.5\%$, $\pm 5\%$
* Other ratings are available by request
- **Power capacity**
Single phase : 20 ~ 2,000kVA
Three phase : 50 ~ 15,000kVA
- **Frequency** : 50Hz, 60Hz
* Other frequency is available by request
- **% Impedance voltage**
IEC STD : 4 ~ 8%
ANSI STD : 5.75%
* Other % impedance voltages are available.
- **Connections**
HV COIL : Delta
LV COIL : Star with neutral point
* Other connections are available to meet requirement.
- **Temperature class (According to IEC 60076-11)**
HV COIL and LV COIL : F CLASS
* H class coils are available by request.
- **Conductor**
Aluminum (standard)
Copper (optional)
- **Noise Level (according to NEMA Std.)**
500kVA - 60dB
750kVA - 64dB
1000kVA - 64dB
1500kVA - 65dB
2000kVA - 66dB
2500kVA - 68dB
*Noise reduction TRs are available by request.

Standards

LS CAST RESIN Transformers confirm to the requirements of IEC 60076-11 (2004).

However we can also meet the requirements of the following standards, upon request.

- **ANSI / IEEE C57.12.01 (2005)**
General requirement for dry-type distribution and power transformers.
- **CSA Standard C9-M1981**
Dry type transformers.
- **HD538.1,2,3(1995)**
3 Phase Dry type distribution transformers.
50Hz from 100kVA to 2500kVA
- **BS 7806 (1995)**
Dry type Power transformers
- **AS 2374 (1982)**
Power transformers
* Transformers for rectifier applications and other special purposes can be supplied according to the client's specification.

Certificates



CESI ABS



ISO14001, ISO 9001

Accessories

● Normally provided accessories

- HV & LV terminals
- Lifting lugs
- Grounding terminals
- Name plate
- Danger label
- Tap terminal link
- Protection cap for tap terminal
- Anti-vibration pads

● Optional accessories

- Wheels
- Cooling fan & temp. controller
- Digital thermometer & PT 100 OHM (1 Phase)
- Digital thermometer & PT 100 OHM (3 Phase)
- Enclosure

HV terminals



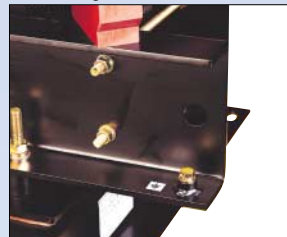
LV terminals



Lifting lugs



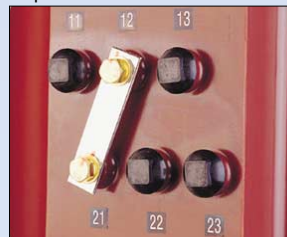
Grounding terminals



Danger label



Tap terminal link



Protection cap



Anti-vibration pads



Wheels



Cooling fan

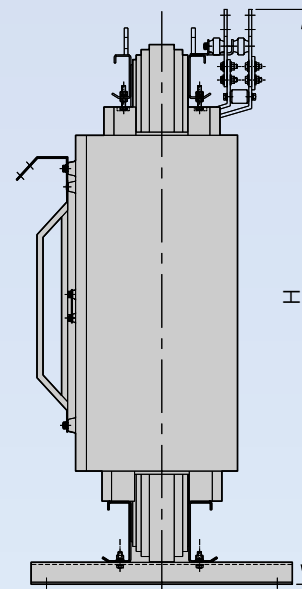
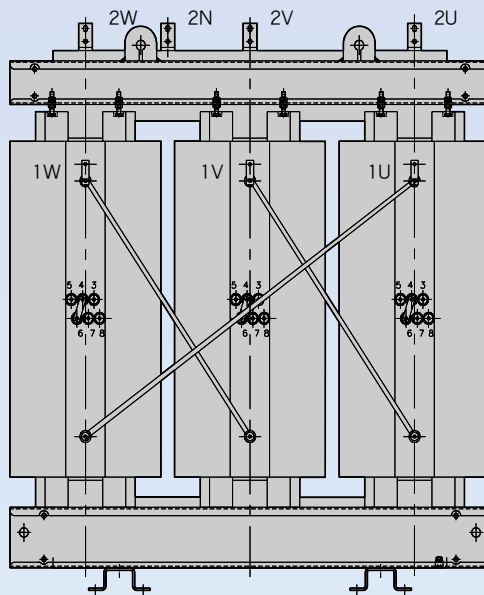
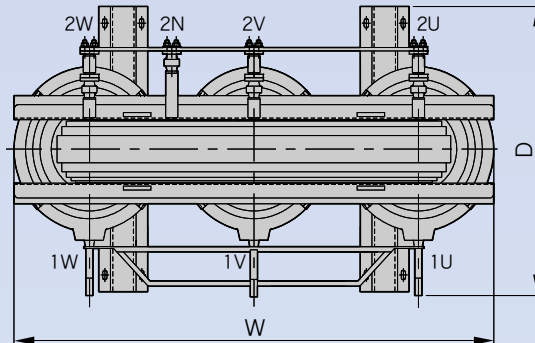


Temperature controller



Temperature indicator





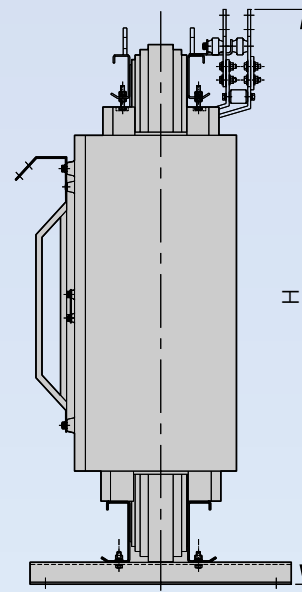
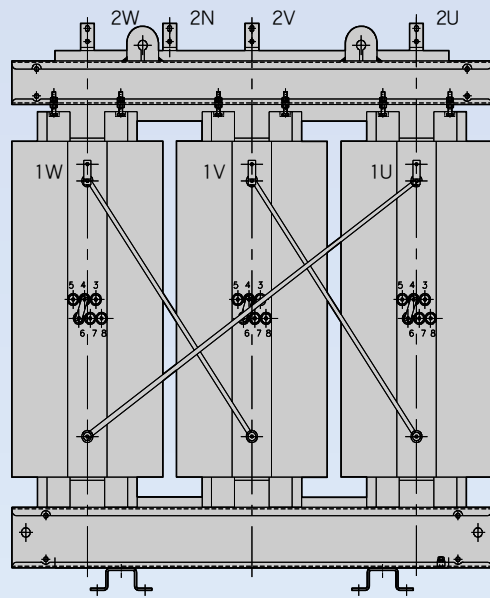
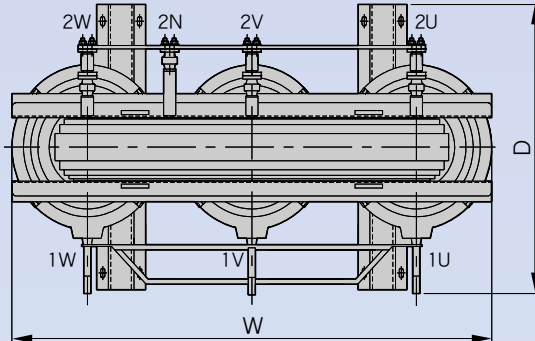
Standard : IEC 60076-11
12kV Class, 50Hz
75 BIL

Temperature Rise : 100K

| Rated Power (kVA) | Impedance Voltage (%) | No Load Loss (W) | Load Loss (W) | Efficiency (%) | | | Dimension (mm) | | | Weight (kg) |
|----------------------|-----------------------------|------------------------|---------------------|----------------|-------------|-------------|----------------|--------------|---------------|----------------|
| | | | | 100% Load | 75% Load | 50% Load | Width (W) | Depth (D) | Height (H) | |
| 400 | 4.0 | 1,150 | 5,200 | 98.4 | 98.6 | 98.8 | 1,220 | 800 | 1,460 | 1,320 |
| 630 | 4.5 | 1,450 | 7,600 | 98.6 | 98.8 | 98.9 | 1,305 | 900 | 1,620 | 1,750 |
| 1,000 | 6.0 | 1,950 | 11,000 | 98.7 | 98.9 | 99.0 | 1,520 | 1,000 | 1,740 | 2,500 |
| 1,250 | 6.0 | 2,450 | 12,500 | 98.8 | 99.0 | 99.1 | 1,700 | 1,000 | 1,820 | 3,060 |
| 1,600 | 6.5 | 2,850 | 14,500 | 98.9 | 99.0 | 99.2 | 1,760 | 1,200 | 2,000 | 3,750 |
| 2,000 | 6.5 | 3,700 | 16,500 | 99.0 | 99.1 | 99.2 | 1,940 | 1,200 | 2,150 | 4,750 |
| 2,500 | 7.5 | 4,200 | 19,000 | 99.1 | 99.2 | 99.3 | 2,115 | 1,200 | 2,190 | 5,600 |

* Other kVA is available according to request.

Technical Data (IEC Standard)

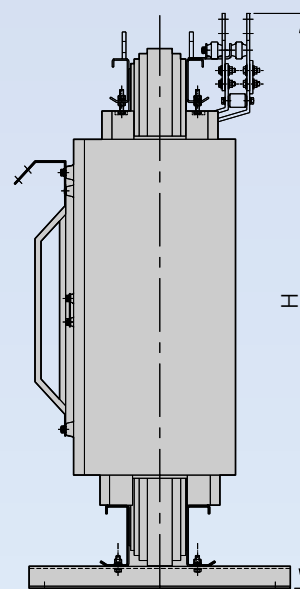
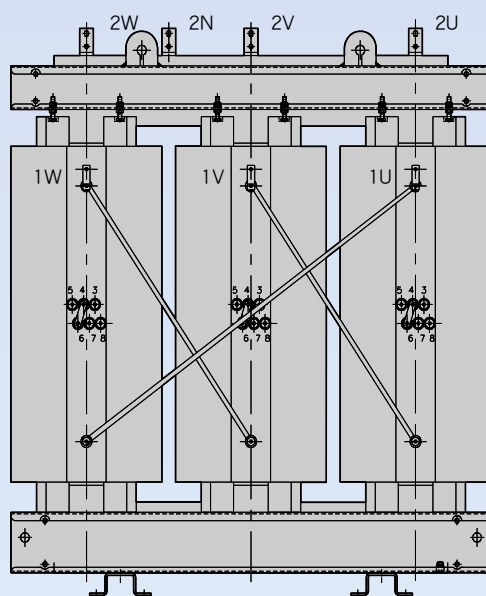
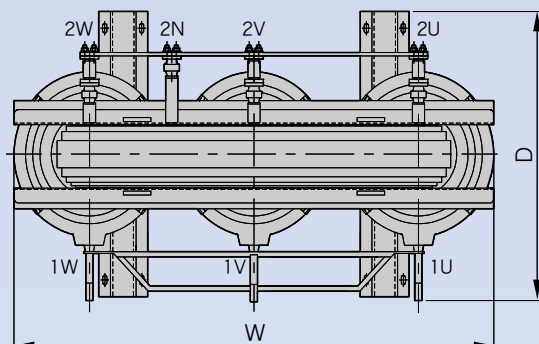


Standard : IEC 60076-11
24kV Class, 50Hz
125 BIL

Temperature Rise : 100K

| Rated Power (kVA) | Impedance Voltage (%) | No Load Loss (W) | Load Loss (W) | Efficiency (%) | | | Dimension (mm) | | | Weight (kg) |
|----------------------|-----------------------------|------------------------|---------------------|----------------|-------------|-------------|----------------|--------------|---------------|----------------|
| | | | | 100% Load | 75% Load | 50% Load | Width (W) | Depth (D) | Height (H) | |
| 400 | 6.0 | 1,200 | 6,000 | 98.2 | 98.5 | 98.6 | 1,350 | 800 | 1,540 | 1,400 |
| 630 | 6.0 | 1,650 | 7,800 | 98.5 | 98.7 | 98.8 | 1,500 | 900 | 1,710 | 2,060 |
| 1,000 | 6.0 | 2,300 | 11,500 | 98.6 | 98.8 | 98.9 | 1,670 | 1,000 | 1,850 | 2,860 |
| 1,250 | 7.0 | 2,550 | 13,000 | 98.7 | 98.9 | 99.0 | 1,750 | 1,000 | 1,900 | 3,220 |
| 1,600 | 7.0 | 3,050 | 16,000 | 98.8 | 99.0 | 99.1 | 1,810 | 1,200 | 2,080 | 3,840 |
| 2,000 | 7.0 | 4,050 | 17,500 | 98.9 | 99.0 | 99.1 | 1,990 | 1,200 | 2,210 | 4,750 |
| 2,500 | 7.5 | 4,600 | 20,500 | 99.0 | 99.1 | 99.2 | 2,160 | 1,200 | 2,250 | 5,530 |

* Other kVA is available according to request.



Standard : IEC 60076-11

36kV Class, 50Hz

170 BIL

Temperature Rise : 100K

| Rated Power (kVA) | Impedance Voltage (%) | No Load Loss (W) | Load Loss (W) | Efficiency (%) | | | Dimension (mm) | | | Weight (kg) |
|----------------------|--------------------------|---------------------|------------------|----------------|----------|----------|----------------|-----------|------------|----------------|
| | | | | 100% Load | 75% Load | 50% Load | Width (W) | Depth (D) | Height (H) | |
| 630 | 6.0 | 2,200 | 7,200 | 98.5 | 98.6 | 98.7 | 1,720 | 1,000 | 1,910 | 2,650 |
| 1,000 | 6.0 | 3,000 | 8,600 | 98.8 | 98.9 | 98.9 | 1,880 | 1,200 | 2,050 | 3,700 |
| 1,250 | 6.5 | 3,650 | 11,000 | 98.8 | 98.9 | 98.9 | 2,060 | 1,200 | 2,100 | 4,400 |
| 1,600 | 7.5 | 3,900 | 14,500 | 98.8 | 99.0 | 99.0 | 2,110 | 1,200 | 2,280 | 4,900 |
| 2,000 | 7.5 | 4,850 | 15,500 | 98.9 | 99.1 | 99.1 | 2,290 | 1,200 | 2,390 | 6,000 |
| 2,500 | 7.0 | 6,300 | 18,000 | 99.0 | 99.1 | 99.1 | 2,470 | 1,200 | 2,460 | 7,400 |

* Other kVA is available according to request.

Maunufacturing Process

CORE CUTTING



COIL WINDING



CORE STACKING



CASTING



ASSEMBLY



TEST



➤ Routine Test

the following tests are made on all transformer.

- Resistance measurements
- Ratio tests
- Polarity and phase relation test
- Impedance and load loss
- No load loss and exciting current
- Applied potential tests
- Double induced potential tests
- Partial discharge test(below 10 PC)

➤ Optional Test

- Impulse test
- Temperature test

Temperature rise test carried out according to the simulated loading method.

 - no load losses
 - load losses

The total temperature rise is calculated in accordance with IEC 60076-11 or ANSI
- Short circuit test
 - 3P 1600kVA Certified by KEMA
- Audible sound level test
 - test by IEC 60076-10
 - LS use Pressure Level (Lp).
$$Lw(A) = Lp(A) + 10 \text{ LOG } S$$

$$S = 1.25 \times H \times P$$

H : Transformer height
P : Measurement contour perimeter
- Climatic, environmental and fire behaviour classes
 - Certificated at CESI according to IEC 60076-11
 - Fire Behavior Class : F1
 - Environmental Class : E2
 - Climatic Class : C1
 - Class C2 is available

ROUTINE TEST



IMPULSE TEST



SHORT CIRCUIT TEST



FIRE BEHAVIOR TEST



Ordering Sheet

Ref. No. :

Date. :

End User and Location :

| ITEM | | TR.-1 | TR.-2 | TR.-3 | TR.-4 |
|---|--------------|---|--------------------------------------|-----------------------------------|---|
| Rated kVA | | | | | |
| Q'ty (sets) | | | | | |
| Rated Voltage(V) | Primary(V) | | | | |
| | Secondary(V) | | | | |
| Connection | Primary | | | | |
| | Secondary | | | | |
| Phase (ϕ) | | | | | |
| % Impedance (%) | | | | | |
| 1. Frequency | | <input type="checkbox"/> 50Hz | <input type="checkbox"/> 60Hz | <input type="checkbox"/> Other | |
| 2. Conductor | | <input type="checkbox"/> Maker Standard | <input type="checkbox"/> Copper | <input type="checkbox"/> Aluminum | <input type="checkbox"/> Other |
| 3. Primary Taps | | <input type="checkbox"/> $\pm 2 \times 2.5\%$ | <input type="checkbox"/> $\pm 2.5\%$ | <input type="checkbox"/> Other | |
| 4. Applied standard | | <input type="checkbox"/> IEC | <input type="checkbox"/> ANSI/IEEE | <input type="checkbox"/> BS | <input type="checkbox"/> Other |
| 5. Insulation Class | | | | | |
| | Primary | <input type="checkbox"/> Maker Standard(155°C) | | | <input type="checkbox"/> Other |
| | Secondary | <input type="checkbox"/> Maker Standard(155°C) | | | <input type="checkbox"/> Other |
| 6. Winding Temperature Rise | | | | | |
| | Primary | <input type="checkbox"/> Maker Standard | <input type="checkbox"/> 80°C | <input type="checkbox"/> 100°C | <input type="checkbox"/> 115°C <input type="checkbox"/> Other |
| | Secondary | <input type="checkbox"/> Maker Standard | <input type="checkbox"/> 80°C | <input type="checkbox"/> 100°C | <input type="checkbox"/> 115°C <input type="checkbox"/> Other |
| 7. Accessories | | <input type="checkbox"/> Digital Thermometer <input type="checkbox"/> Cooling Fans controller <input type="checkbox"/> Cooling fans <input type="checkbox"/> User Spec . (P V Hz) <input type="checkbox"/> Maker Standard. | | | |
| 8. Protection | | <input type="checkbox"/> IP00 | <input type="checkbox"/> IP21 | <input type="checkbox"/> IP31 | <input type="checkbox"/> Other |
| 9. Attached specification (<input type="checkbox"/> Yes , <input type="checkbox"/> No) , If "Yes" (Total page : pages) | | | | | |
| 10. Remarks | | | | | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

Leading Innovation, Creating Tomorrow 



Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- Contact the nearest authorized service facility for examination, repair, or adjustment.
- Please contact qualified service technician when you need maintenance.
Do not disassemble or repair by yourself!
- Any maintenance and inspection shall be performed by the personnel having expertise concerned.

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Specifications in this catalog are subject to change without notice due to continuous product development and improvement.

■ Global Network

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