Hermetically
Sealed Distribution Transformers

WE EARN CUSTOMER SATISFACTION

- Without gas Cushion (fully oil filled)
- With gas Cushion (nitrogen gas)

For use in high humidity environment

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Kooshkan Transformers

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Kaveh Chemical and Industrial Plant

Introduction:

Hermetically sealed transformers, due to their advantages have been the center of attentions in recent years. These types of transformers have a system of oil preservation, that prevent exposing the insulating oil to oxygen or humidity. This improves the operating condition of the oil so that no maintenance is required during the life time of transformer.

Hermetically sealed transformers are recommended for being used in high humid environment, limitation of maintenance service, pole-mounted transformers, and confined space conditions such as package or compact substation units.

Three phase oil immersed Hermetically Sealed distribution transformers are the main part of productions that are designed and manufactured in Iran Transfo Corporation (ITC) and the scope of work is 25-5000 KVA up to maximum system voltage of 36 KV.

Technical characteristics of the transformers comply with the latest edition of international standards such as IEC, DIN, BS, or national standards on request. On the other hand , the of quality products are assured according to international quality standard ISO 9001-2000.

ITC oil immersed distribution transformers are produced by three joint companies known as:

1- Iran Transfo Co.
2- Transformer Sanat-e-Rey Co.
3- Kooshkan Transformers Co.

Designing:

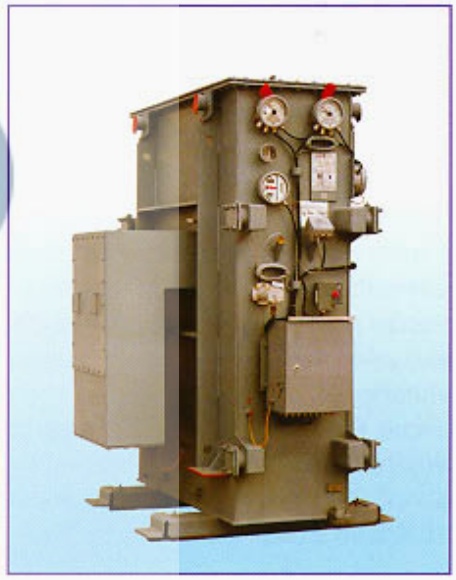
Transformers are designed by qualified engineering teams according to technical specification and standards ordered by the customers. There are some computer soft wares for analysis and optimization of designs ,which assure the reliable and efficient design of the transformers.

The most common types of Hermetically sealed transformers of ITC products are as follows:

1- Hermetically sealed-fully filled with oil
2- Hermetically sealed-with gas cushion

In the fully oil filled hermetically sealed transformers, oil expansion is taken up by the flexible corrugated steel tank (variable volume tank design), where the maximum operating pressure remains at only a fraction of the normal prescribed level .These transformers are always shipped completely filled with oil and sealed for their lifetime.

In the case of hermetically sealed transformers with gas cushion oil expansion taken up by the nitrogen cushion above the oil level. Generally these transformers are made up rigid tank and cooling radiators (removable or welded on), and the HV , LV bushings are fitted to the long side of tank.



Hermetically sealed transformers should not be opened unless in the event that the transformer has to be opened for unavoidable reasons (e.g. subsequent installation of a hermetic protection device or repair work), in that case a new pressure setting must be performed. This work may only be carried out by qualified personnel.

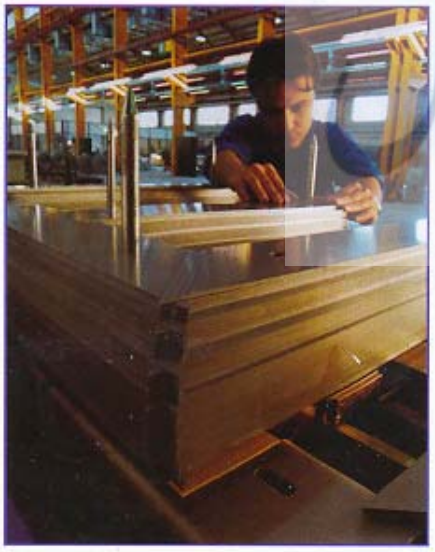
Magnetic core:

The core is constructed from high quality, grain oriented silicon steel laminations with 0.3 or 0.27 mm thickness and low hysteresis losses. Both sides of laminations have an insulation coating which provide the required interlamination resistance for decreasing eddy current losses. To obtain the superior flux path and density, specially in corners and T-joints of three limbs and two yokes, we consider:

-Maximum flux density: 1.6-1.7 Tesla
-Arrangement of lamination : step lap
-Cutting angle: 45°

For precisely cutting and stacking, we use the full automatic GEORG machines.

Finally the core sheets are carefully assembled and rigidly clamped to ensure adequate mechanical strength to support the windings and to prevent shifting the laminations during short circuit. Results of using step-lap joints are; reduction of exciting current by about 30%, no load losses by about 10% and noise levels up to 3 dB.



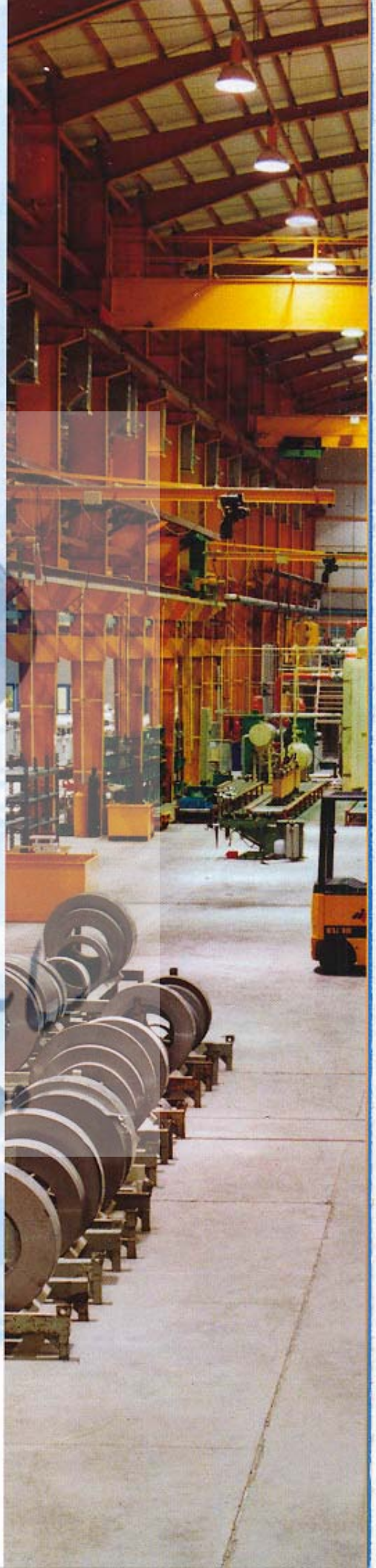
Windings:

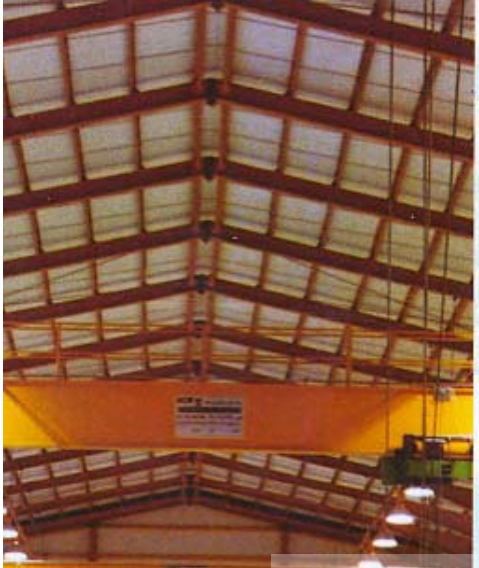
The LV windings are normally made of either foil or rectangular copper conductors with paper insulation. In the foil windings, there are diamond pattern papers as interlayer insulator , which have epoxy adhesive and cures during oven process to form a high strength winding against short circuit . Also , due to continuity of foil and absence of insulation material in axial direction, the foil windings have a great advantage, as axial short circuit compressing forces have no effect on them.

On the other hand, the cylindrical form of windings creates the maximum strength against radial short circuit forces.

The HV windings are normally made by either enameled round or paper insulated rectangular copper conductors, and are wound in layer or disc type.

The extension of tap changer steps are determined accurately by using full automatic winding machines of L.a.e Co. The insulation of windings are designed to give full protection against dielectric voltage stresses. Insulation materials meet the requirements of class A insulating materials withstanding maximum continuous operating temperature of 105 degree of centigrade without loss of life.





Active part drying:

The completed active part (core and coil assembly which is bolted to the cover of tank) must be dried, before charging oil to prevent remaining humidity of the insulation materials in the oil which could decrease not only the dielectric strength but also lifetime of transformer.

For this process, the Low Frequency Heating (LFH) oven with MICAFIL technology is used in addition to conventional hot air / vacuum ovens. In this method, the heat is generated by short circuit losses of windings. The microprocessor-based circuit controls the feeding current, so that winding's resistance and hence the temperature of insulation materials are controlled and of course with regard to Paschen Law the frequency of current is reduced so that the feeding voltage will be kept minimum.

Some of advantages of this new technology are:

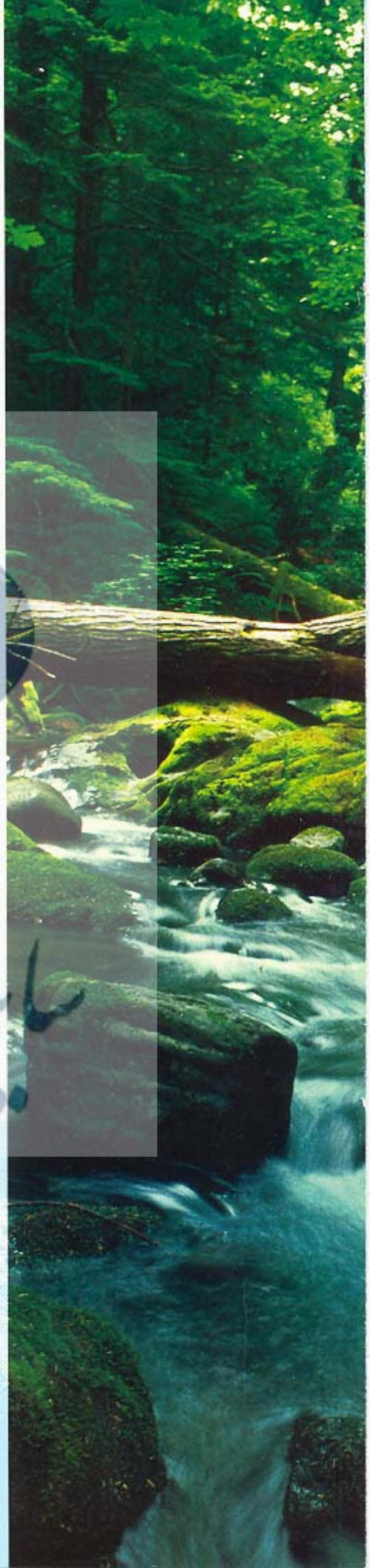
- Superior temperature control and drying results
- Heat is generated inside the windings
- Shortest process time
- Possibility to simultaneous effective drying of several transformers

Insulating oil:

The oil is used in transformers as insulating and cooling liquid. Normally we use mineral type of transformer oil having excellent properties that complies with IEC 60296. For reasons of fire safety and/or environmental concern, it is sometimes requested by customers to use alternative silicon oil or ester oil (MIDEL) that have a much higher flash point . The design of transformers with alternative oils must take into account the specific properties of that fluid:
-the increased thermal expansion of silicon oil requires larger conservators or even the application of a gas cushion in the case of hermetically sealed transformers
-the increased viscosity of especially silicon oil requires wider cooling ducts

Tank and cover:

The transformers are normally equipped with folded corrugational tanks. The number, depth and length of corrugations are chosen to give safe dissipation of the internal heat generated during the operation of transformer. Hermetically sealed transformers (fully filled with insulating oil) are always equipped with flexible (variable volume) folded corrugational tank, that is needed to accommodate the expansion and contraction of oil due to varying service conditions.
In some cases flat-sided tanks with welded-in or removable radiators are used. By use of stiffeners the strength of these types can be increased to withstand practically the full vacuum.
The tanks of hermetically sealed transformers with gas cushion are usually made of flat sides and cooling radiators. In this case the HV and LV bushings are attached to longitudinal sides of tank. In the lower part of the tank side there is a device for draining and down sampling of the transformer oil. Two earthing screws M12 are provided for earthing the transformer. One is fitted at the bottom on the high voltage side of the tank and the other on the tank cover adjacent to Low voltage neutral bushing.
All tanks have fixing at the bottom to prevent any movement of the active part during transportation. Two base frames that carrying the bidirectional wheels and have four puling lugs are welded to tank bottom. After tank parts have been assembled by welding process, it is checked for leakage with control liquid and ultraviolet radiation.
The tank cover is bolted and sealed to it. There is one thermometer pocket on the tank cover for thermometer; also there are two lifting lugs on the cover for lifting and carrying the transformer.
In the case of hermetically sealed transformer (Without gas cushion) the tank cover is equipped with a filling pipe which is high enough to ensure a safe oil filling level in the insulating elements at all times for DIN lead-through bushings .The filling pipe also serves as a filling inlet and as insulation option for the hermetic protection device.



Cleaning and painting:

All metal parts such as cover, tank, core clamping, etc., shot blasted first to eliminate all signs of rust, welding spatters, grease, oil, and mill scale and to achieve a good abrased surface for the paint to hold for long period of time.

The tanks are shot blasted in the blast chamber, then the residual stresses that appears after welding and punching process are eliminated, this improves the stability and withstanding of the tank against the internal pressure. Painting of transformers flooding can be done with flooding or electrostatic process. In the process three coats of paint are applied, one under coat, one intermediate and one top coat of paint. Each coat has a minimum 40µm thickness. In the electrostatic process one coat of paint with minimum thickness of 80µm is applied. The transformers are delivered in the final color shade RAL 7038, RAL 7001, RAL 7047 and other color shades may be applied upon request.

Accessories of Hermetically Sealed transformers:

Common accessories:

1- off–circuit tap changer:

Tappings which can be changed with an off-circuit tap changer, are provided on the high voltage windings so that the voltage can be matched to local system voltage conditions. The tap changer handle is located on the top cover and acts directly on the

switching mechanism. As the name indicates the tap changer must only be operated when the transformer is deenergized. The tap positions are inscribed on the rating plate of transformer as follows:

11 and 33KV transformers: ±2*2.5%
20 KV transformers:
For rated power 25 to 200 KVA: ±4%
For rated power 250 to 2500 KVA: ±5%

2- HV and LV bushings:

For medium voltage of 6, 10, 20, and 30KV, porcelain bushings according to DIN 42531 are used.
Low voltage bushings of 1kv series, according to DIN 42530, are used in the L.V. connectors, according to DIN 43675.
Upon request plug-in type bushings can also be fitted on HV side.

3- Dial-type contact thermometer:

The thermocouple of thermometer is set at the higher oil level in order to measure the maximum oil temperature. Alarm and trip contacts with one maximum pointer are available.

Special accessories:

1- Oil level indicator

In the case of hermetically (fully filled) sealed transformers the tank cover is equipped with one filling pipe which is high enough to ensure a safe oil filling

level in the insulating elements lead-through bushing at all times. Usually a visual oil level indicator (with hollow sphere and sight glass) is fitted to filling pipe.On request a vertical magnetic oil level indicator may be installed on filling pipe.

2- Hermetic protection relay

Protective device (hermetic schutz) can be used on hermetically sealed (fullyoil filled) transformers. This device gives alarm upon loss of oil .and gas accumulation, and is mounted directly (permanently sealed) on the filling pipe of these transformers.

3- Pressure relief device

- Without electrical contact
- With trip contact

4- Pressure and vacuum gauge

5- Sudden pressure relay

Only used in hermetically sealed with gas cushion transformers to detect any gas emission in the oil space ,and has a trip contact.

6- Gas filling valve

Only used in hermetically sealed with gas cushion transformers for filling nitrogen gas into the tank.

7- DGPT2 and DMCR

On request the DGPT2 or DMCR multi function relays can be installed on these transformers. These protective blocks have the contacts for over temperature (alarm and trip), over pressure and oil level detection (trip).

DMCR

DGPT2

Additional accessories:

In addition to common accessories and protective devices, the following accessories are also available :

1) Winding thermometer
2) Current transformers
3) Skid base
4) Jacking pads
5) Terminal box
6) HV and LV cable box
7) LV bus duct

Testing:

For approval of the technical characteristics and guarantied specifications, the transformers shall be subjected to some tests ,whichare categorized as routine, type and special tests

Routine tests:

According to IEC 60076 standard, the following tests must be carried out for all units of the transformers:

a) Measurement of winding resistance
b) Measurement of voltage ratio and check of phase displacement
c) Measurement of short circuit impedance and load losses
d) Measurement of no-load losses and current
be) Dielectric routine tests including the separate source AC voltage withstanding test and short duration induced over voltage withstanding test (ACSD)

Type tests:

Whenever a new type of transformer is designed and produced, it is necessary to carry out the following tests on at least one sample of the transformer:

a) Temperature rise test
b) Lightning impulse test

Special tests:

All the tests other than routine and type tests, are carried out as the contract may require. These tests are:

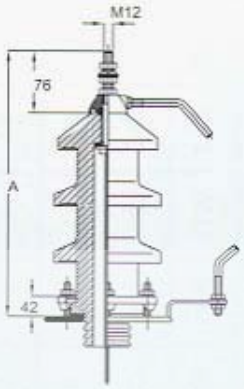
a) Measurement of zero sequence impedance
b) Determination of noise level according to IEC 60551
c) Short-circuit withstanding test, can also be carried out at CESI, KEMA , ...

Table1 Technical Specification of standard Transformers (20/0.4 KV)

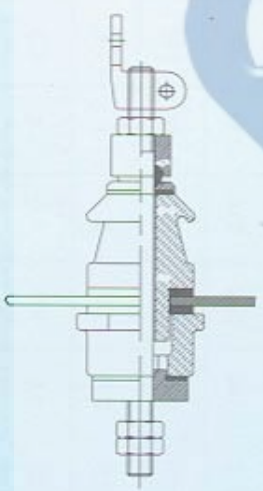
Type		TSUN 4444	TSUN 4744	TSUN 5044	TSUN 5344	TSUN 5444	TSUN 5544	TSUN 5644	TSUN 5744	TSUN 5844	TSUN 5944	TSUN 6044	TSUN 6144	TSUN 6244
Rated power (KVA)		25	50	100	200	250	315	400	500	630	800	1000	1250	1600
Rated HV/LV voltage (KV)		20/0.4	20/0.4	20/0.4	20/0.4	20/0.4	20/0.4	20/0.4	20/0.4	20/0.4	20/0.4	20/0.4	20/0.4	20/0.4
Taps in HV (%)		±4	±4	±4	±4	±5	±5	±5	±5	±5	±5	±5	±5	±5
Rated Frequency (HZ)		50	50	50	50	50	50	50	50	50	50	50	50	50
Vector Group		Yzn5	Yzn5	Yzn5	Yzn5	Dyn5	Dyn5	Dyn5	Dyn5	Dyn5	Dyn5	Dyn5	Dyn5	Dyn5
Short Circuit Voltage (%)		4	4	4	4	6	6	6	6	6	6	6	6	6
Max. Ambeint Temp. (˚c)		40	40	40	40	40	40	40	40	40	40	40	40	40
Max. Altitude above Sea Level (m)		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Rated HV Current (A)		0.72	1.44	2.89	5.77	7.22	9.09	11.55	14.43	18.2	23.09	28.87	36.1	46.2
Rated LV Current (A)		36.1	72.2	144.3	289	361	455	577	722	909.3	1155	1443	1804	2309
No - Load Losses (W)	A	150	210	340	570	610	720	850	1000	1200	1450	1750	2100	2550
	B	-	125	210	360	425	510	610	720	800	950	1100	1300	1700
No - Load Current (%)	A	4.3	2.8	2.6	2.4	2.1	2	1.8	1.7	1.6	1.5	1.4	1.4	1.3
	B	-	2	1.8	1.6	1.5	1.4	1.3	1.2	1.1	1	1	1.1	1.2
Short Circuit Losses in 75˚c (W)	A	750	1250	2150	3600	4450	5400	6450	7800	9300	11000	13500	16400	19800
	B	-	875	1475	2350	2750	3250	3850	4950	5600	7400	9500	11400	14000
Applied insulation Test Voltage (KV)		50/3	50/3	50/3	50/3	50/3	50/3	50/3	50/3	50/3	50/3	50/3	50/3	50/3

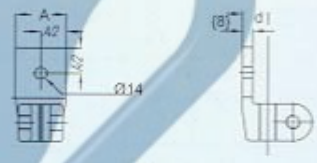
A: Standard version B: Low-loss version

Hermetically Sealed Distribution Transformers

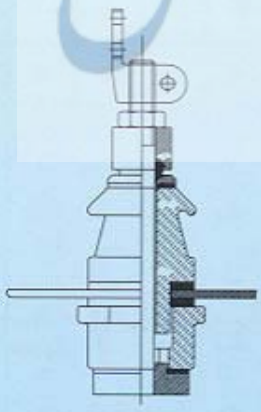


Nr.	A
DT10Ni250	260
DT10Nf250	310
DT20Ni250	310
DT20Nf250	385
DT30Ni250	385
DT30Nf250	485



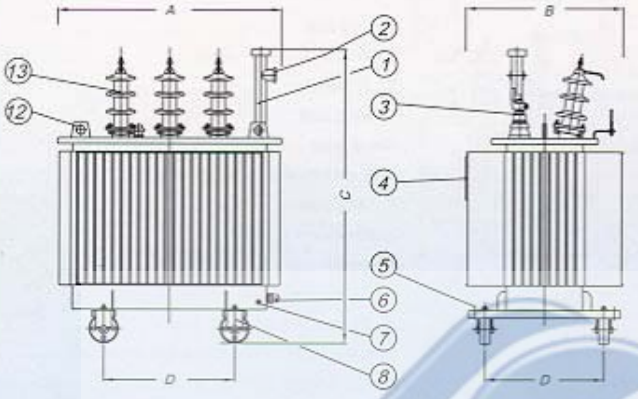


Nr.	A	d	M	L
DT1/ 250	30	18	12	156
DT1/ 630	40	20	20	191

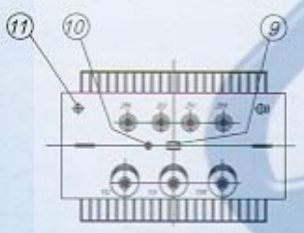


Nr.	A	S	d	M	k	N	L
DT1/ 1000	60	12	30	30	32	2*Ø14	263
DT1/ 2000	100	20	45	42	50	4*Ø18	340
DT1/ 3150	120	20	45	48	60	4*Ø18	372

Hermetically Sealed Distribution Transformers

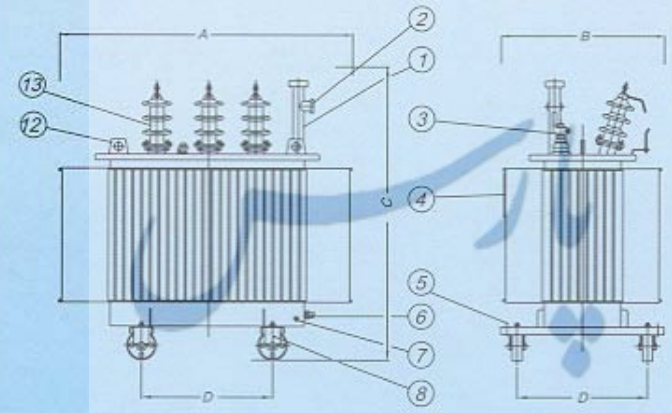


1) Filling pipe
2) Visual oil level eye indicator
3) L.V. Bushing
4) Rating plate
5) Pulling lug
6) Oil drain valve & Sampling valve
7) Earthing screw
8) Bidirectional wheels
9) Terminal plate
10) Tapping switch with indicator & device
11) Thermometer pocket R1"
12) Lifting lugs for complate trans. & active part
13) H.V. Bushing



POWER	25 kVA	50 kVA
A(mm)	804	834
B(mm)	728	738
C(mm)	1338	1368
D(mm)	520	520
W_T(Kg)	473	500

Hermetically sealed (oil filled)
Technical Specification according to Table 1 (20\0.4 kV)



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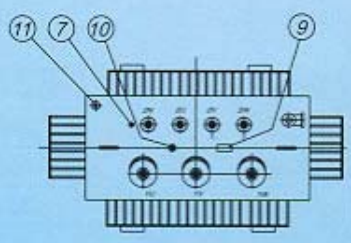
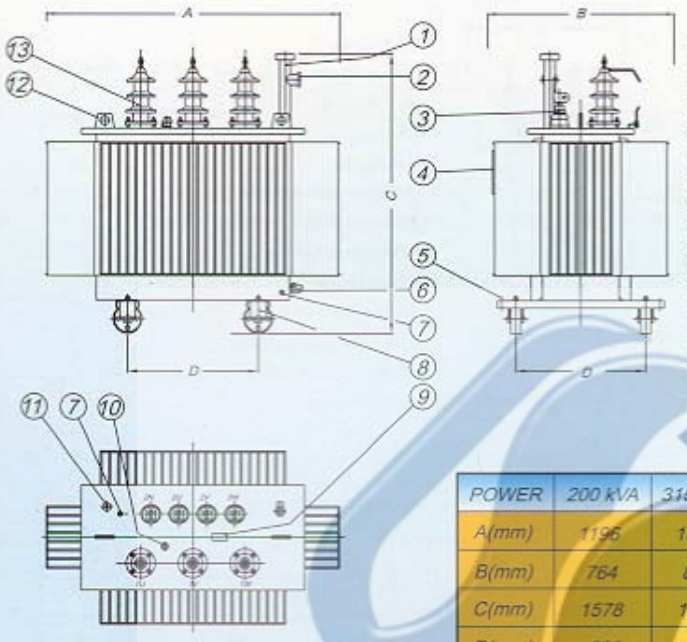


POWER	100 kVA
A(mm)	1208
B(mm)	690
C(mm)	1560
D(mm)	520
W_T(Kg)	643

Hermetically sealed (oil filled)
Technical Specification according to Table 1 (20\0.4 kV)

Hermetically Sealed Distribution Transformers



1) Filling pipe
2) Visual oil level eye indicator
3) L.V. Bushing
4) Rating plate
5) Pulling lug
6) Oil drain valve & Sampling valve
7) Earthing screw
8) Bidirectional wheels
9) Terminal plate
10) Tapping switch with indicator & device
11) Thermometer pocket R1"
12) Lifting lugs for complate trans. & active part
13) H.V. Bushing

POWER	200 kVA	315 kVA	400 kVA	500 kVA	630 kVA	800 kVA
A(mm)	1196	1332	1562	1592	1692	1742
B(mm)	764	840	956	972	986	1062
C(mm)	1578	1580	1622	1732	1802	1912
D(mm)	520	670	670	670	670	670
W_T (Kg)	904	1177	1457	1748	1981	2372

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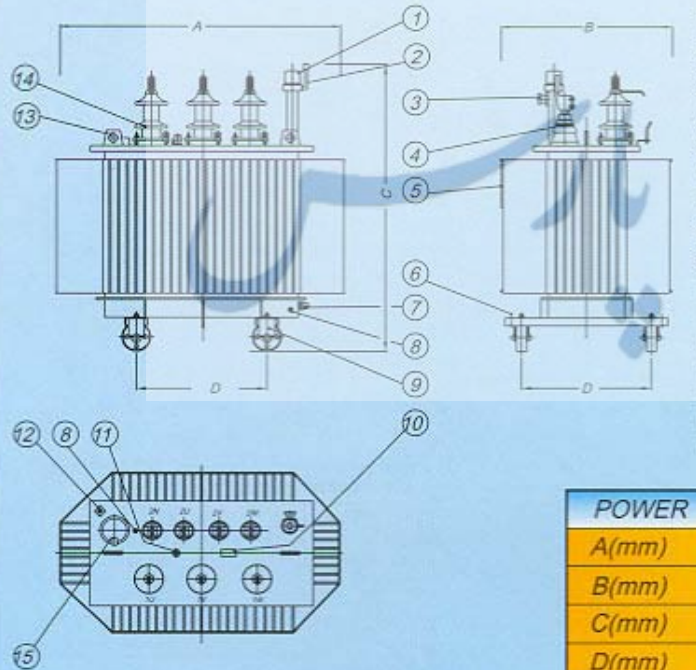
Technical Specification according to Table 1 (20/0.4 kV)

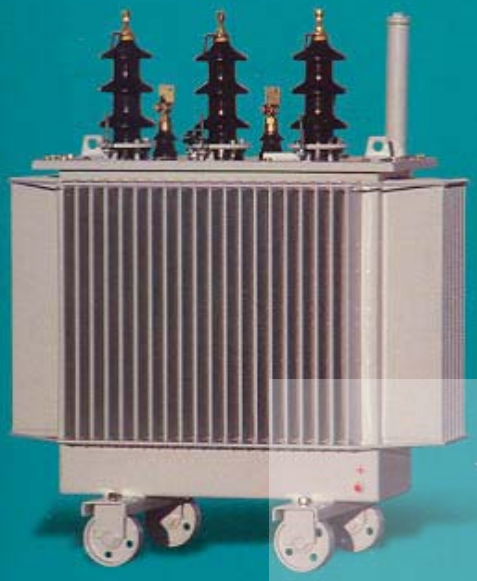


1) Filling pipe
2) Hermetic protection realy
3) Visual oil level eye indicator
4) L.V. bushing
5) Rating plate
6) Pulling lug Ø30
7) Oil drain valve & Sampling valve
8) Earthing screw
9) Bidirectional wheels
10) Terminal plate
11) Tapping switch with indicator & device
12) Thermometer pocket R1"
13) Lifting lugs for complate trans. & active part
14) H.V. bushing
15) Pressure relief device

POWER	1000 kVA	1250 kVA	1600 kVA
A(mm)	1792	2092	2392
B(mm)	1072	1172	1162
C(mm)	2266	2276	2316
D(mm)	820	820	820
W_T(Kg)	2923	3711	4501

Hermetically sealed (oil filled)
Technical Specification according to Table 1 (20/0.4 kV)

KOOSHKAN TRANSFORMERS



We look forward to serving the purchasers, nationwide and beyond, constantly through or dedication to quality, firm belief in advancement and our solemn pledge to manufacture the state-of-the art products.

Thus
we always endeavor to stay ahead and explore the best.

KOOSHKAN TRANSFORMERS

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