

ELMACO

ELNASR TRANSFORMERS & ELECTRICAL PRODUCTS CO.

Distribution Transformers



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Registration Schedule

SCOPE OF REGISTRATION

*Design and Production of Power and Distribution transformers,
LV capacitors and MV disconnectors and the production of
HRC LV/MV fuse links*

Company Name: **EL NASR TRANSFORMERS &
ELECTRICAL PRODUCTS COMPANY (ELMACO)**

Sites Registered: PO Box 1916, 3 Kablat Street, Mataria, Cairo, Egypt

Standard: **BS EN ISO 9001:2008**

EAC: 19

Date of Registration: 26/05/2009

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Certificate Number: AJA09/13581



Raymond Hinton *Timothy Dixon*
Joint Chief Executives, AJA Registrars



This certificate is the property of AJA Registrars and must be returned on request

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INTRODUCTION

ELMACO is an Egyptian private sector manufacturing company, founded in 1957.

ELMACO produces wide range of power and distribution transformers in addition to other electrical products such as capacitors, disconnectors, fuses and a.c arc welding transformers.

ELMACO has shares in some other companies such as (EGEMAC), for manufacturing switch boards and switchgear and (EPS) for electrical network project engineering and consultancy service.

ELMACO employs about 1100 persons and managed by highly qualified team. The company has a turnover of about 200 million Egyptian pounds. Its international standing is reflected by its export record to many Arab countries like Syria, Yemen, Saudi-Arabia, Sudan, Abu-Dhabi, Bahrain ,and also for African countries like Nigeria , Kenya , and Ghana .

ELMACO has qualified team of designers and researchers. This is supported by a data processing system controlling all its activities.

All operational groups are supported by quality assurance department equipped with the necessary human and technical means to guarantee the quality control of all steps of manufacturing the products, starting from raw material acceptance to the testing of the final products.

The international standards control all procedure of quality systems . The several quality control and quality assurance systems assessment is made by qualified and specialized organization.



Elmaco Company

STANDARDS

ELMACO transformers and all of its electrical products comply with the latest editions of IEC standards. They satisfy also the requirements of the following specifications and standards: EN, BS, DIN and VDE. Any other standards can be also considered on request

GENERAL SPECIFICATIONS

ELMACO produces three and single phase oil immersed distribution transformers, core type, continuous operation and natural cooling (ONAN).

ELMACO transformers are either free breathing with conservator or hermetically sealed in leak proof tank, totally filled or with gas cushion for indoor and outdoor installations.

ELMACO produces transformers with rating up to 3000 K.V.A and with rated voltage up to 36 K.V single and dual voltages, 50 or 60 Hz with all different connection groups.

All distribution transformers are equipped with off circuit tap changers connected to the high voltage side with different tapping ranges. **ELMACO** distribution transformer can be equipped with all normal accessories.

Special accessories can be also added on request. Transformers may be pole or ground mounted. Cables end boxes for high voltage and low voltage can be provided. Transformer tanks can be manufactured as corrugated or with tank walls and radiators.

Due to the availability of manufacturing improvements processes, remarkable improvement and high quality have been achieved.

Insulating materials used in windings and the clamping structure are high temperature resistant and have comparatively small volume.



3. ϕ Oil Immersed Distribution Transformer

ELMACO transformers are manufactured only from highest quality materials and by the most modern and reliable methods.

TRANSFORMER CONSTRUCTION

The transformer consists mainly of the following parts:

1- MAGNETIC CIRCUIT (IRON CORE)

The iron core represents the magnetic circuit of the transformer , it is constructed from low loss, cold rolled grain oriented, silicon steel sheets which comply with IEC- 60404, NFC28920, ASTMA - 725, and JISC 2550 (1986).

The laminations of the silicon steel from which the iron core is manufactured are insulated on both sides by an inorganic extremely thin, tightly adherent, oil resistant, and rust- proof insulation coats.

For effectively utilizing the grain orientation of the laminations , the ends of the limbs and yokes are mitered and stacked together by overlapping the laminations to reduce the no load losses and consequently the power consumed for magnetizing the iron core .

The cross section of the core is stepped to be as circular as possible. This arrangement produces an optimum core filling factor.



Stacking Process of Iron core

2-ELECTRICAL CIRCUIT WINDINGS:

The windings represent the electrical circuit of the transformer.

They are manufactured from high conductivity electrolytic copper wires E-CU 58(F20) which comply with DIN 1787/4500 or equivalent.

The conductor insulation has a high dielectric strength and very good temperature stability.

The winding are braced in axial and radial directions so that short circuit forces can not cause any damage or deflection.

The inter layer insulation of the winding is designed to withstand the power frequency and impulse voltage stresses at all points.

Both low and high voltage windings are provided with vertical ducts to improve the cooling efficiency. Each phase has two main windings.

A- LOW VOLTAGE WINDING

For transformer with ratings up to 200 KVA, flat copper wire according to DIN 46433/2, DIN 46434, IEC- 60317-27 and NFC 31011 is used.

The flat wire is cold draw annealed electrolytic copper with round edges, and insulated with multi-layers of Electro-paper class (A) insulation, Other classes can be used on request.

The winding is multi-layers helical type for transformers with ratings higher than 200KVA to 3000KVA, copper foils are used to obtain multi-layers cylindrical windings which are characterized with highest mechanical stability during short circuit stresses.

The axial forces which are developed by short circuit are avoided with this system of winding .Axial contraction forces also do not affect the conductors.

The low voltage terminals consist mainly of massive bars which are press welded to the conductor in the foil winding machine.



Low Voltage Winding (Foil Conductor)

B-HIGH VOLTAGE WINDINGS

The high voltage windings are manufactured from circular copper wire or rectangular copper wire depending upon the nominal current of the transformer.

The circular conductor is insulated with special type of varnish which has a good resistance to heat and oil according to DIN 46435, IEC- 60182-1, and IEC- 60182-2. The flat wire is insulated with multi-layers of electro-paper according to DIN 46433/2 DIN 46434, IEC- 60317-27 and NFC 31011.

The high voltage windings are of multi-layers helical type. The layers insulation is made of high quality insulation paper according to DIN 6740 and it is adapted to the particular electrical insulation. This yields compact windings with high short circuit withstand voltage and optimal impulse voltage distribution.



High Voltage Winding

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3-THE TANK

The tank represents the outer enclosure of the transformer.

There are two types of tanks:

A-THE CORRUGATED TANK

Which is manufactured from cold rolled sheet steel, of folded fins with thickness not more than 1.5 mm and with adequate dimensions and sizes according to the size of transformer and cooling requirement

This type of tanks can be used for transformers with rating up to 2.5 MVA.

The corrugated tank can withstand inside pressure up to gage pressure 0.2 bar (0.2 bar over atmospheric pressure)



Corrugated Sheet Production Line



Assembly Of
Transformer Tank

B-THE TANK WITH WELDED RADIATORS (OR SEPARATE RADIATORS)

This tank composes mainly of four sides of sheet steel of 6 mm thickness. Which are welded together to form one rectangular tank.

Each tank is equipped with the pre designed radiators to satisfy the cooling requirement. The radiators are manufactured normally from cold rolled sheet steel of maximum thickness 1.5 mm according to DIN 1623.

This type of tank can be used normally for transformers with rating from 2.5 MVA and higher (and can be used for all rating on request). All these tanks are leakage proof and can withstand inside pressure up to gage pressure 0.3 bar (0.3 bar over atmospheric pressure).



Transformer With Radiators Tank

OPTIONS

ELMACO can also manufacture on request:

- 1- Hermetically sealed transformers (corrugated tanks type or radiator tanks type).
- 2- Tanks which withstand inside pressure higher than 1.3 bar without any deformation.

★ The tanks are sand blasted to clean them before painting with an active base primary and two finishing coats according to B.S.7079 to protect them against moisture, rust and corrosion. (More finishing coats can be added upon request).

TRANSFORMER OIL

Mineral oil (un-inhibited) according to IEC- 60296 class 1 & BS 148

The oil is primary intended for use in transformer as:

- A dielectric insulation for the winding.
- A coolant to dissipate the heat generated during loading of transformer.
- An arc extinguishing agent.

CHARACTERISTICS OF INSULATING OIL:

Kinematic Viscosity, mm^2/s at	40 °C	≤ 16.5
	20 °C	Approximation 40
	-15 °C	≤ 800
Flash point °C		≥ 140
Pour point °C		≤ -30
Density gm/cm^3 at 20 °C		≤ 0.895
Neutralization value mg.KOH/g		≤ 0.03
Corrosive sulphur		Not corrosive
Oxidation stability :		
- Neutralization value, mg KOH/g		≤ 0.4
- Sludge % by mass		≤ 0.1
Break down voltage, KV:		
- Oil delivered in barrel (new untreated oil)		≥ 40
- After treatment		≥ 60
- Dissipation factor at 90 °C ($\text{Tan } \delta$)		< 0.005

ACCESSORIES

The distribution transformers are equipped with following accessories.

A- MAIN ACCESSORIES

- 1- HV bushings
- 2 - LV bushings
- 3 - Off circuit tap changer
- 4 - Magnetic oil level indicator
- 5 - Thermometer
- 6 - Rollers for ground mounted transformer
- 7 - Dehydrating breather
- 8 - Earthing terminal
- 9 - Draining valve

B-ADDITIONAL ACCESSORIES

(Added on request only)

- 1 - Double-float Buchholz relay.
- 2 - Pressure relief valve.
- 3 - Thermometer with max. pointer.
- 4 - Thermometer with max. pointer and two contacts.
- 5 - Visual oil level indicator (for hermetically sealed transformers).
- 6 - Skids under base.
- 7 - Cable end box for HV and LV
- 8 - Bus duct for LV.

Any other requested accessories



Elastimold Bushings



Porcelain Bushings

MAIN ACCESSORIES:

MAGNETIC OIL LEVEL INDICATOR

The oil level indicator is of magnetic type provided with indicator to indicate the oil level in the expansion tank (conservator) for distribution transformers filled with mineral oil.



Operating temperature:

Rating from -20 °C to 100 °C of protection IP54

DEHYDRATING BREATHER (SILICA-GEL TYPE)

It is used to trap out the moisture of the air entering the expansion vessel during the transformers operation.

Silica-gel material absorbs air humidity.

The saturation degree is distinguished by the changed color of silica gel as follows:

- Blue = completely dry
- Light blue = partly humid
- Pink = completely saturated with humidity.



TAP CHANGER

Distribution transformers are equipped with off circuit tap changer on the high voltage side to regulate the secondary voltage to adapt the site voltage within the regulation percentage. The operating handle can be mounted on the cover or on tank side.

The control device (operating handle) is provided with notches to lock each position and control knob provided with suitable locking arrangement.

The step of tap changer may have five or seven steps according to client request (each step $\pm 2.5\%$ from the HV nominal voltage)



BUSHINGS

The terminals of the low and high voltage winding are connected through porcelain bushings suitable for rated voltage and current, indoor or outdoor installation.

The high voltage bushing is provided with an arcing horn with gap clearance which depends on the impulse withstand strength of the corresponding winding and the altitude of the installation. It is fixed on the tank cover such that it can be changed without need to removing the cover.



H.V Bushing



L.V Bushing
1.1KV - 630 Amp.



L.V Bushing
1.1KV - 3150 Amp.

ADDITIONAL ACCESSORIES

PRESSURE RELIEF VALVE (Fig1)

The pressure relief valve is mounted on the cover of the distribution transformers (conservator type or hermetically sealed type) which is full filling with mineral oil or with inert gas in hermetically sealed type to relieve any over internal pressure of transformer pressure .

The relief valve is a flanged type with operating over pressure from 0.2 bar to 0.7 bar (20 to 70 kPa).

The valve can be setted by screwing the nut which compresses the spring the disc stem the relief valve is sitting in 0.2 bar for corrugated type and 0.3 bar for radiator type.

VISUAL OIL LEVEL INDICATOR (Fig2)

It is used for hermetically sealed full filling oil transformers and mounted on top of transformer.

The visual type has a transparent cup to indicate the oil clearly.

THERMOMETER (Fig3)

Thermometer is straight as per DIN 16170 complete with polished brass cases as per DIN 16167.

DIAL THERMOMETER WITH TWO CONTACTS. (Fig4)

This instrument will be mounted horizontally to indicate the oil temperature in the transformers.

It should be dial type, fitted with maximum reading pointer and suitable for outdoor mounting .

BUCHHOLZ REALY (Fig5)

Buchholz type is provided to:

- Detect any generation of gas bubbles and energize alarm contact (first stage)
- Detect any sudden oil level drop and actuate tripping contact (second stage)
- The relay is according to NFC 52-100, DIN42566.



Fig 1



Fig 2

Fig 3



Fig 4



Fig 5

ELECTRICAL TESTS

ROUTINE TESTS:

The following routine tests are completely performed on each transformer:

- * Measurement of transformation ratio and vector group.
- * Separate source voltage withstand test.
- * Induced overvoltage withstand test.
- * Measurement of no-load losses and current.
- * Measurement of impedance voltage and load losses.
- * Measurement of windings resistance.

TYPE TESTS:

- * Test ability to withstand lightning impulse: According to IEC-60076 part5.
- * Temperature rise test: According to IEC-60076.

SPECIAL TESTS:

- * Ability to withstand short-circuit test.
All of ELMACO transformers passed this test in KIMA & EDF laboratories
- * Measurement of noise level: Measured in according with the requirements of IEC-60 551
- * Oil leakage test performed for a twelve- hour under adequate over pressure.



Elmaco's Test Field

NOISE LEVEL

ELMACO transformers are friends to the environment conditions. For this reason the noise created by **ELMACO** transformers in service are within the minimum level according to DIN 42540.

* THE NOISE LEVELS MEASURED AT 1 M FOR TRANSFORMER UP TO 1600 KVA

Rated power (KVA)	Noise level (dB)
25 up to 50	45
63 up to 100	46
125 up to 160	47
200 up to 250	48
315 up to 400	50
500 up to 630	52
800 up to 1000	54
1250 up to 1600	56

* THE NOISE LEVELS AT 3 M FOR TRANSFORMERS UP TO 5000 KVA

Rated power (KVA)	Noise level (dB)
2000	52
2500	53
3150	55
4000	56
5000	57

INSULATION LEVELS:

* The following table indicates the testing voltage for different system voltage of transformers according to IEC-60076

System highest Voltage (KVA) r.m.s	Power frequency Test (kv) r.m.s	Impulse test Voltage (KV) peak
1.1	3	8
3.6	16	45
7.2	22	60
12	28	75
24	50	125
36	70	170

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OVER LOADING

ELMACO transformers are designed to withstand overloading according to IEC-60354.

On request Elmaco transformers are withstand 10 % overloading starting from full rated power for two hours without exceeding the temperature rise.

Other condition of overloading can be designed upon request.

ORDERING DATA

The following data are the main requested data during order:

- * Rated power (K.V A).
- * Rated voltage at no load or at full load.
- * Frequency.
- * Connection group.
- * Voltage ratio and tapping range at no load.
- * Either indoor or outdoor installation and site altitude.
- * In case of parallel operation state the rated data of the existing transformers:
 - A - Rated frequency.
 - B - Voltage ratio and tapping range at no-load.
 - C - Impedance voltage.
 - D - Connection group.
- * Required additional accessories.
- * Temperature limits and atmospheric conditions.
- * Transformers required with cable end box, state.
 - A - Number of cables.
 - B - Cables types.
 - C - Cross-section and outer diameter.
- ** Others if necessary.

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OPERATING INSTRUCTIONS

Before putting the transformers into service the following points must be taken into consideration:

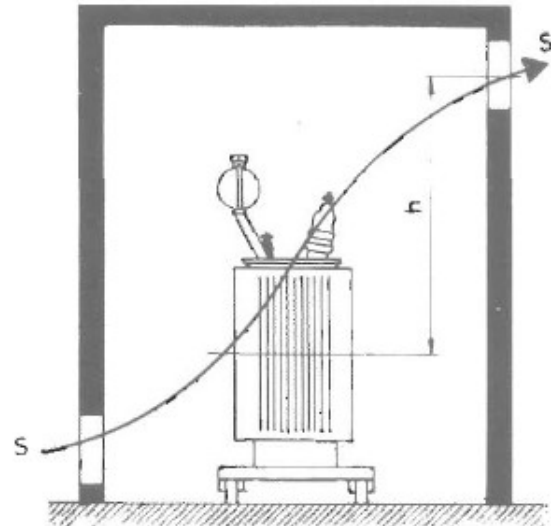
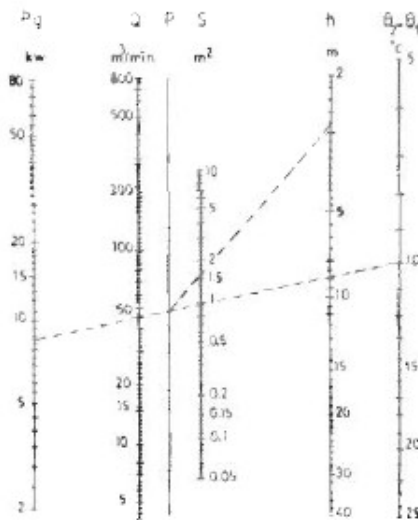
- 1 - Both voltages on the rating plate the transformer and the network must be identical.
- 2 - Cleaning the porcelain bushings and the connecting bars of both high voltage and low voltage sides.
- 3 - checking that the oil level is enough for operation, It will not be less than the lowest level indicated on the conservator, In such case oil can be added through the filling plug mounted on the conservator. Oil of the same grade as the original or its equivalent must be used.
- 4 - If the transformers is stored for more than 6 months before use, a sample of oil must be tested and the dielectric strength must not be less than 40 KV/2.5 mm
- 5 - The protective equipment such as thermometer and buchholz relay must be checked.
- 6 - Checking the blue color of the silica gel crystals if it has changed to pink, The silica gel crystals should be dried by exposing them to a temperature of 140 °C until it regains its blue color, Otherwise it should be changed.
- 7 - Making sure that the tap-changer is adjusted on the required position according to the voltage of the network.
- 8 - For indoor installation the dimensions of the transformer room must be suitable to the size of the transformer. Two ventilating openings on two opposite walls of the room should be made. One opening is near the ground for the air inlet and the other at the top for air outlet. It is preferable to cover the ventilating openings with metallic shutters.
- 9 - Checking the insulation by 2.5 KV megger between the following:
 - a - High voltage and low voltage terminals.
 - b - High voltage terminal and tank.
 - c - Low voltage terminal and tank.

PERIODICAL MAINTENANCE:

It is necessary to check periodically (every six months) the following:

- 1- The values of the voltages at high voltage and low voltage sides.
- 2- The clearness of the bushings and the tank body.
- 3- The oil level in the expansion conservator.
- 4- Ensuring that the oil is not leaking from the transformer below the bolts of the tank cover and connections to the terminal are well tight.
- 5 - Making sure that the color of silica-gel crystals is blue and drying them if the color changed to pink.
- 6 - Testing the dielectric strength of the oil for transformers once every three years. If the dielectric strength is below 30 KV the oil must be changed or reconditioned and dried.

CALCULATION THE SECTION AREA OF THE VENTILATION OPENING IN THE TRANSFORMER ROOM



P_g = Total copper and iron loss.

Q = Quantity of air required for cooling.

S = Section area of opening

h = Distance between the mean high of the transformer and the center of the upper opening

θ_1 = Maximum temperature of incoming air

θ_2 = Maximum temperature rise of oil above ambient temperature.

P = Auxiliary line

EXAMPLE

500- KVA transformer

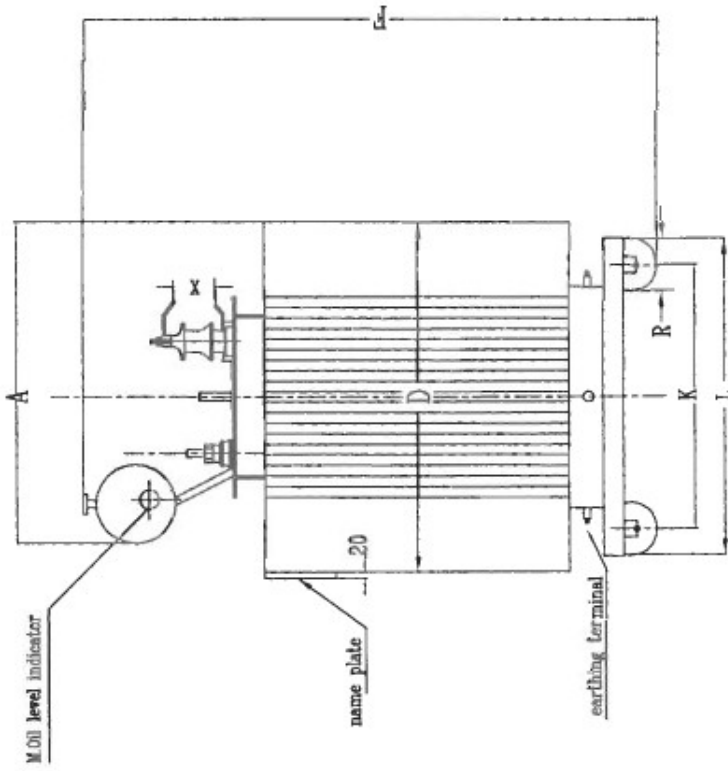
Total copper and iron loss (P_g) = 7800 + 1000 = 8800 W = 8.8 KW

Difference in temperature ($\theta_2 - \theta_1$) = 55 - 45 = 10 °C

Assuming that the distance between the main high of the transformer and the centre of the upper opening (h) = 3 m.

On the scale, the intersection of the line through $P_g = 8.8$ KW and $(\theta_2 - \theta_1) = 10$ °C gives for Q the amount of 47 m³/min, And the intersection of the line connecting point $h=3$ m and the intersection point on the auxiliary line P indicates the section area of the opening S as 1.6 m².

In case metallic shutters are used to cover the openings, the area (S) is increased by 10% - 50%.



NOTES: -

X = 85 In Case Of System Voltage 12 K.V.

X = 155 In Case Of System Voltage 24 K.V.

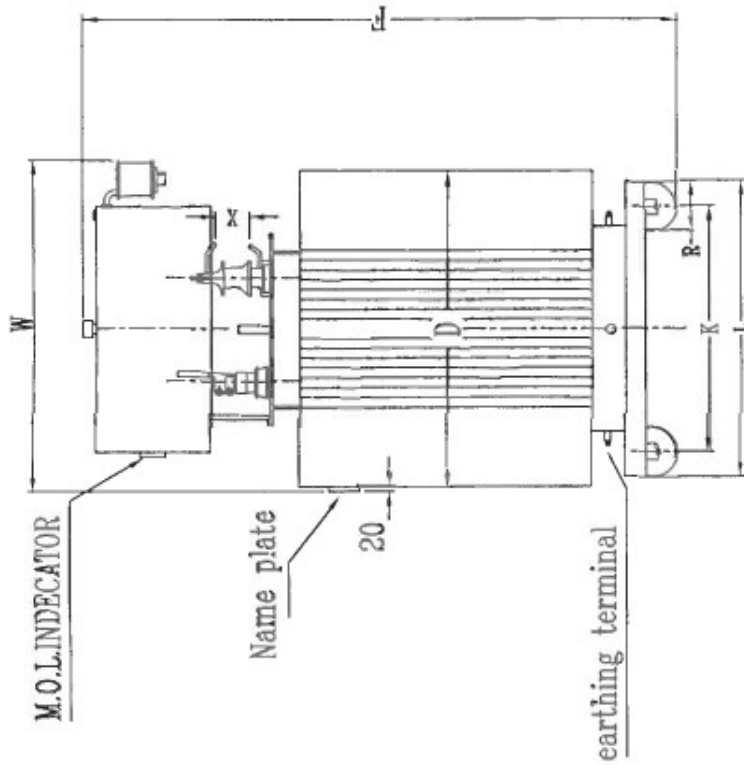
DM. DK (mm)

FIG. (1)

Distance Between H.V. Terminal = 285

Distance Between L.V. Terminal = 150

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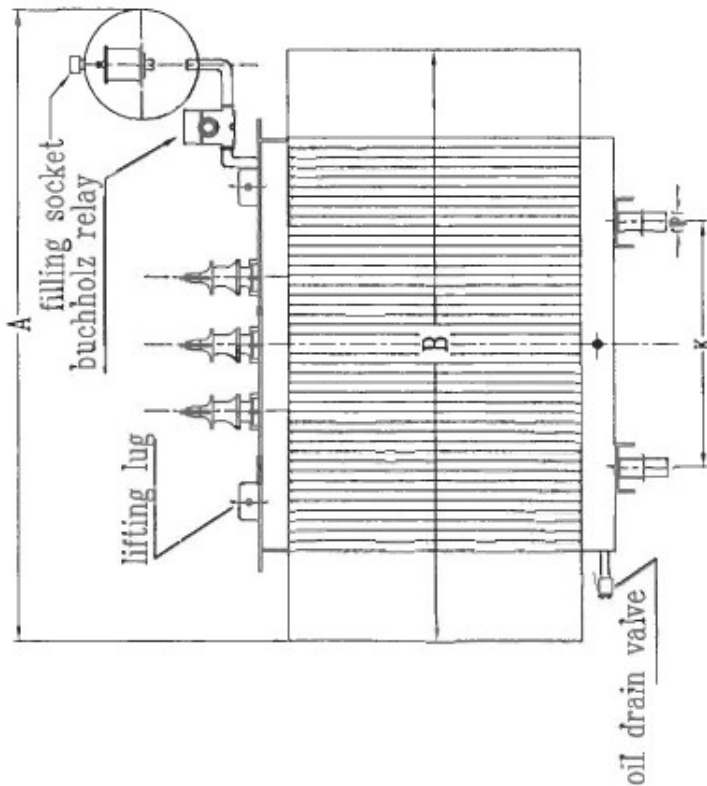


NOTES:-

X = 85 In Case Of System Voltage 12 K.V.

X = 155 In Case Of System Voltage 24 K.V.

DIM. IN (mm)

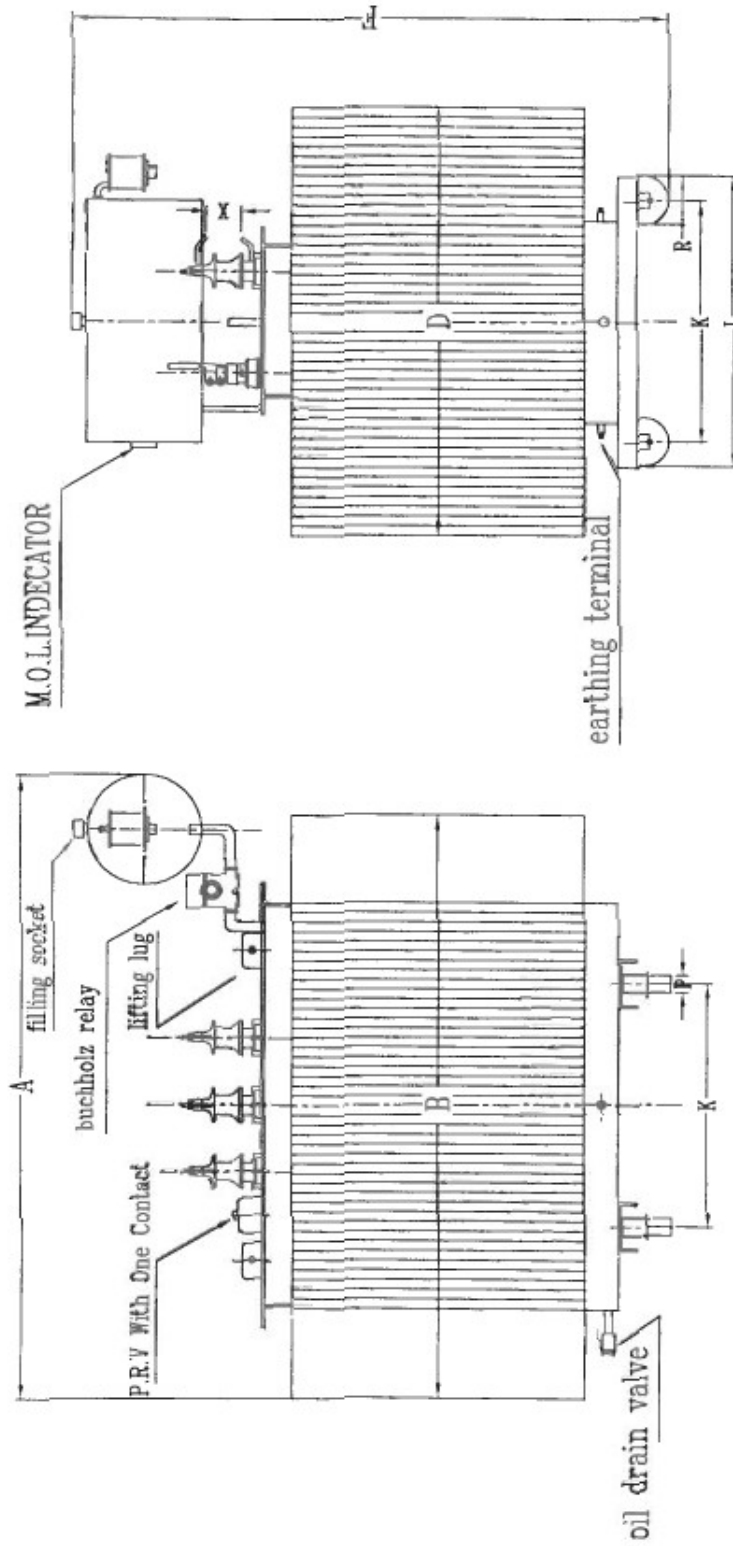


Distance Between H.V. Terminals = 265

Distance Between L.V. Terminals = 750 Up To 1000 K.V.A.

Distance Between L.V. Terminals = 150 From 1500 K.V.A To 2000 K.V.A

FIG. (2)



NOTES:-

X = 85 In Case Of System Voltage 12 K.V.

X = 155 In Case Of System Voltage 24 K.V.

Distance Between H.V. Terminals = 275

Distance Between L.V. Terminals = 265

DIM. IN (mm)

FIG. (3)

Guarantee figure for ordinary transformer
system voltage up to (12 K. V.)

Temperature limits

Maximum ambient temperature	45 °C
Maximum temperature rise of oil	55 °C
Maximum temperature rise of copper	60 °C

Transformers are withstand over loading acc. to IEC 600354

(Power K.V.A)	No load losses(w)	Load losses(w) at 75°C ^o	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	Oil (KG)	Total weight(KG)
25	120	650	4	1	455	730	410	1250	520	645	50	125	95	365
50	210	1250	4	1	590	750	530	1295	520	645	50	125	100	445
63	250	1575	4	1	600	1000	550	1365	520	645	50	125	155	545
100	340	2150	4	1	715	875	695	1330	520	645	50	125	165	635
160	480	3100	4	1	710	1210	690	1575	520	645	50	125	235	925

Any specification can be fulfilled upon request.

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Guarantee figure for ordinary transformer
system voltage up to (12 K.V.)

Temperature limits

Maximum ambient temperature 45 °C

Maximum temperature rise of oil 55 °C

Maximum temperature rise of copper 60 °C

Transformers are withstand over loading acc. to IEC 600354

Power (K.V.A)	No load losses(w)	Load losses(w) at 75 °C	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	W (mm)	Oil (KG)	Total weight(KG)
200	570	3600	4	2	1620	1490	920	1570	520	645	50	125	935	250	1025
300	720	5450	4	2	1880	1565	965	1690	670	795	50	125	960	400	1440
500	1000	7800	4	2	1780	1685	1030	1750	670	795	50	125	1040	415	1700
630	1200	9300	4	2	1740	1570	930	1800	670	795	50	125	990	470	2005
800	1450	11000	4.5	2	1810	1765	1075	1870	670	795	50	125	1215	550	2330
1000	1750	13500	5	2	1925	1870	1090	1870	820	945	50	125	1220	595	2580
1500	2550	19800	6	2	2260	2110	1280	2130	820	945	50	125	1315	965	4075
1600	2550	19800	6	2	2195	2140	1260	2275	820	945	50	125	1305	1180	4580
2000	3900	22500	7	2	2365	2165	1250	2350	820	945	50	125	1300	1200	4965

Any specification can be fulfilled upon request

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Guarantee figure for ordinary transformer
system voltage up to (12 K.V)

Temperature limits

Maximum ambient temperature	45 °C
Maximum temperature rise of oil	55 °C
Maximum temperature rise of copper	60 °C

Transformers are withstand over loading acc. to JEC 600354

Power (K.V.A)	No load losses(w)	Load losses(w) at 75 C°	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	Oil (KG)	Total weight(KG)
2500	2850	29500	7	3	2585	2400	1875	2385	1000	1200	70	200	1395	6480
3000	3500	32500	7	3	2585	2400	1875	2385	1000	1200	70	200	1400	7095

Any specification can be fulfilled upon request.

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Guarantee figure for ordinary transformer
system voltage up to (24 K. V)

Temperature limits

Maximum ambient temperature 45 °C
 Maximum temperature rise of oil 55 °C
 Maximum temperature rise of copper 60 °C

Transformers are withstand over loading acc. to IEC 600354

(Power K.V.A)	No load losses(w)	Load losses(w) at 75°C	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	Oil (KG)	Total weight(KG)
25	120	650	4	1	455	730	410	1250	520	645	50	125	90	395
50	210	1250	4	1	650	875	635	1350	520	645	50	125	160	565
63	250	1575	4	1	715	875	695	1330	520	645	50	125	165	570
100	340	2150	4	1	680	995	675	1475	520	645	50	125	210	745
160	480	3100	4	1	710	1210	690	1575	520	645	50	125	235	920

Any specification can be fulfilled upon request.

Guarantee figure for ordinary transformer

system voltage up to (24 K.V.)

Temperature limits

Maximum ambient temperature	45 °C
Maximum temperature rise of oil	55 °C
Maximum temperature rise of copper	60 °C

Transformers are withstand over loading acc. to IEC 600354

Power (K.V.A)	No load losses(w)	Load losses(w) at 75 (C°)	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	W (mm)	Oil (KG)	Total weight(KG)
200	570	3600	4	2	1620	1490	920	1570	520	645	50	125	940	250	1030
300	720	5450	4	2	1830	1565	965	1690	670	795	50	125	960	380	1445
500	1000	7800	4	2	1670	1465	1030	1750	670	795	50	125	1040	395	1715
630	1200	9300	4	2	1720	1535	845	1825	670	795	50	125	950	420	1920
800	1450	11000	4.5	2	1875	1770	1080	1875	670	795	50	125	1215	530	2305
1000	1750	13500	5	2	1990	1865	1085	1885	820	945	50	125	1220	565	2625
1500	2550	19800	6	2	2260	2110	1280	2130	820	945	50	125	1315	965	4085
1600	2550	19800	6	2	2195	2140	1260	2275	820	945	50	125	1305	1175	4600
2000	3900	22500	7	2	2365	2165	1250	2350	820	945	50	125	1300	1190	4950

Any specification can be fulfilled upon request

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Guarantee figure for ordinary transformer
system voltage up to (24 K.V.)

Temperature limits

Maximum ambient temperature 45 °C

Maximum temperature rise of oil 55 °C

Maximum temperature rise of copper 60 °C

Transformers are withstand over loading acc. to IEC 600354

(Power K.V.A)	No load losses(w)	Load losses(w) at 75 C°	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	Oil(KG)	Total weight(KG)
2500	2850	29500	7	3	2585	2400	1875	2385	1000	1200	70	200	1385	6525
3000	3500	32500	7	3	2585	2400	1875	2385	1000	1200	70	200	1400	7085

Any specification can be fulfilled upon request.

Guarantee figure for reduced transformer
acc. to electrical companies specifications
system voltage up to (12 K. V.)

Temperature limits

Maximum ambient temperature 45 °C
Maximum temperature rise of oil 45 °C
Maximum temperature rise of copper 55 °C

Transformers are withstand over loading acc. to IEC 600354

(Power K.V.A)	No load losses(w)	Load losses(w) at 95 C°	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	Oil weight(KG)	Total weight(KG)
25	120	500	4	1	510	870	395	1295	520	645	50	125	135	450
50	168	875	4	1	570	1025	520	1335	520	645	50	125	155	615
63	224	1260	4	1	580	890	510	1435	520	645	50	125	160	630
100	272	1505	4	1	665	1175	610	1445	520	645	50	125	210	855
160	384	2170	4	1	705	1260	705	1510	520	645	50	125	225	980

Any specification can be fulfilled upon request.

Guarantee figure for reduced transformer
acc. to electrical companies specifications
system voltage up to (12 K.V.)

Temperature limits

Maximum ambient temperature 45 °C
Maximum temperature rise of oil 45 °C
Maximum temperature rise of copper 55 °C

Transformers are withstand over loading acc. to IEC 600354

(Power K.V.A)	No load losses(w)	Load losses(w) at 95 °C	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	W (mm)	Oil (KG)	Total weight(KG)
200	456	2520	4	2	1620	1415	785	1575	520	645	50	125	870	270	1150
300	576	3815	4	2	1595	1350	935	1730	670	795	50	125	945	350	1440
500	700	5460	4	2	1795	1630	1125	1860	670	795	50	125	1090	435	2195
630	850	6400	4	2	1785	1580	840	1930	670	795	50	125	945	470	2455
800	1015	7700	5	2	1975	1870	870	1930	670	795	50	125	1110	540	2725
1000	1222	9450	5	2	1995	1890	1090	1965	820	945	50	125	1220	590	3085
1500	1785	13860	6	2	2305	2245	1365	2120	820	945	50	125	1360	800	4285
1600	1950	14500	6	2	2270	2065	1325	2065	820	945	50	125	1335	845	4320
2000	2736	15750	7	2	2300	2155	1345	2205	820	945	50	125	1350	985	5255

Any specification can be fulfilled upon request.

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Guarantee figure for reduced transformer
acc. to electrical companies specifications
system voltage up to (12 K.V.)

Temperature limits

Maximum ambient temperature 45 °C
Maximum temperature rise of oil 45 °C
Maximum temperature rise of copper 55 °C

Transformers are withstand over loading acc. to IEC 600354

(Power K.V.A)	No load losses(w)	Load losses(w) at 95 °C ^b	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	Oil (KG)	Total weight(KG)
2500	3200	21300	7	3	2585	2400	1875	2505	1000	1200	70	200	1290	7190
3000	3300	31500	7	3	2395	2060	2085	2575	1000	1200	70	200	1630	7250

Any specification can be fulfilled upon request.



Guarantee figure for reduced transformer
acc. to electrical companies specifications
system voltage up to (24 K.V.)

Temperature limits

- Maximum ambient temperature 45 °C
- Maximum temperature rise of oil 45 °C
- Maximum temperature rise of copper 55 °C

Transformers are withstand over loading acc. to IEC 600354

(Power K.V.A)	No load losses(w)	Load losses(w) at (95 °C)	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L _v (mm)	P (mm)	R (mm)	Oil (KG)	Total weight(KG)
25	120	500	4	1	555	935	465	1295	520	645	50	125	140	480
50	168	875	4	1	595	1010	525	1445	520	645	80	125	185	655
63	224	1260	4	1	635	1165	695	1570	520	645	50	125	190	680
100	272	1505	4	1	720	1255	750	1435	520	645	80	125	235	915
160	384	2170	4	1	735	1340	760	1525	520	645	50	125	245	1025

Any specification can be fulfilled upon request.

Guarantee figure for reduced transformer
acc. to electrical companies specifications
system voltage up to (24 K.V.)

Temperature limits

Maximum ambient temperature 45 °C

Maximum temperature rise of oil 45 °C

Maximum temperature rise of copper 55 °C

Transformers are withstand over loading acc. to IEC 600354

Power (K.V.A)	No load losses(w)	Load losses(w) at (95 C°)	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	W (mm)	Oil (KG)	Total weight(KG)
200	456	2520	4	2	1625	1420	785	1570	520	645	50	125	870	270	1155
300	576	3815	4	2	1595	1350	935	1810	670	795	50	125	945	350	1465
500	700	5460	4	2	1795	1630	1125	1860	670	795	50	125	1090	435	2175
630	850	6400	4	2	1815	1610	850	1925	670	795	50	125	950	490	2530
800	1015	7700	5	2	2015	1910	890	1945	670	795	50	125	1120	570	2940
1000	1222	9430	5	2	1995	1890	1090	1965	820	945	50	125	1220	590	3065
1500	1785	13860	6	2	2265	2170	1070	2120	820	945	50	125	1210	725	4010
1600	1950	14500	6	2	2160	1845	1325	2065	820	945	50	125	1335	810	4255
2000	2736	15750	7	2	2360	2155	1345	2205	820	945	50	125	1350	995	5430

Any specification can be fulfilled upon request.

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Guarantee figure for reduced transformer
acc. to electrical companies specifications
system voltage up to (24 K.V.)

Temperature limits

Maximum ambient temperature 45 °C
Maximum temperature rise of oil 45 °C
Maximum temperature rise of copper 55 °C

Transformers are withstand over loading acc. to IEC 600354

(Power K.V.A)	No load losses(w)	Load losses(w) at 95 C°	Impedance %	Fig	A (mm)	B (mm)	D (mm)	F (mm)	K (mm)	L (mm)	P (mm)	R (mm)	Oil (Kg)	Total weight(Kg)
2500	3200	21300	7	3	2585	2400	1875	2505	1000	1200	70	200	1295	7145
3000	3300	31500	7	3	2595	2060	2085	2575	1000	1200	70	200	1620	7200

Any specification can be fulfilled upon request.



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