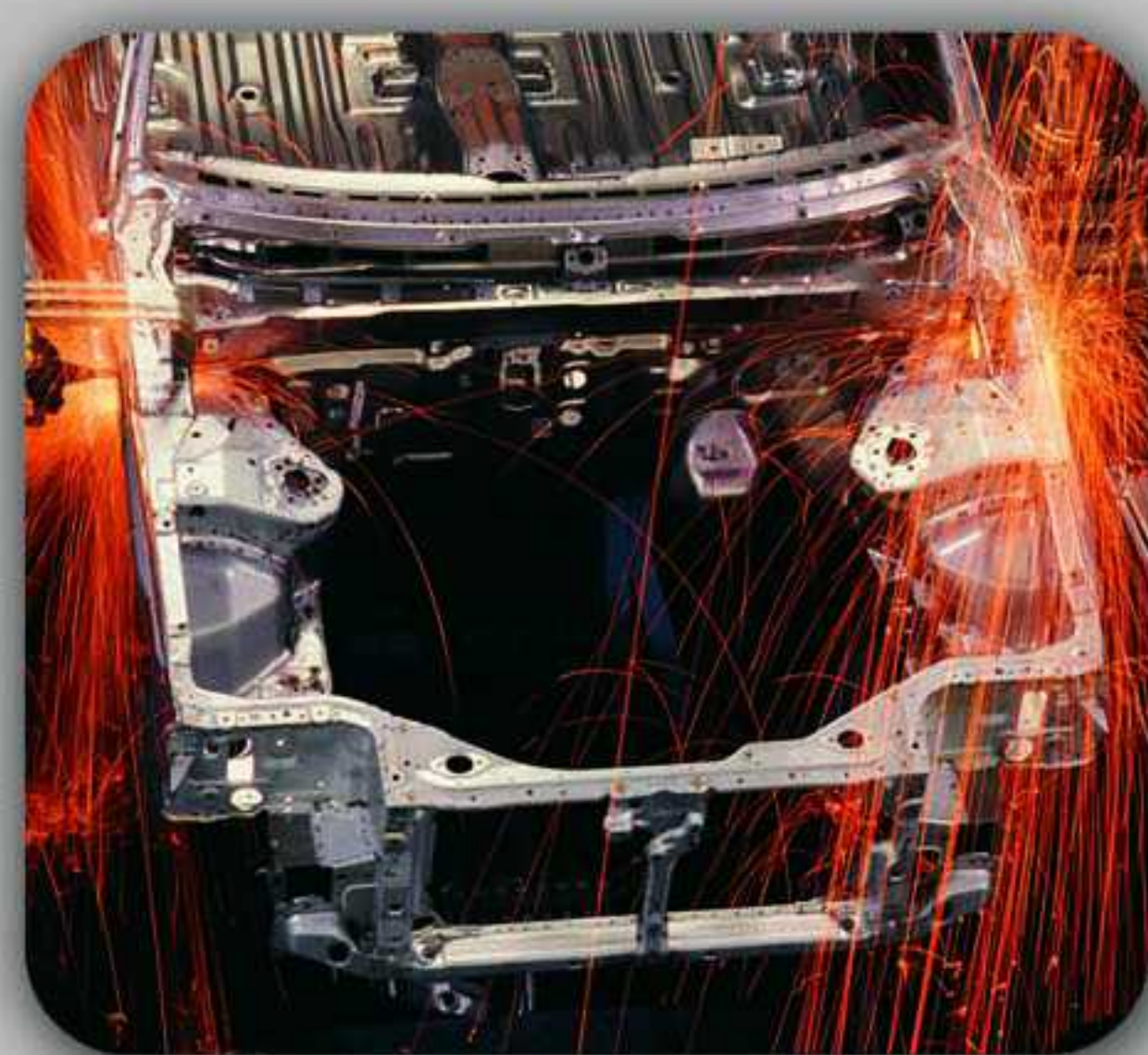
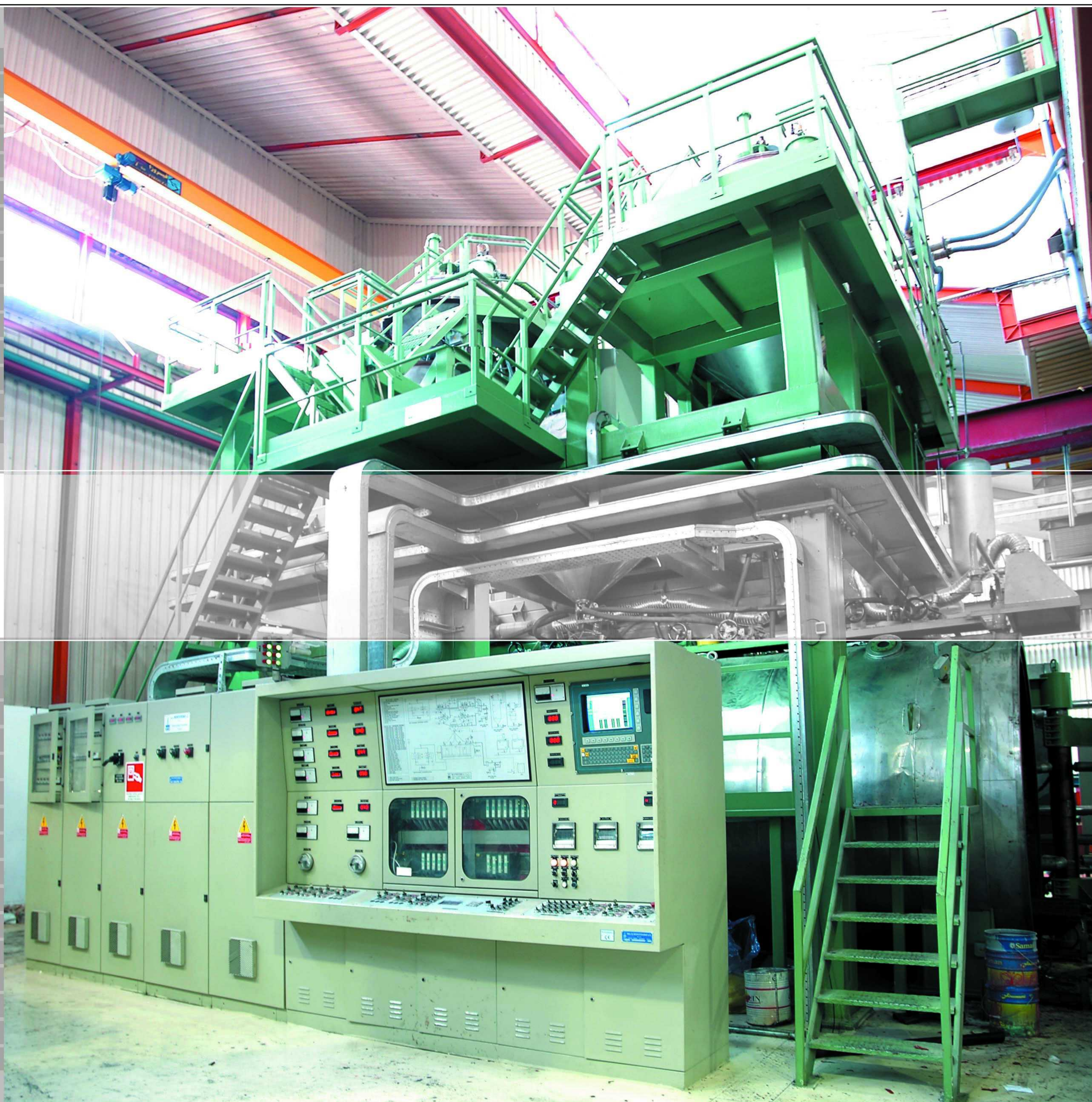




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| 4. construction | 8 |
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IRAN TRANSFO

Cast Resin Transformers

Introduction to IRAN TRANSFO Cast resin transformers

Cast resin dry type transformers are the most suitable transformers for distribution of electricity in high degree of safety.

They do not propagate fire. They are self-extinguishing and in the event of a break down, there is no risk of leakage of inflammable or contaminating substances such as oil. Cast resin transformers are maintenance free, no checking of the oil level is necessary and due to free of partial discharge feature, they have long service life.

All above mentioned features make it the markets safest and most reliable transformer.

We offer:

- All technologies (Dry/Liquid)
- All standards(IEC, ANSI, etc)
- Ratings 160 to 8000 KVA
- Applications up to 36 KV

Quality statement

IRAN TRANSFO cast resin transformers are manufactured in accordance with the international quality standard ISO 9001 and ISO 14001. Our aim is to deliver cast resin transformers on time and conform to your specifications.

Where can be used cast-resin transformers?

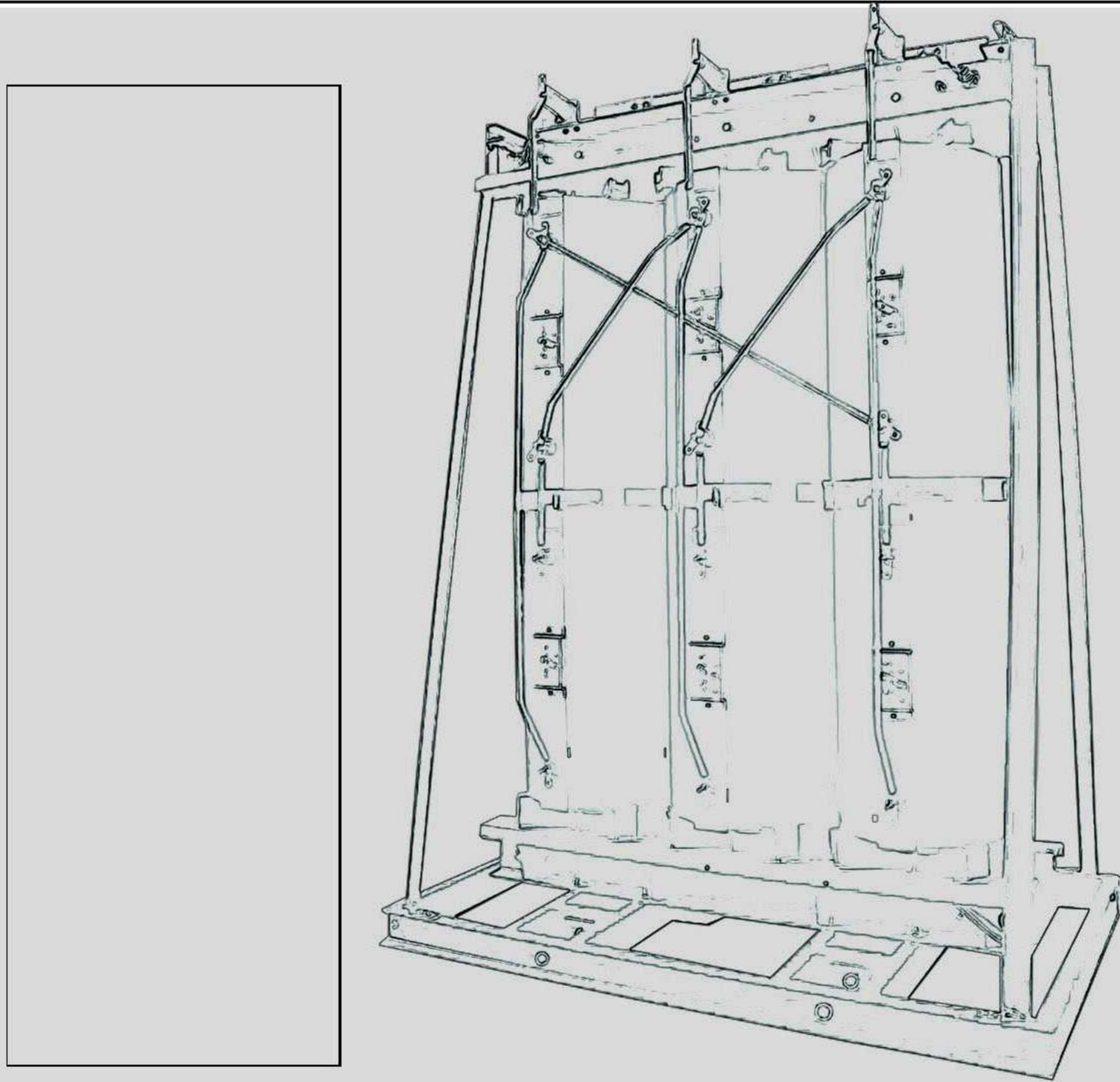
With IRAN TRANSFO cast resin Transformers the limitations of liquid filled transformers are avoided, but the proven characteristics such as operational reliability and service life are retained.

The electrical and physical properties of cast-resin transformers fit them for both civil and industrial use.

Applications

| | |
|---|---------------------------------------|
| High rise building | Refineries and petrochemicals |
| Hotels, Hospitals, Theatres, Stadiums | Metro railways |
| Chemical ,Cement, Textile, Steel plants | Material handling equipments |
| Electronics industries, Radio & TV towers | Power plants ,Power stations, nuclear |
| Ports, Ships, Off shore platforms | Air ports |



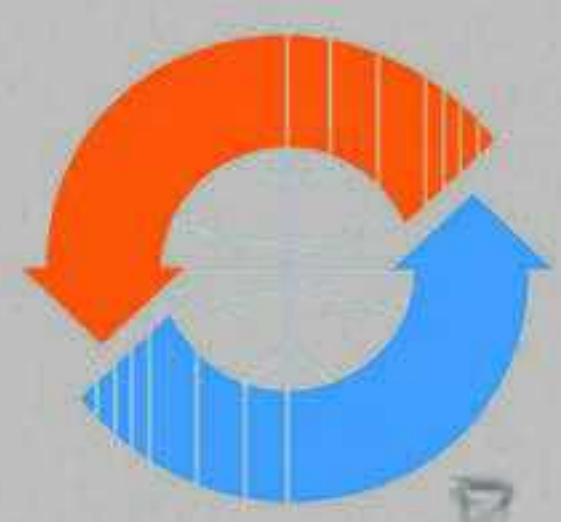


IRAN TRANSFO cast resin transformer advantages:

- ❑ The most economical
- ❑ Almost maintenance free
- ❑ Better repair possibilities (at site)
- ❑ Reduced overall dimensions
- ❑ Easy to integrated anywhere
- ❑ Less space needed
- ❑ Position of HV and LV terminals on top or bottom possible (high flexibility)
- ❑ High resistance to short circuits
- ❑ Low levels of partial discharges ensure a relatively longer average life to the transformer
- ❑ The high stability of the physical characteristics of the materials
- ❑ Installation close to center of load and consumption
- ❑ Environmentally friendly technology
- ❑ Non flammable and self extinguishing
- ❑ Zero risk of leakage of flammable substance
- ❑ Excellent antipollution features and maximum safety
- ❑ Elimination of sumps for oil collection
- ❑ Easy to computerize thermal process control

IRAN TRANSFO TOZEI ZANGAN

The most economical
High resistance to short circuits
Non flammable and self extinguishing
Zero risk of leakage of flammable substance



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iran Transfo factories : 4th Km of Zangjan - Tehran Road ,

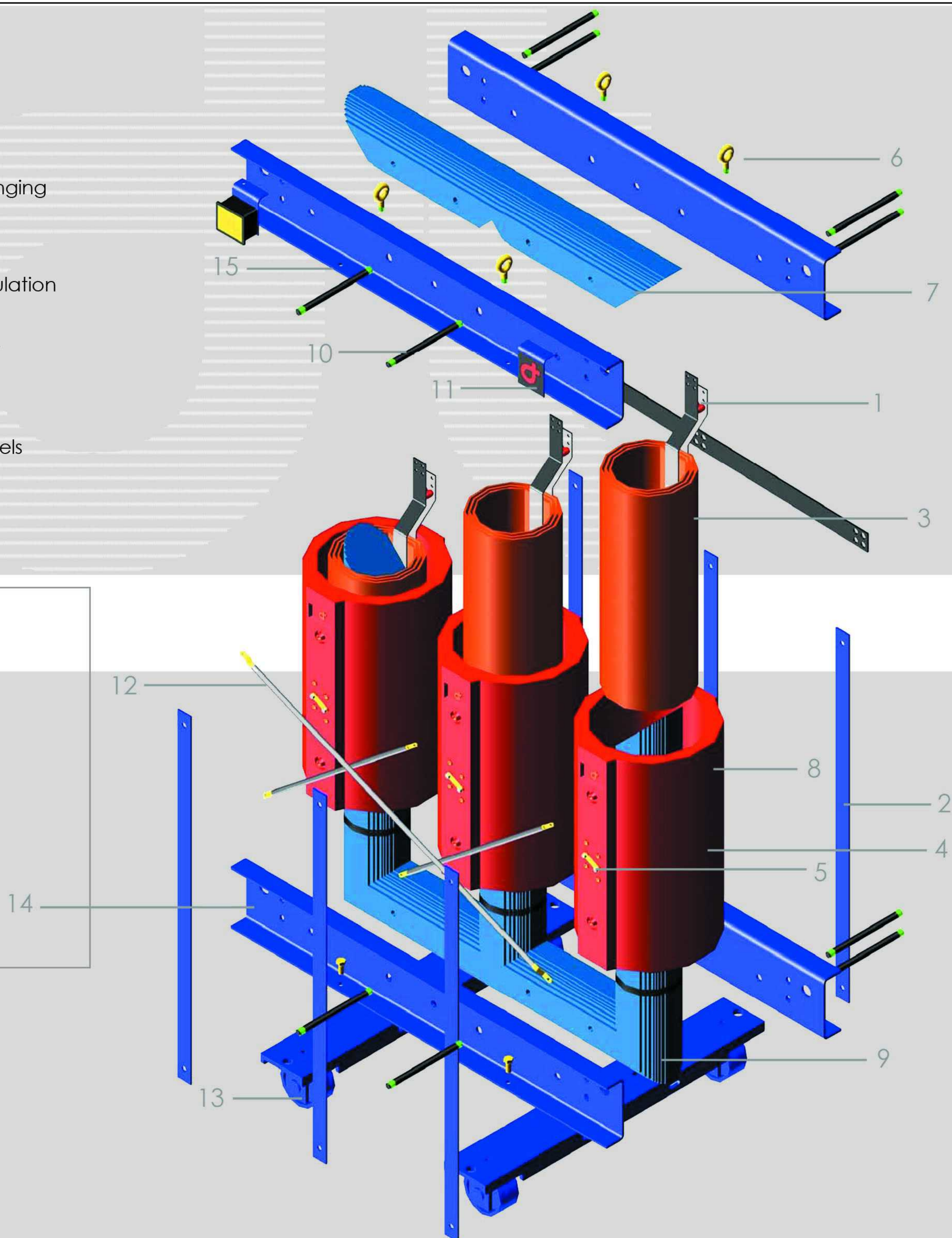
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IRAN TRANSFO

Cast Resin Transformers

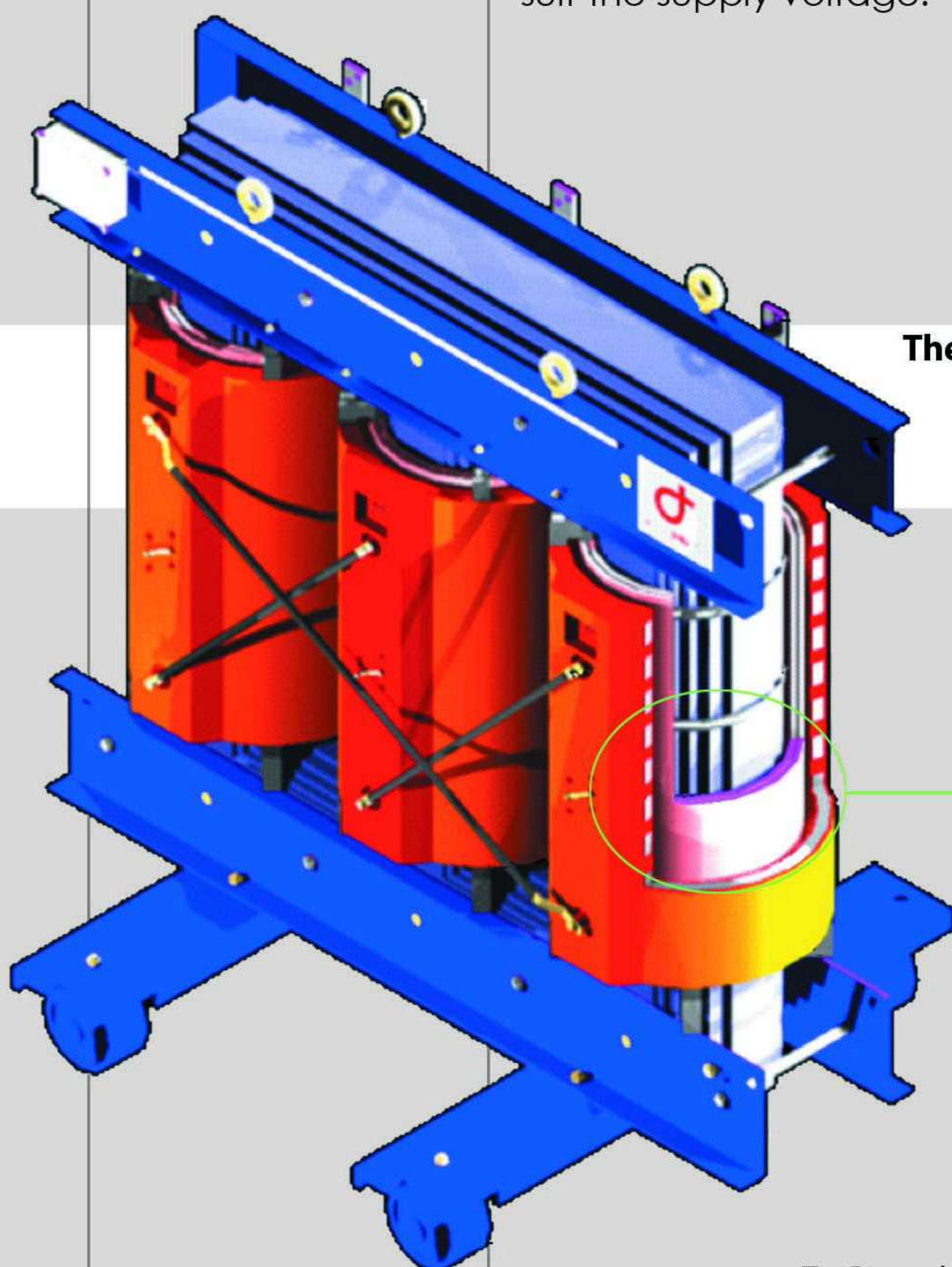
Cast resin transformer main components

1. LV connection
2. HV connections
3. LV windings
4. HV winding
5. Off circuit tap changing
6. lifting lugs
7. Core yoke
8. The epoxy resin insulation
9. Core leg
10. Core pressing bolt
11. Name plate
12. Inter phase lead
13. Bi-directional wheels
14. Lower frame
15. Upper frame

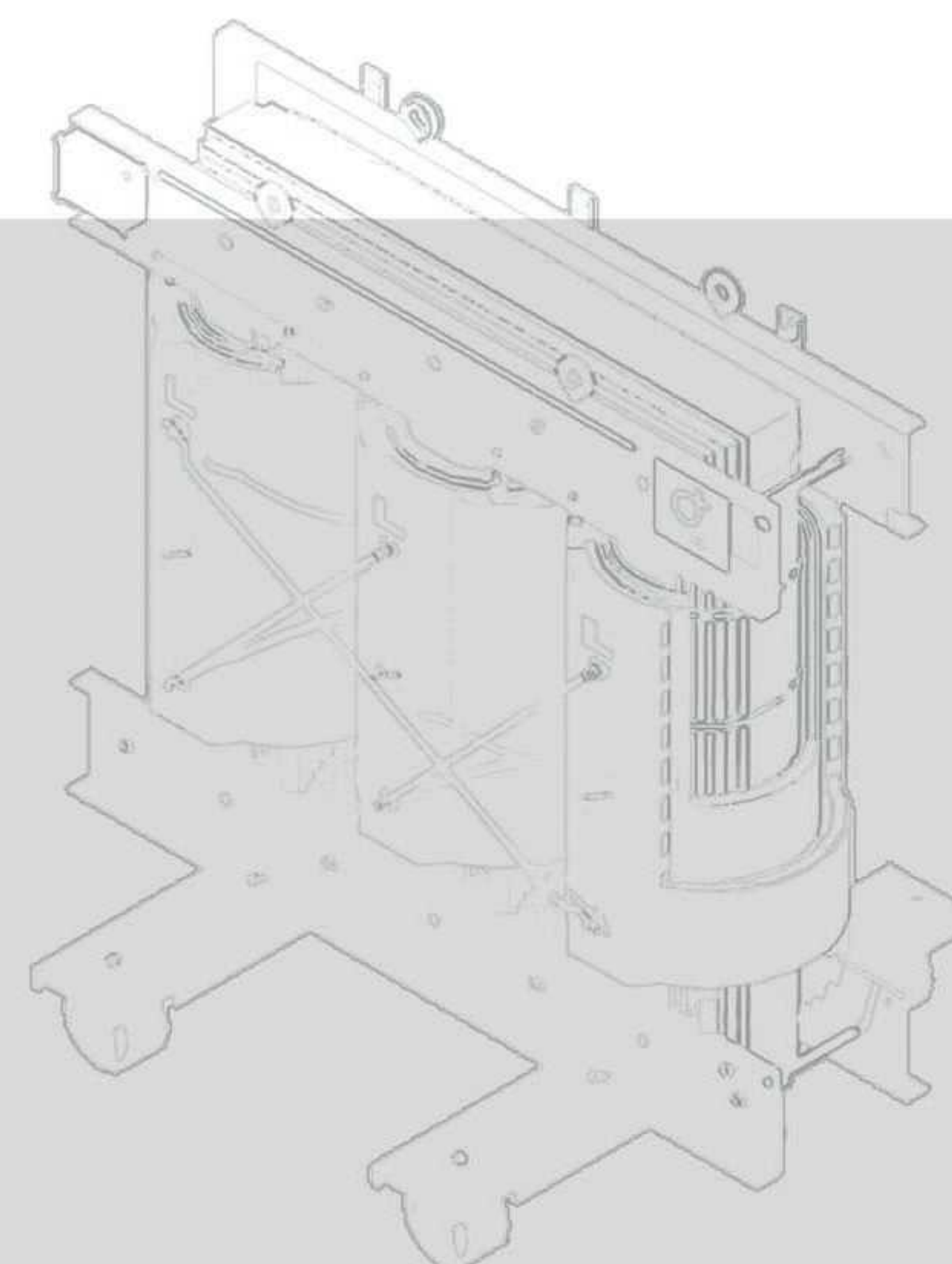




1. LV connection are usually made at the top (standard) or the bottom (on request); the inter gas welding process again gives a high level of quality to the windings.
2. HV connections are also available with elbow connectors.
3. LV windings are of aluminum foil and insulation material, impregnated under vacuum.
4. HV winding resin coils, cast under vacuum controlled by a computerized system, the windings are made of aluminum foil to optimize the thermal characteristics. An inter gas welding process ensures a high quality for the windings.
5. Off circuit tap changing links on the HV winding, to allow step by step regulation to suit the supply voltage.



The construction features of IRAN TRANSFO cast resin transformers



6. Lifting lugs for safe lifting on 4 points.
7. Core is composed of three columns, upper and lower yokes and made in laminated magnetic steel sheets, which are available with standard or reduced losses.
8. The epoxy resin insulation has a high flammability point and has high self extinguishing characteristics; furthermore maintenance requirements are reduced to a minimum.

IRAN TRANSFO

Cast Resin Transformers

Technology

- Magnetic core

Three leg magnetic core is made from cold rolled grain oriented, low loss sheet of silicon steel insulated by an inorganic insulation.

The sheets composing the core are cut at 45 degrees. Thanks to step-lap laminated joints, no load loss and noise level are reduced. A two component special resin is used to protect core laminations against corrosion and further reduction of noise level as low as possible.

-High voltage winding

High voltage winding are made of high grade aluminum foil interleaved with high grade PET insulating foil. Wound coils are located in special moulds and undergo preheating to remove humidity. Coils are cast under vacuum with a mixture of several component epoxy resin into a heated vessel. These features result in a fire-resistant, moisture proof and partial discharge free high voltage windings.



-Low voltage winding

Low voltage winding is made of full-height aluminum sheet interleaved with high grade DMD insulating materials. Wound coils are impregnated under vacuum by special resin and baked in an oven through controlled temperature-time cycle to build a rigid cylinder which will withstand perfectly against humidity and short circuit conditions forces.

Outlet bars are welded by a special technique to the aluminum sheets to make terminals.



Manufacturing process

Very low partial discharge level (≤ 10 p C) provides excellent impulse strength.



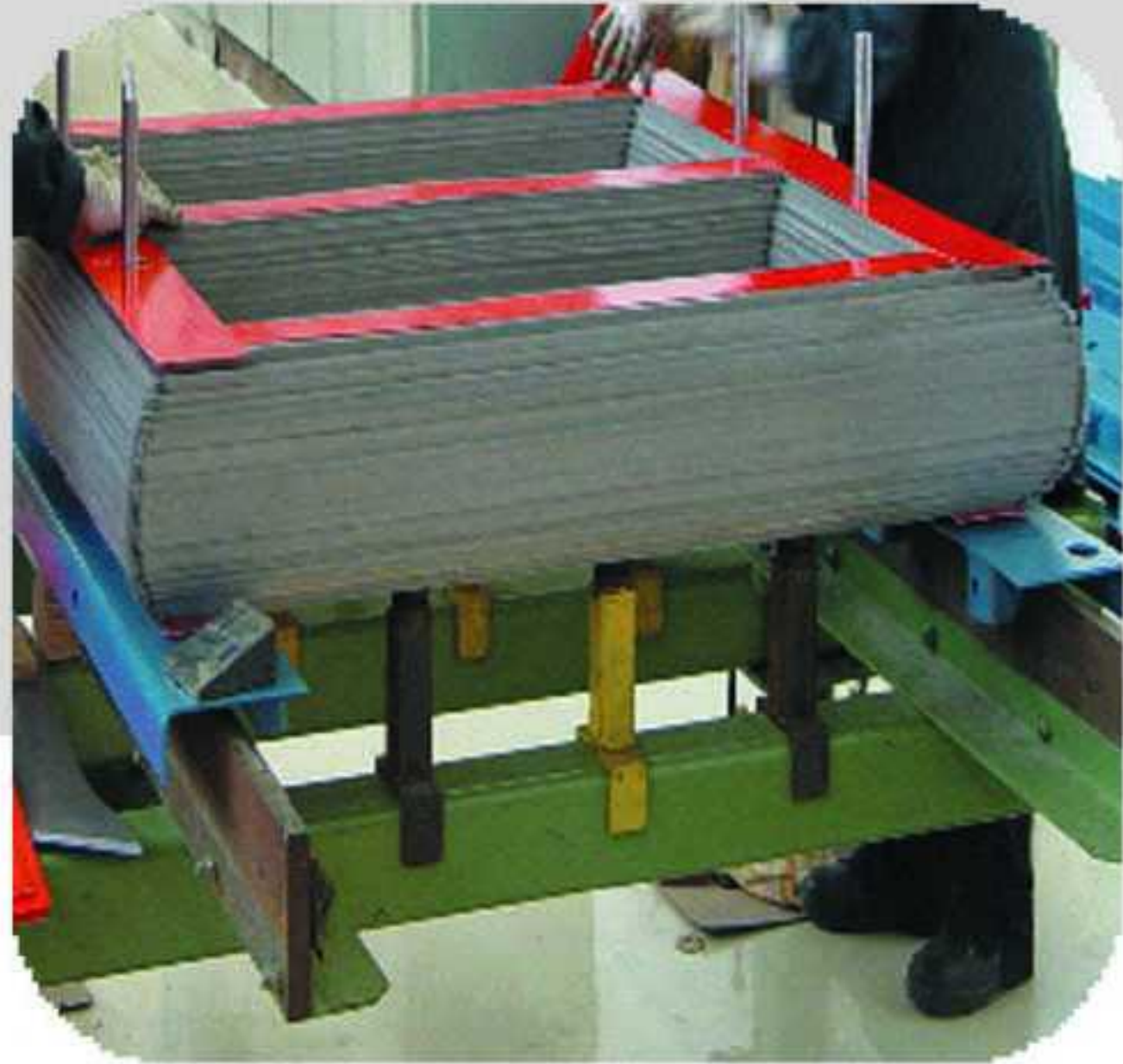
HV winding



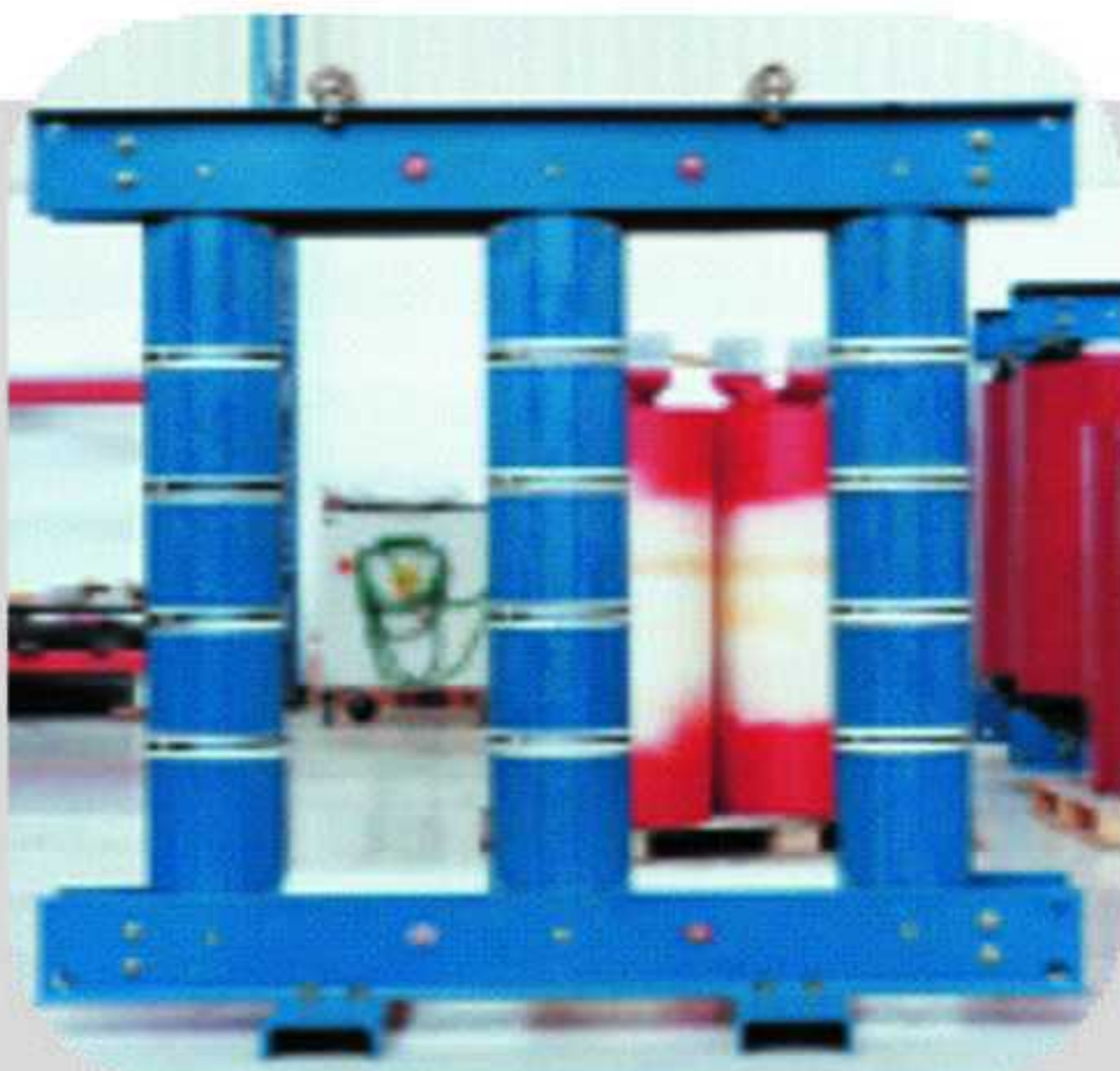
Core cutting



Vacuum casting



Core staking



Final assembly



Test

IRAN TRANSFO

Cast Resin Transformers

□ Standard Accessories



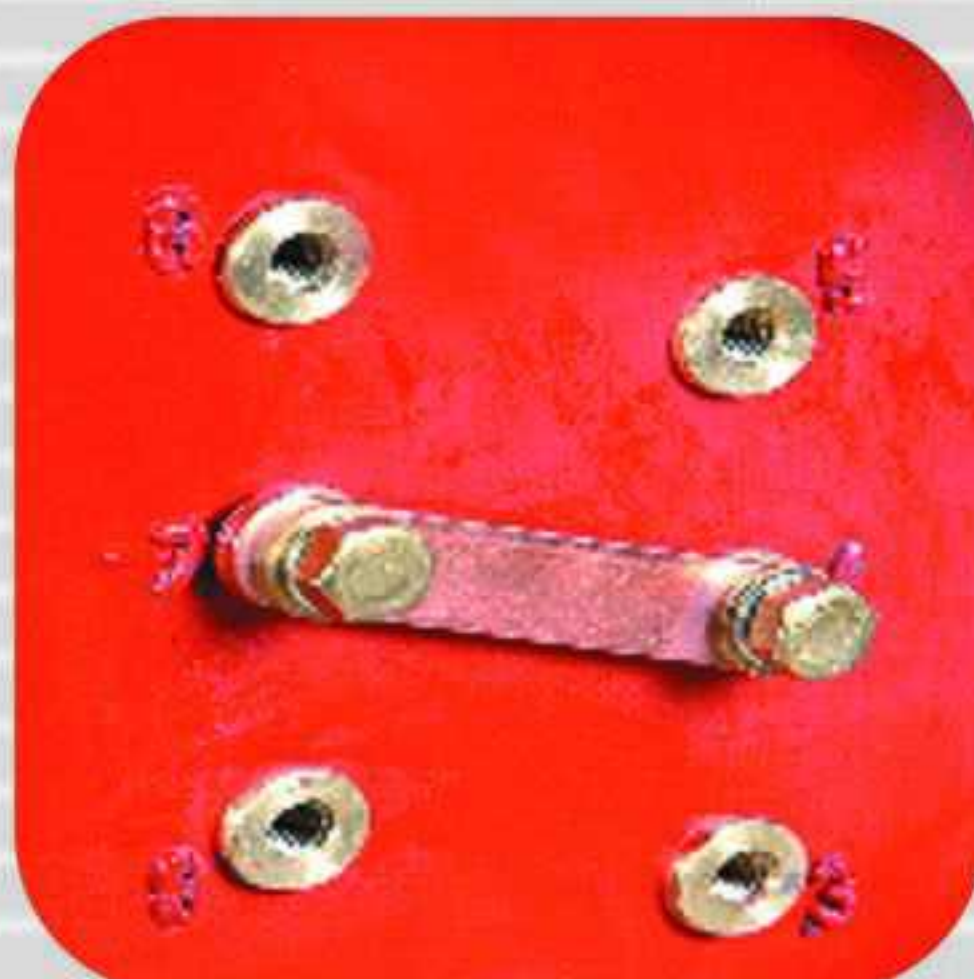
HV terminals



LV terminals



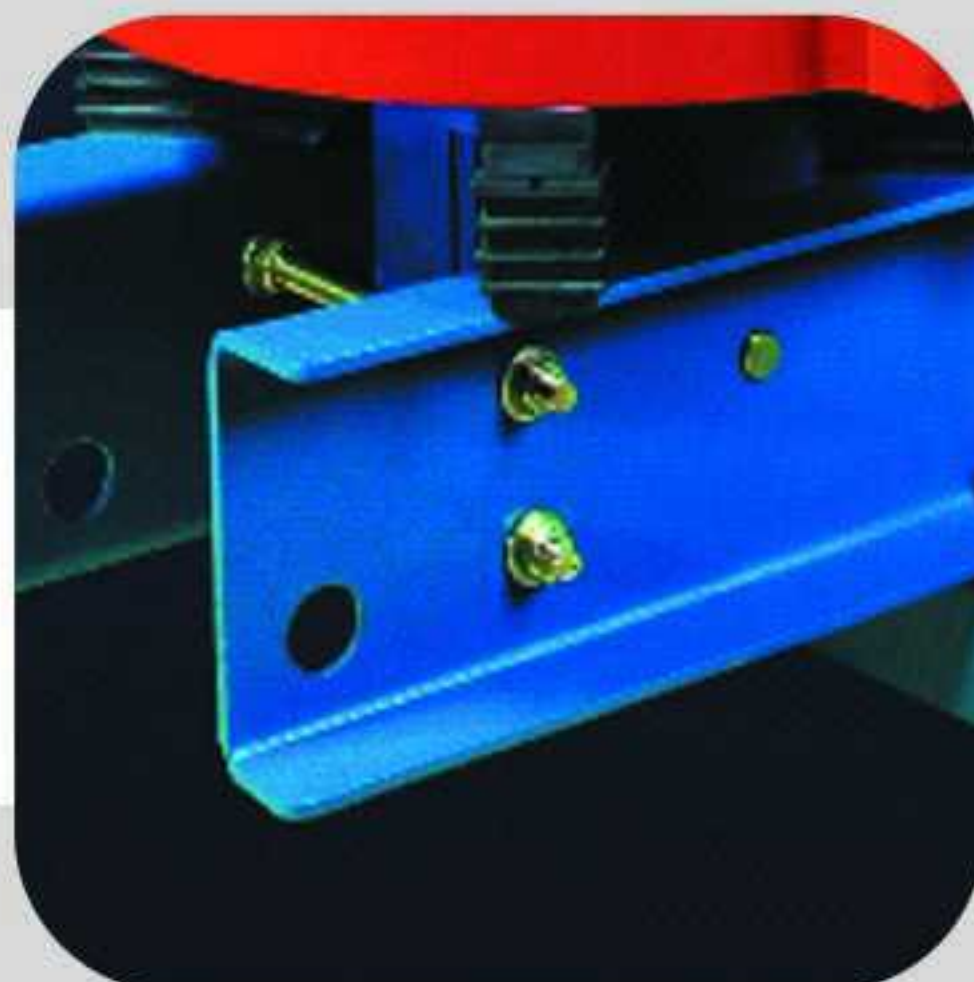
Lifting lug



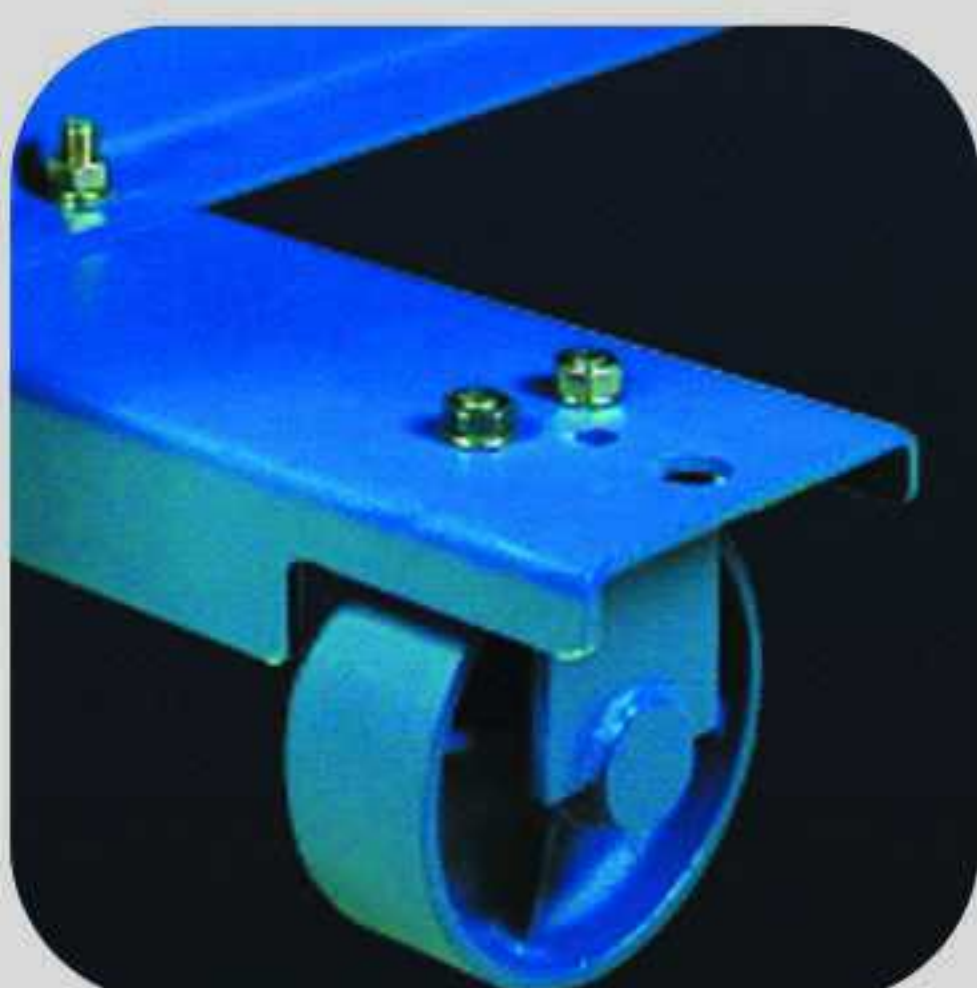
Tap changing links



Phase connection lead



Earthing terminal



Bidirectional wheels



Danger label



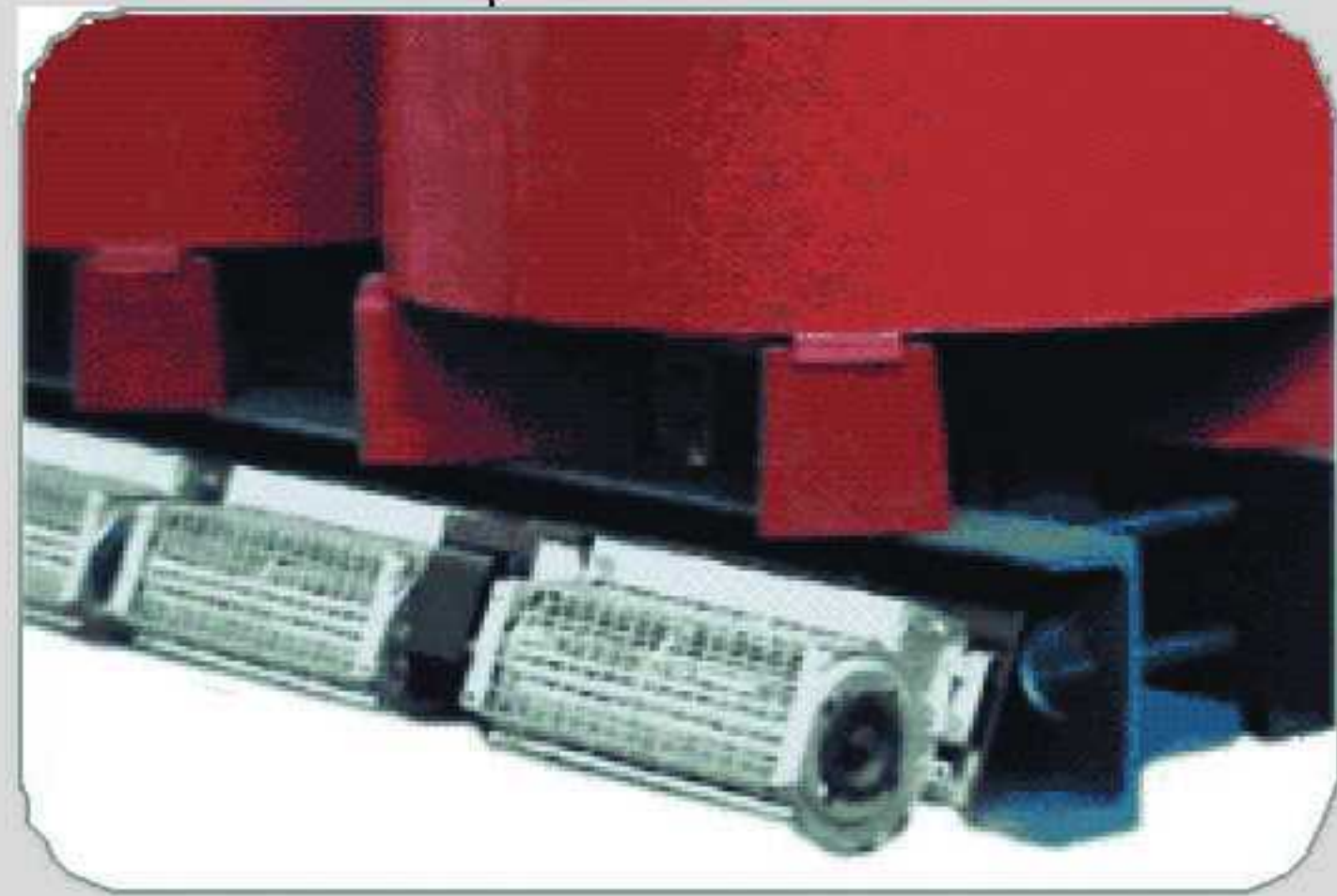
Rating and diagram plate



Digital Temperature Monitor



□ Special Accessories



Cross-flow fans

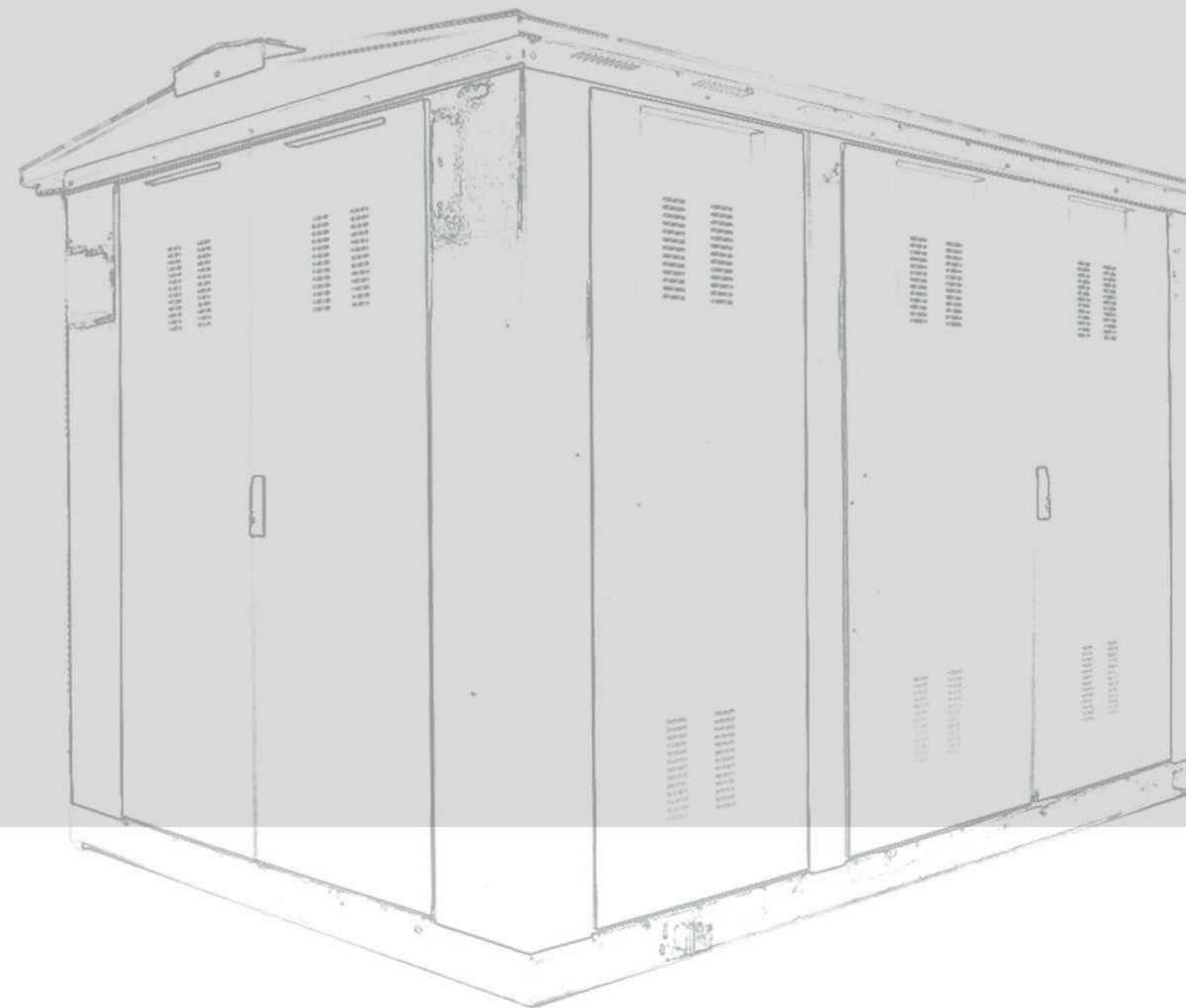


Plug-in bushings



Fan

Enclosure



Test Categories

The tests to be described in this document can be grouped in three main categories:

Routine tests which according to standards and practice are performed on every transformer, special and type tests which are performed only as a result of specific agreement between customer and manufacturer.

The electrical characteristics and dielectric strength of the transformers are checked by means of measurements and tests defined by standards (e.g. TS, IEC, DIN/VED, ANSI, NEMA, and BS).

Summary of the tests and measurements processes are given as follows:



| No. | ITEMS | ROUTINE TEST* | TYPE TEST* * | SPECIAL TEST* * |
|-----|--|---------------|--------------|-----------------|
| 1 | Measurement of winding resistance | • | | |
| 2 | Measurement of voltage ratio and check of phase displacement | • | | |
| 3 | Measurement of short-circuit impedance and load loss | • | | |
| 4 | Measurement of no-load loss and current | • | | |
| 5 | Separate-source AC withstand voltage test | • | | |
| 6 | Induced AC withstand test | • | | |
| 7 | Partial discharge measurement (routine and special test) | • | | |
| 8 | Lightning impulse test | | • | |
| 9 | Temperature rise test | | • | |
| 10 | Measurement of noise level | | | • |
| 11 | Short-circuit test | | | • |

*All transformer are singly tested acc. IEC60076-11

**These tests can be carried out on customer request



IRAN TRANSFO cast resin transformer Classification: E2 C2 F1

Cast resin transformers must be marked in conformity with verified environment, climate and fire categories. IRAN TRANSFO cast resin transformers conform to the highest defined categories and can be used anywhere:

Environmental classes E2

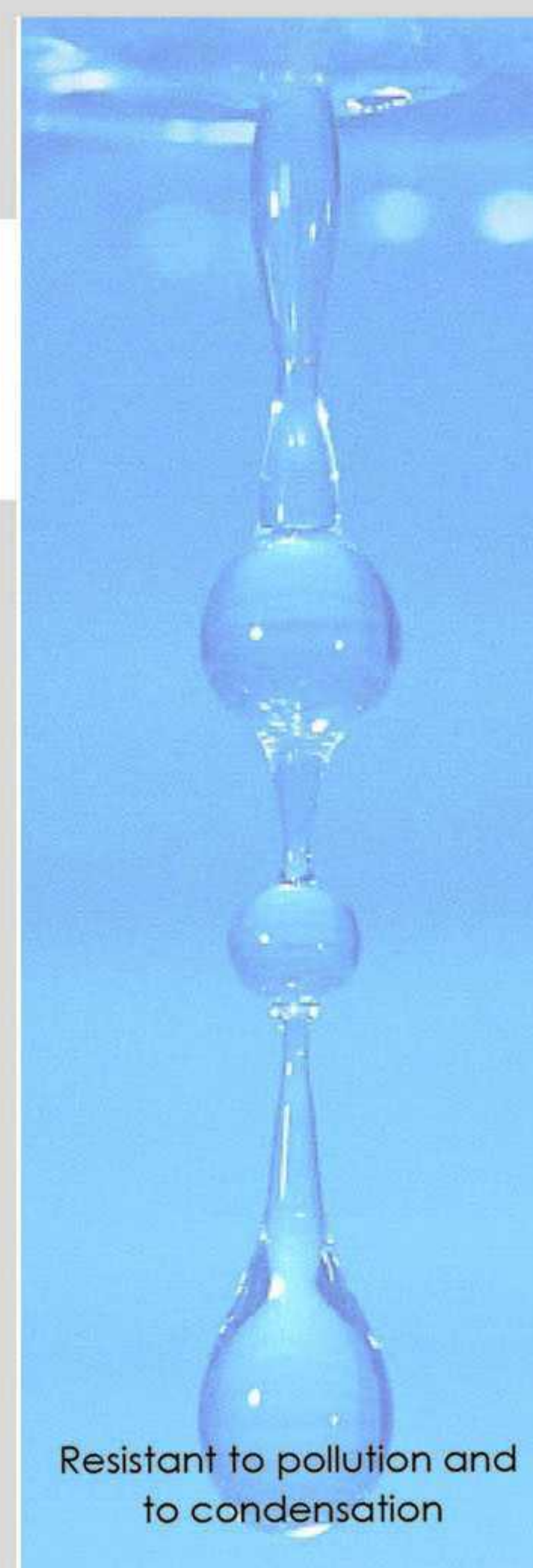
E2=the transformer is subjected to sever condensation or to heavy pollution or to a combination of both.

E0=no condensation on the transformer, negligible pollution, installation in dry and clean ambient.

E1=occasional condensation and little pollution.



Self extinguishing when exposed to fire



Resistant to pollution and to condensation

Climate classes C2

C2=the transformer can be transported and stored down to -25°C .

C1=the transformer is not suitable for operation at temperature below -25°C during transportation and storage.

Fire behavior classes F1

F1=the transformer is subject to fire hazard and a restricted flammability is required. Self extinguish of fire shall take place within a specified time period.

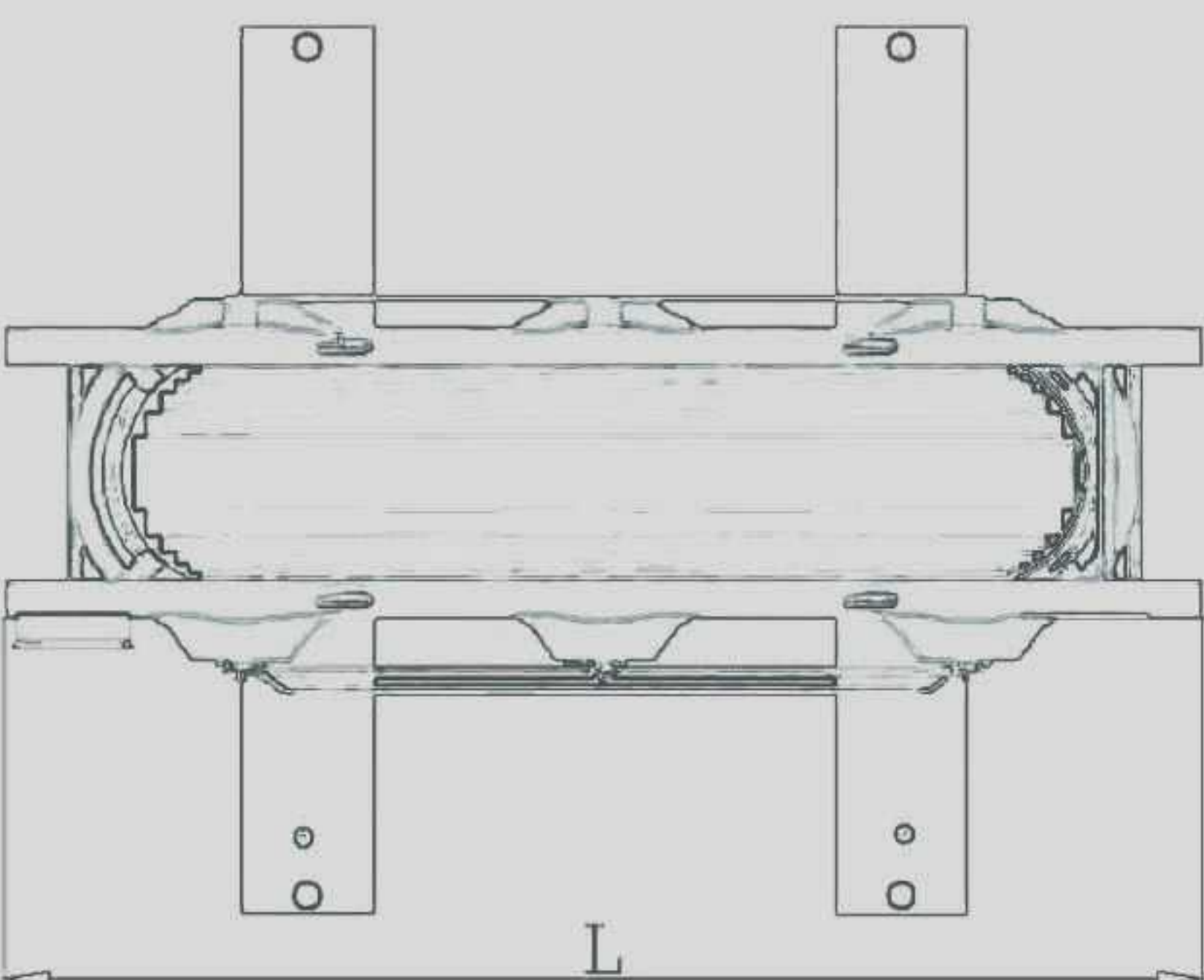
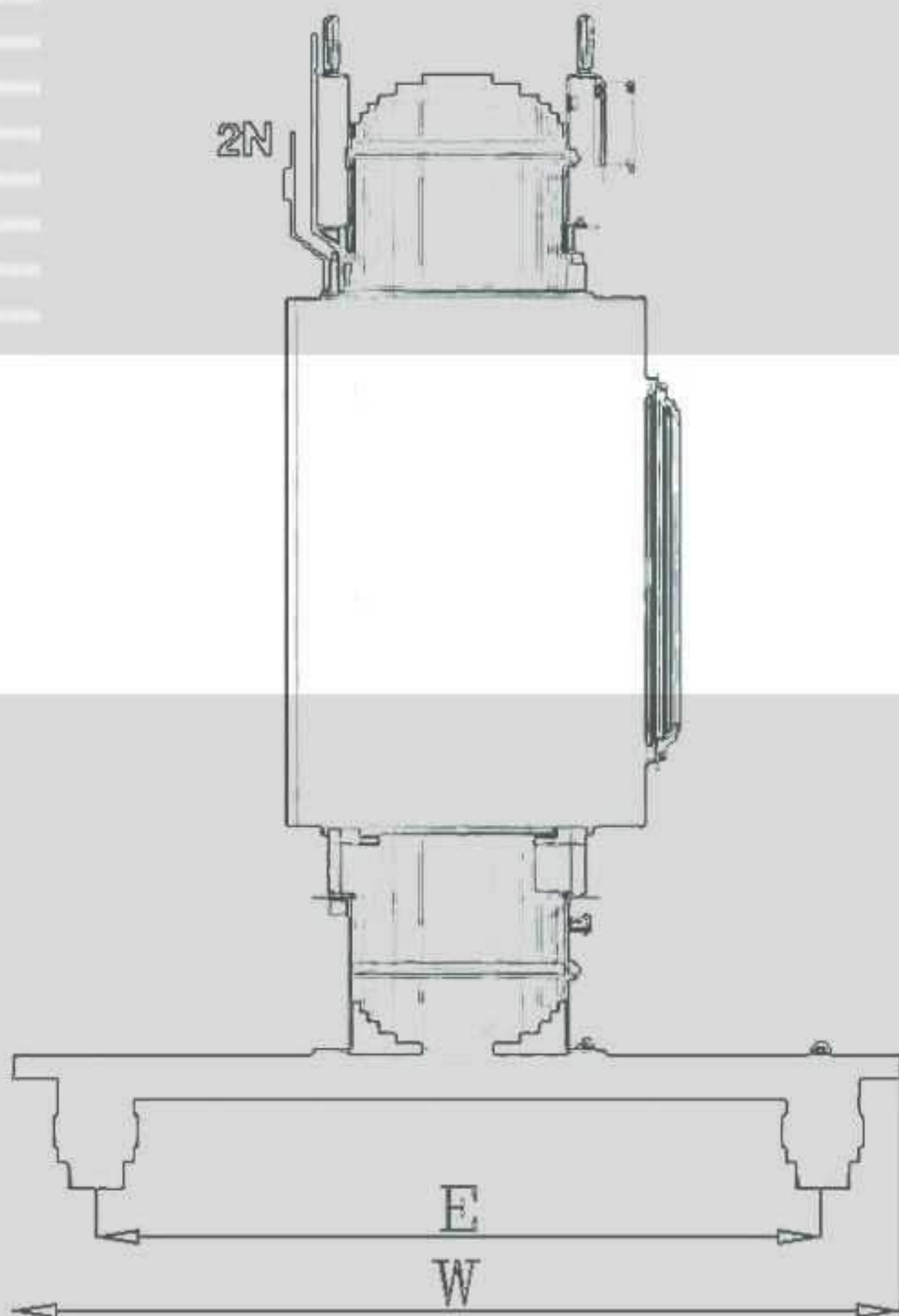
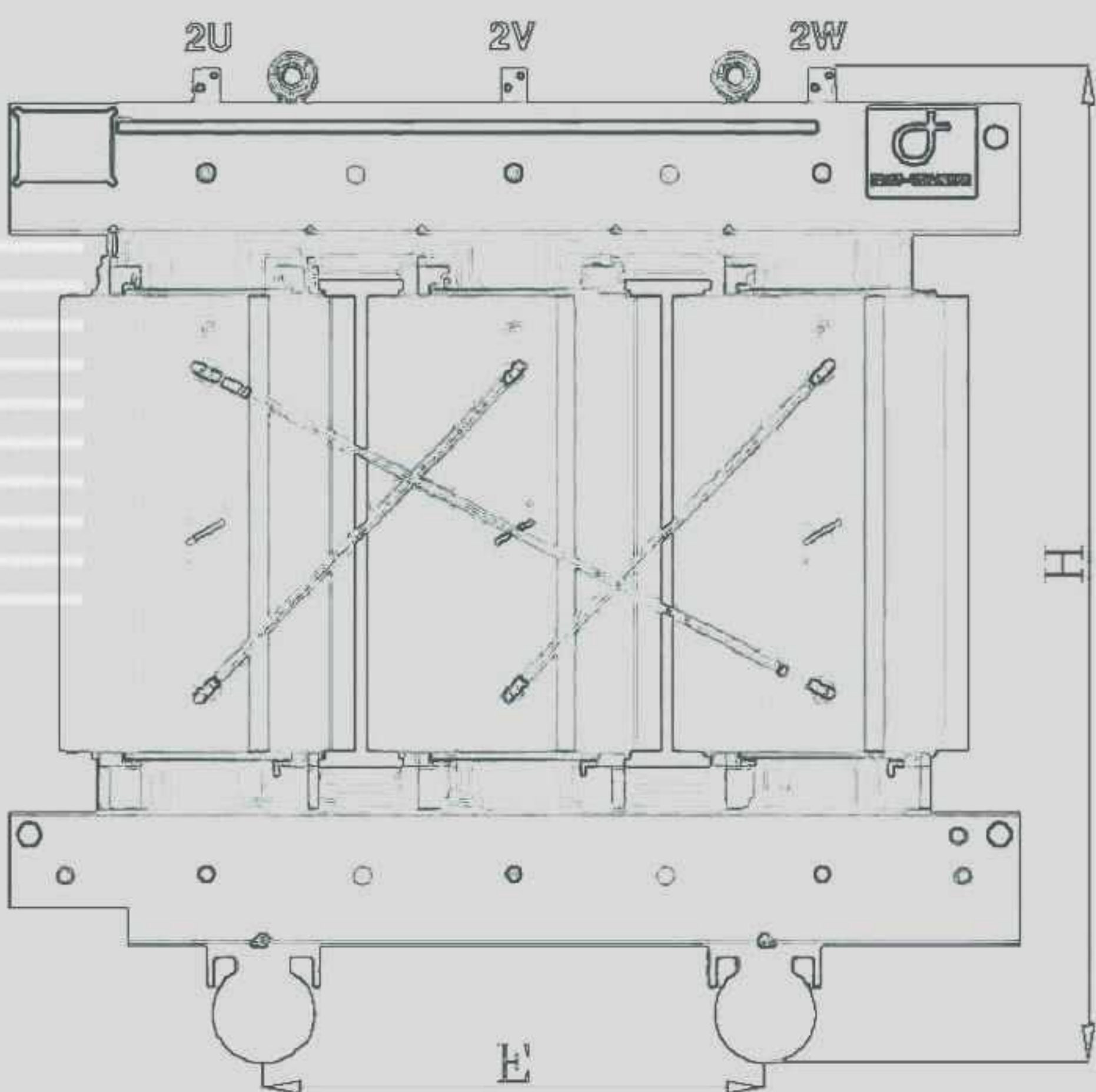
F0=no fire hazard is envisaged and no measures to limit the flammability are taken.

Resistant to load variations and overloads

Specifications of cast resin standard transformer

IRAN TRANSFO cast resin transformers are produced in accordance with IEC60076-11 and are suitable for operation in humid or heavily polluted environments.

| Specifications | |
|---------------------------------|--------------|
| Applicable standard | IEC 60076-11 |
| Rated power (k VA) | 160-3150* |
| Rated frequency (Hz) | 50,(60**) |
| High voltage(k V) | Up to 36 kV |
| Low voltage (V) | 400 |
| Taping on HV side (%) | ±(2*2.5) |
| Impedance voltage (%) | 6 |
| Connection | Dyn5 |
| Max ambient temperature (°C) | 40 |
| Installation altitude a.s.l (m) | 1000 |
| Class | E2-C2-F1 |
| Insulation class | F |
| Temperature rise (K) | 100 |



Insulation levels for all the transformers are according IEC 60076-11 as below

| Um (k V) | Lightning impulse (k V) | AC (k V) |
|----------|-------------------------|----------|
| <=1.1 | - | 3 |
| 12 | 60/75** | 28 |
| 17.5 | 75/95** | 38 |
| 24 | 95/125** | 50 |
| 36 | 145/170** | 70 |

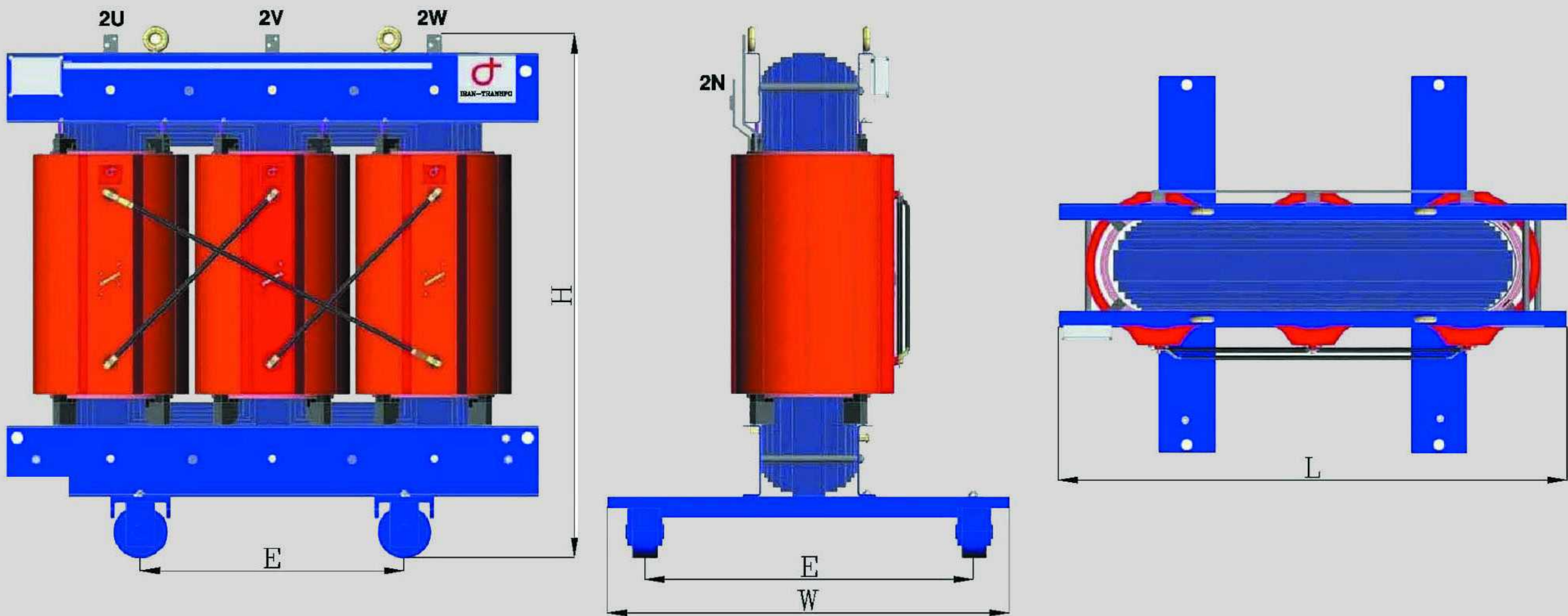
* Transformers with rated power less than 160 and higher than 3150 k VA at voltages up to 36 k V are considered as special transformer.

**The values are available upon request of customer



Technical data at a glance

IRAN TRANSFO cast resin transformers achieve a compact solution decreasing weight and dimensions.



RATED PRIMERY VOLTAGE $\pm 2.5\%$ **20KV** **IP00** **VECTOR GROUP** Dyn5
RATED SECENDARY VOLTAGE (NO LOAD) 0.4 KV **IMPEDANCE VOLTAGE** UK 6%

| RATED POWER | KVA | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |
|----------------------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| INSULATION LEVEL HV(AC/LI) | KV | 50/95 | 50/95 | 50/95 | 50/95 | 50/95 | 50/95 | 50/95 | 50/95 | 50/95 | 50/95 | 50/95 | 50/95 | 50/95 |
| INSULATION LEVEL LV(AC/LI) | KV | 3/- | 3/- | 3/- | 3/- | 3/- | 3/- | 3/- | 3/- | 3/- | 3/- | 3/- | 3/- | 3/- |
| NO LOAD LOSSES I0 | W | 1900 | 1700 | 1500 | 1400 | 1300 | 1200 | 1200 | 1100 | 1000 | 1000 | 900 | 900 | 800 |
| NO LOAD LOSSES P0 | W | 800 | 800 | 1000 | 1100 | 1200 | 1270 | 1650 | 2200 | 2700 | 3000 | 3900 | 4100 | 5050 |
| LOAD LOSSES AT 120° C PK | W | 3200 | 3900 | 4700 | 5100 | 6050 | 6350 | 8700 | 9200 | 11000 | 12700 | 14600 | 22100 | 25250 |
| NOISE LEVEL | dB | 62 | 54 | 55 | 55 | 68 | 61 | 57 | 58 | 59 | 73 | 76 | 79 | 81 |
| TOTAL WEIGHT(approx) | Kg | 880 | 1020 | 1120 | 1420 | 1530 | 1780 | 2060 | 2315 | 2830 | 3425 | 4090 | 4580 | 5410 |
| LENGTH(L) | mm | 1350 | 1350 | 1400 | 1470 | 1480 | 1530 | 1620 | 1650 | 1770 | 1800 | 1900 | 1930 | 2020 |
| WIDTH(W) | mm | 690 | 690 | 690 | 850 | 850 | 850 | 850 | 850 | 1030 | 1030 | 1030 | 1285 | 1285 |
| HEIGHT(H) | mm | 1200 | 1260 | 1310 | 1380 | 1440 | 1560 | 1590 | 1770 | 1890 | 2085 | 2175 | 2220 | 2360 |
| ROLLERS DISTANCE (E) | mm | 520 | 520 | 520 | 670 | 670 | 670 | 670 | 670 | 820 | 820 | 820 | 1070 | 1070 |
| ROLLERS DIAMETER | mm | 125 | 125 | 125 | 125 | 125 | 150 | 150 | 150 | 200 | 200 | 200 | 200 | 200 |
| ROLLERS WIDTH | mm | 50 | 50 | 50 | 50 | 50 | 60 | 60 | 60 | 68 | 68 | 68 | 68 | 68 |

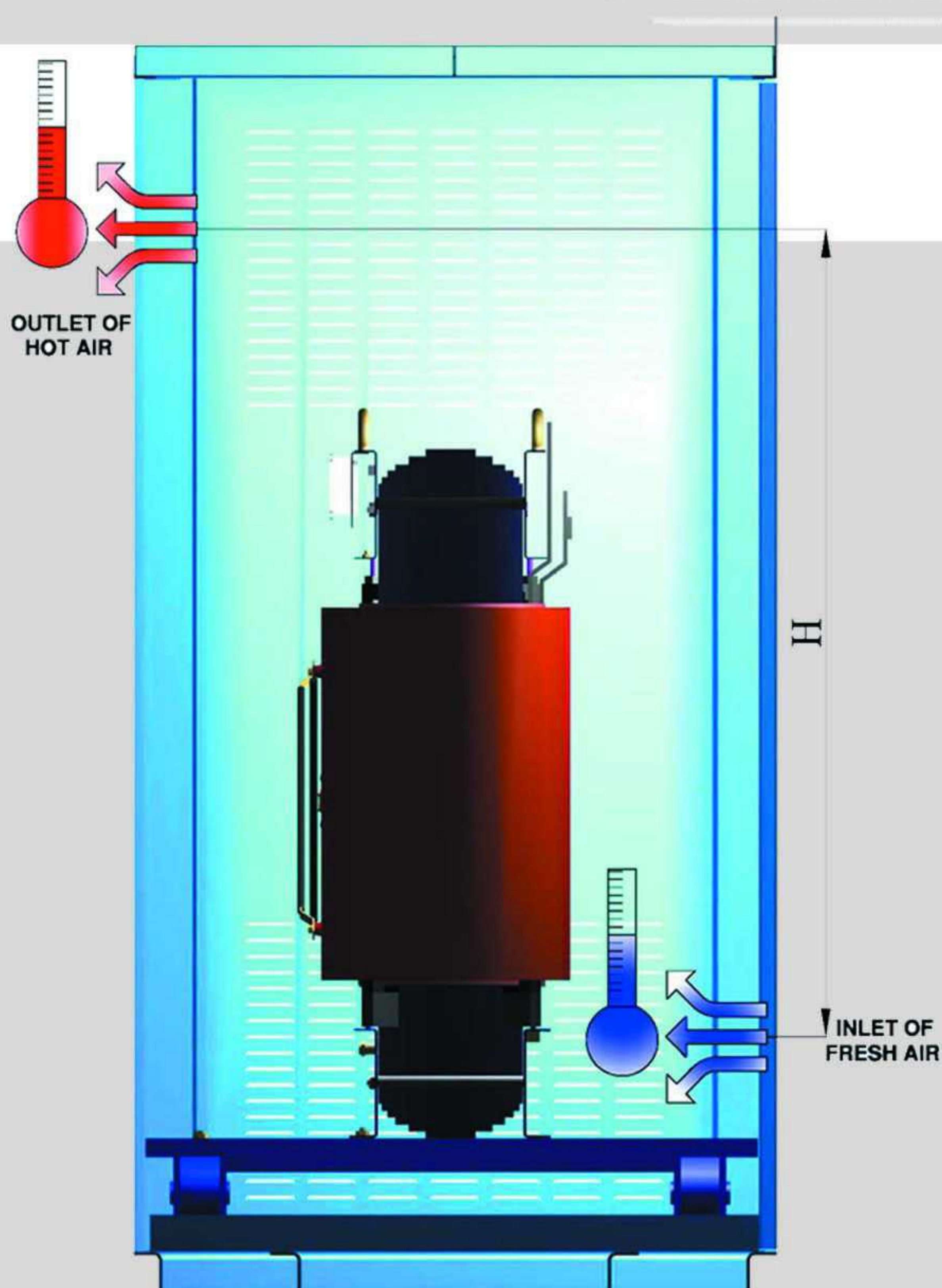
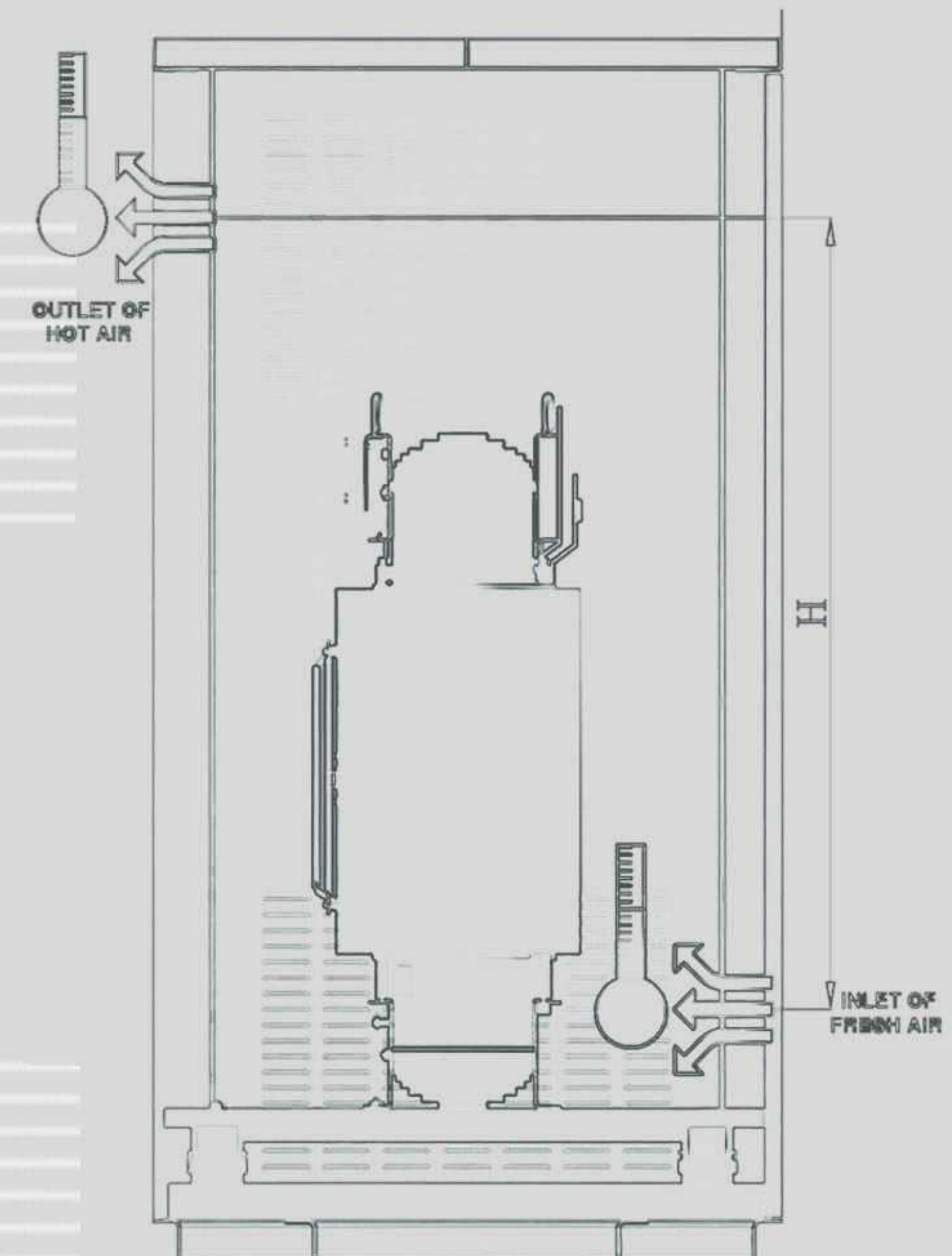
Ventilation and thermal protection

When the transformer is put under operation, the losses are generated as heat which should be dissipated in order to use full transformer rating. The first choice of dissipation method is natural circulation of air (AN).

The room which transformer is installed should provide proper circulation of air and that is correct size having inlet and outlet to allow air to pass in and out.

Since natural air circulation happens from bottom upwards, so lower opening (inlet) must be placed near the transformer as low as possible on the wall, whereas the outlet opening must be located as high as possible across from inlet one and be by 10-15% larger than inlet opening. The heated air has lower density.

The opening dimensions depend on the losses of the transformer and inlet and outlet temperature of air.



Min. air throughput can be calculated approximately using following formula:

$$Q = Pt / (1.15 * \Delta\theta) \quad \text{m}^3/\text{s}$$

Consequently, the lower opening surface can be calculated using below formula:

$$S = 10.752 * (Pt / (\sqrt{H * \Delta\theta^3})) \quad \text{m}^2$$

If the difference between temperature of inlet and outlet air is considered $\Delta\theta$, the formula is simplified as:

$$S = 0.185 * (Pt / \sqrt{H}) \quad \text{m}^2$$

Pt=total loss (kW)

$\Delta\theta$ =air temperature difference (°C)

Q=air throughput (m³/s)

H=distance between center of transformer and outlet opening (m)

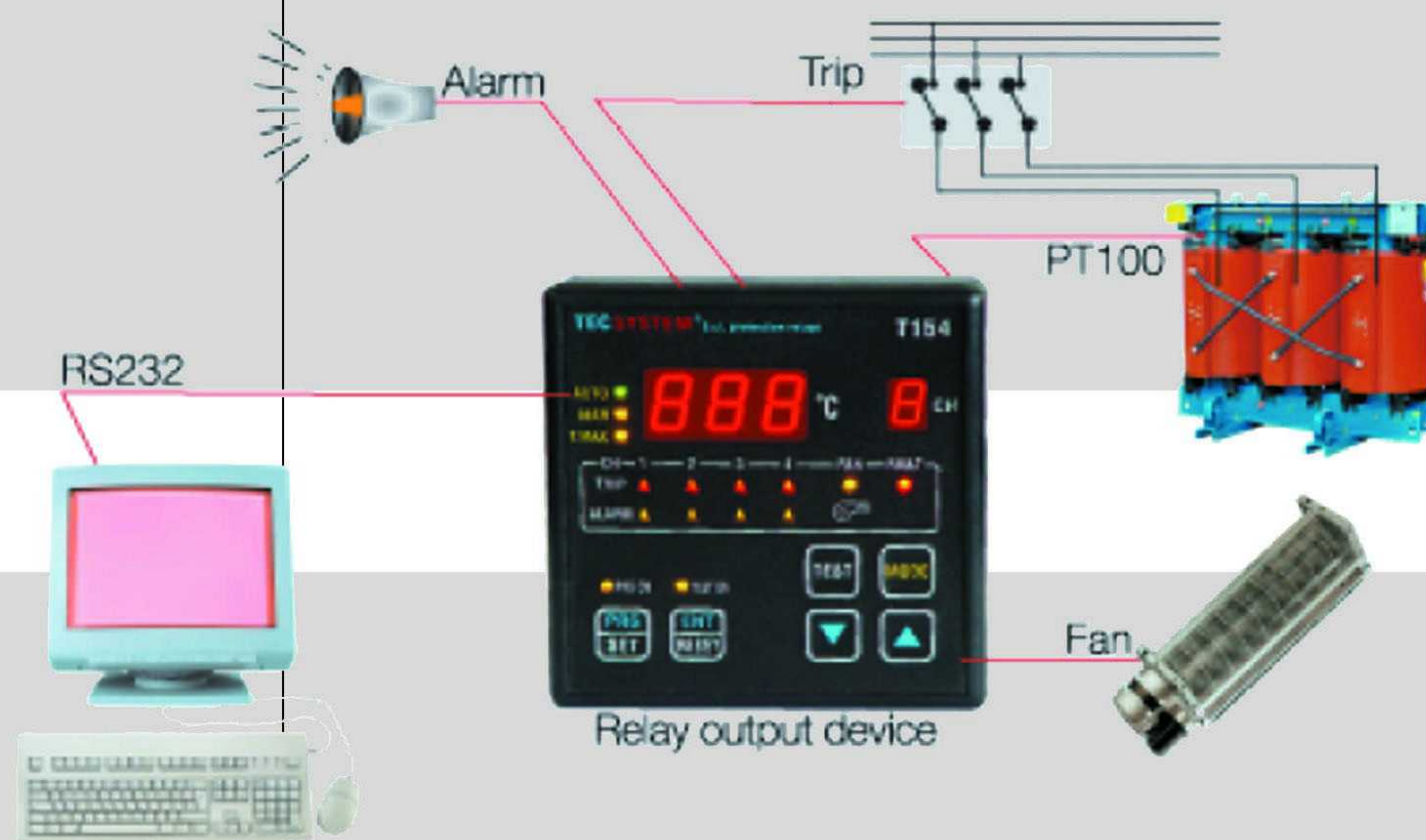
S=surface of inlet opening (m²)

If the room dimensions of the transformer do not provide proper cooling, it is recommended to use forced air circulation using fans. For effective cooling in forced ventilation, provide at least 500 mm distance around the transformer.



Temperature monitoring

Temperature control of the cast resin transformer is done by PTC or PT100 sensors and a relay output temperature monitoring device.



Required temperatures are set as follows:

Alarm temperature

Trip temperature

Fan controlling temperatures in case of air forced cooling system

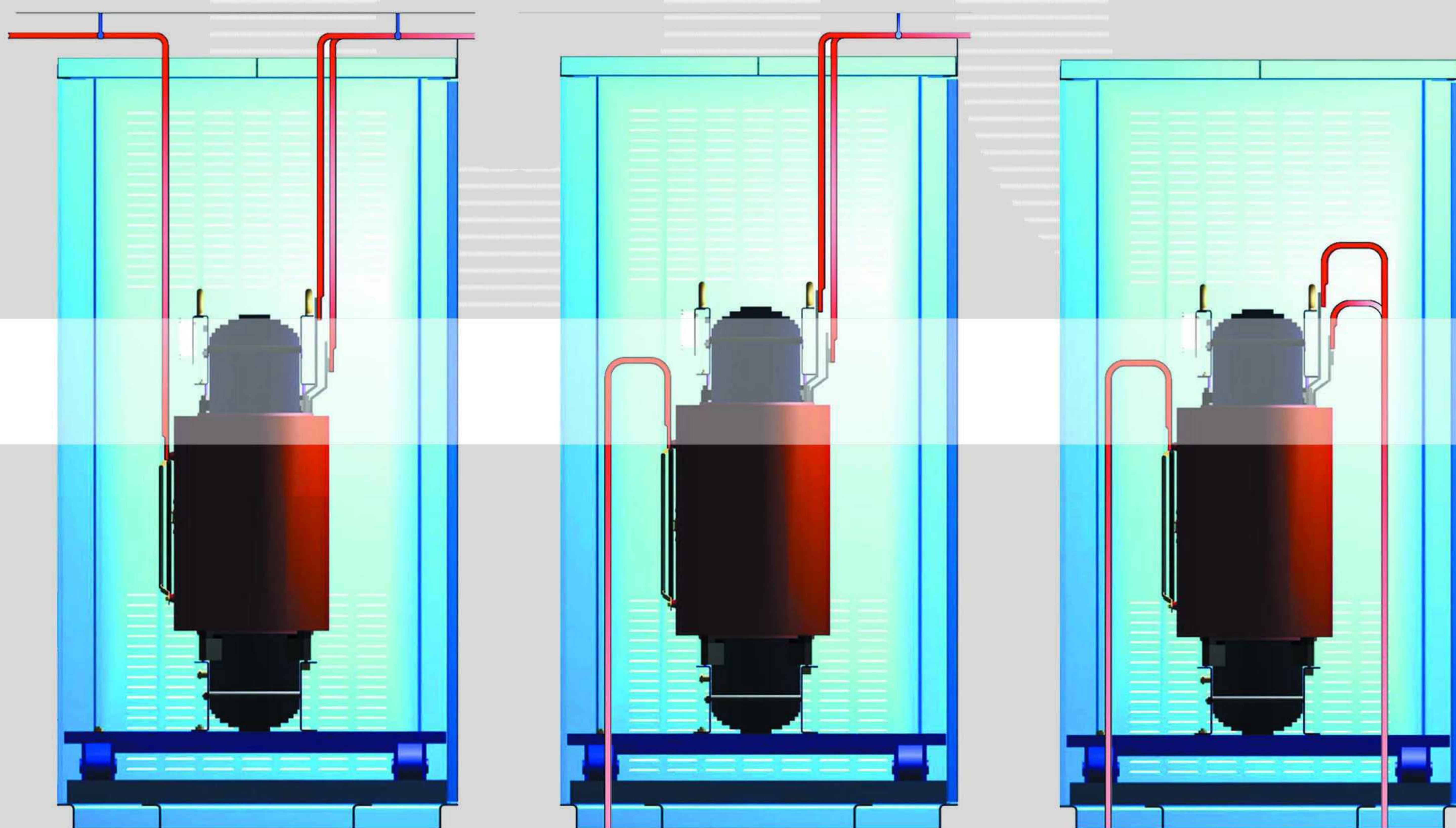
Easy to computerize thermal process control

Connection system:

Connection of high voltage and low voltage sides:

In the standard design the HV and LV connection of the transformer are at the top coil connection, connections at the bottom for both sides (HV/LV) are available as an option.

To simplify installation and connection, the transformer is optionally available with connection on either the HV or LV side top or bottom



If intermediate expansion links are employed the LV side connection is protected against mechanical stress and transmission of structure-borne noise.



Packing

All transformers are wrapped in plastic sheet in order to protect them against pollution, dust and water penetration. Accessibility of lifting lugs is provided for transformer lifting without any need to tear plastic cover.

Two wooden bars are mounted under U formed undercarriages to support the transformer during transport.



Storage

The cast resin transformers must be stored indoors, in clean and ventilated rooms, with temperatures ranging from -25 to +40 °C. Dusty rooms must be avoided. Protect the transformer in order to avoid accidental crashes. In case of plug-in type connectors, be sure that the sockets are properly protected by their relevant cover for the entire storage period.

TRANSPORTATION AND MOVEMENT

The dry type transformers are normally supplied completely assembled. Some small accessories may not be mounted. During the transportation, exposure to rain and drops of condensation must be avoided.

Transportation by truck

the transformer is delivered without packaging, braced to the truck by ropes. The wheels are not mounted but are fixed in a safety position.

Transportation by sea or rail

normally in these cases the transformer is properly packed in an open type or hermetic wooden case.

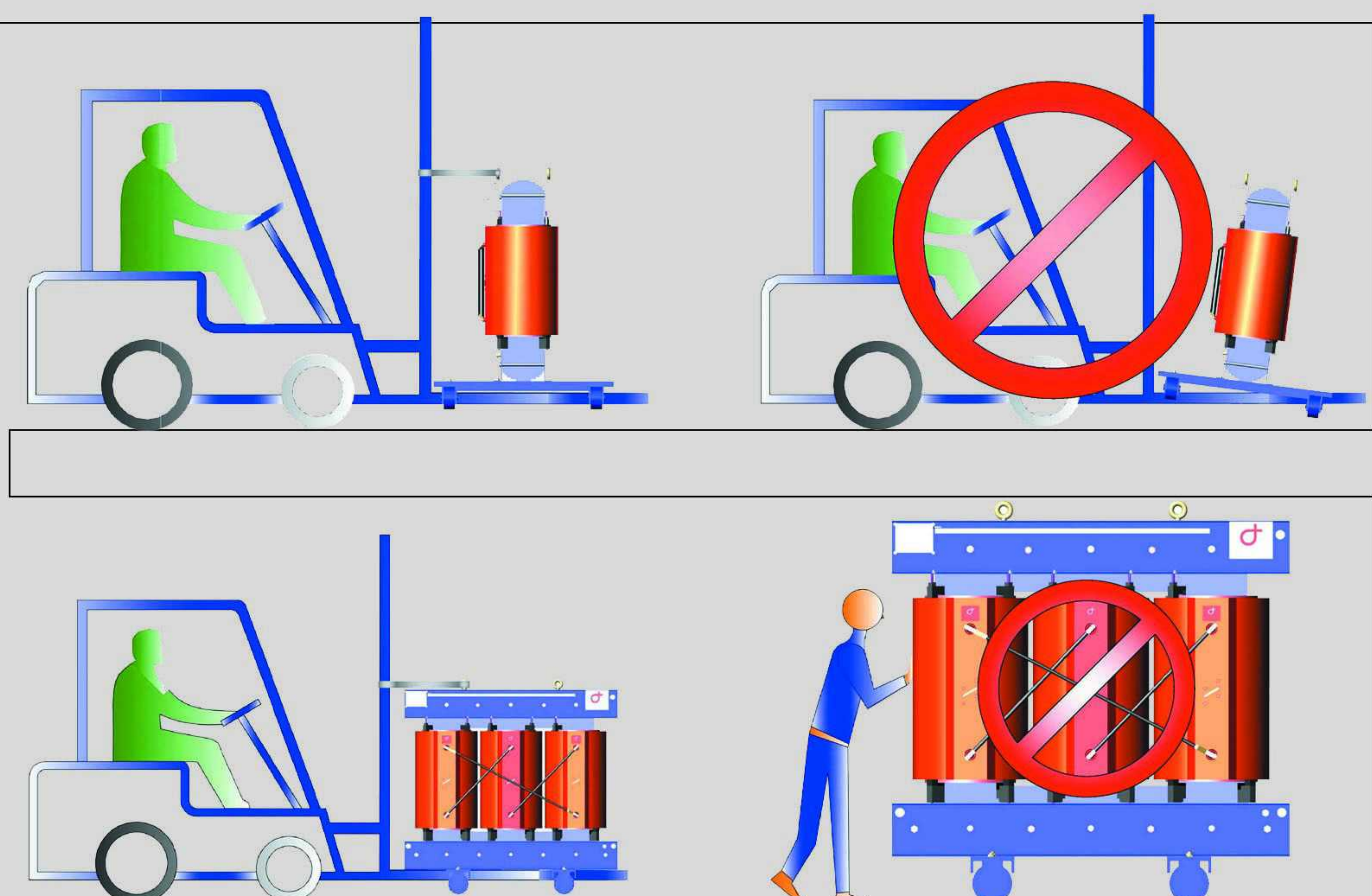
Movement

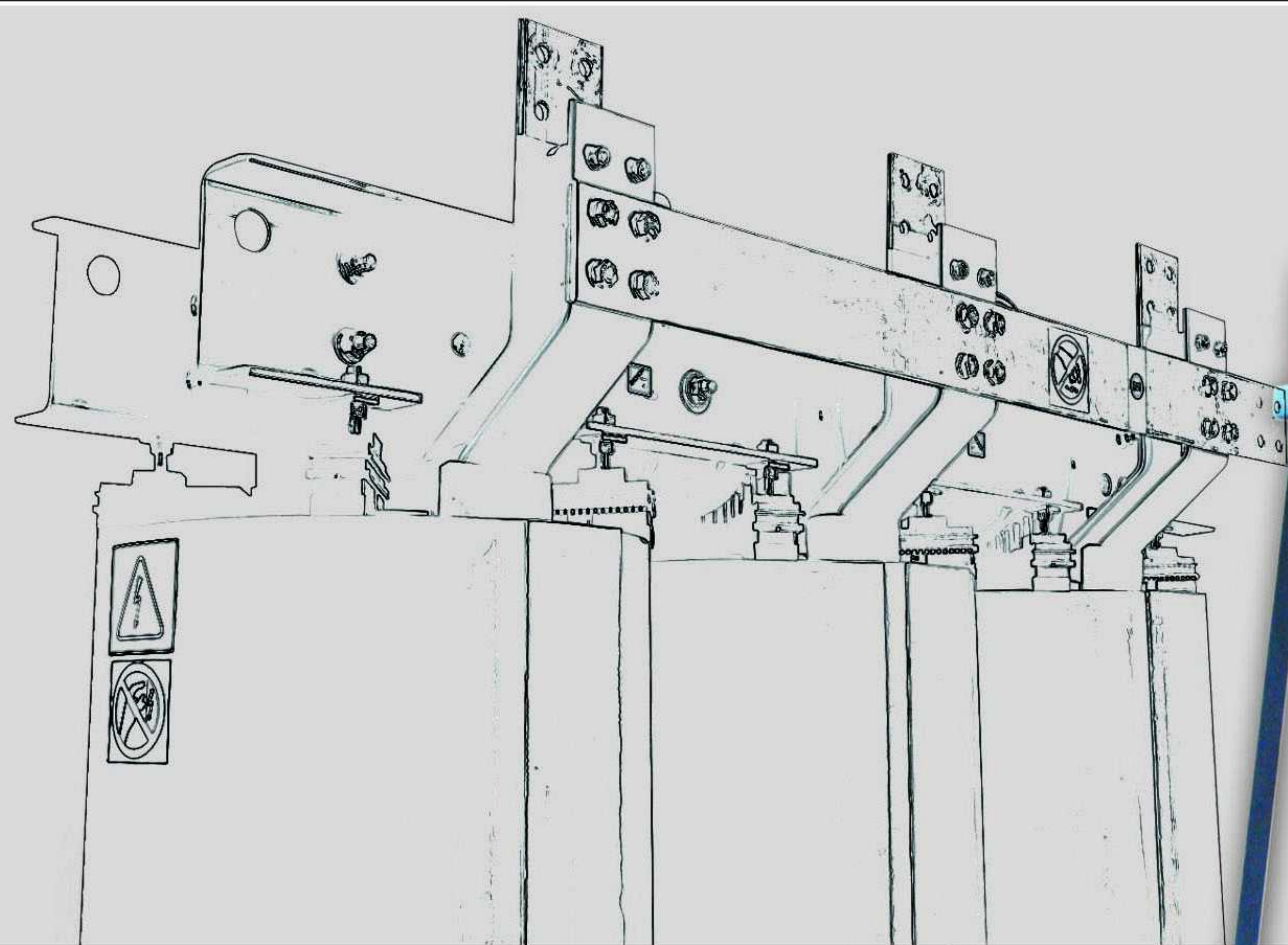
Each transformer is equipped with the following accessories:

- 4 wheels or skids for translation;
- pulling eyes
- 4 lifting lugs.

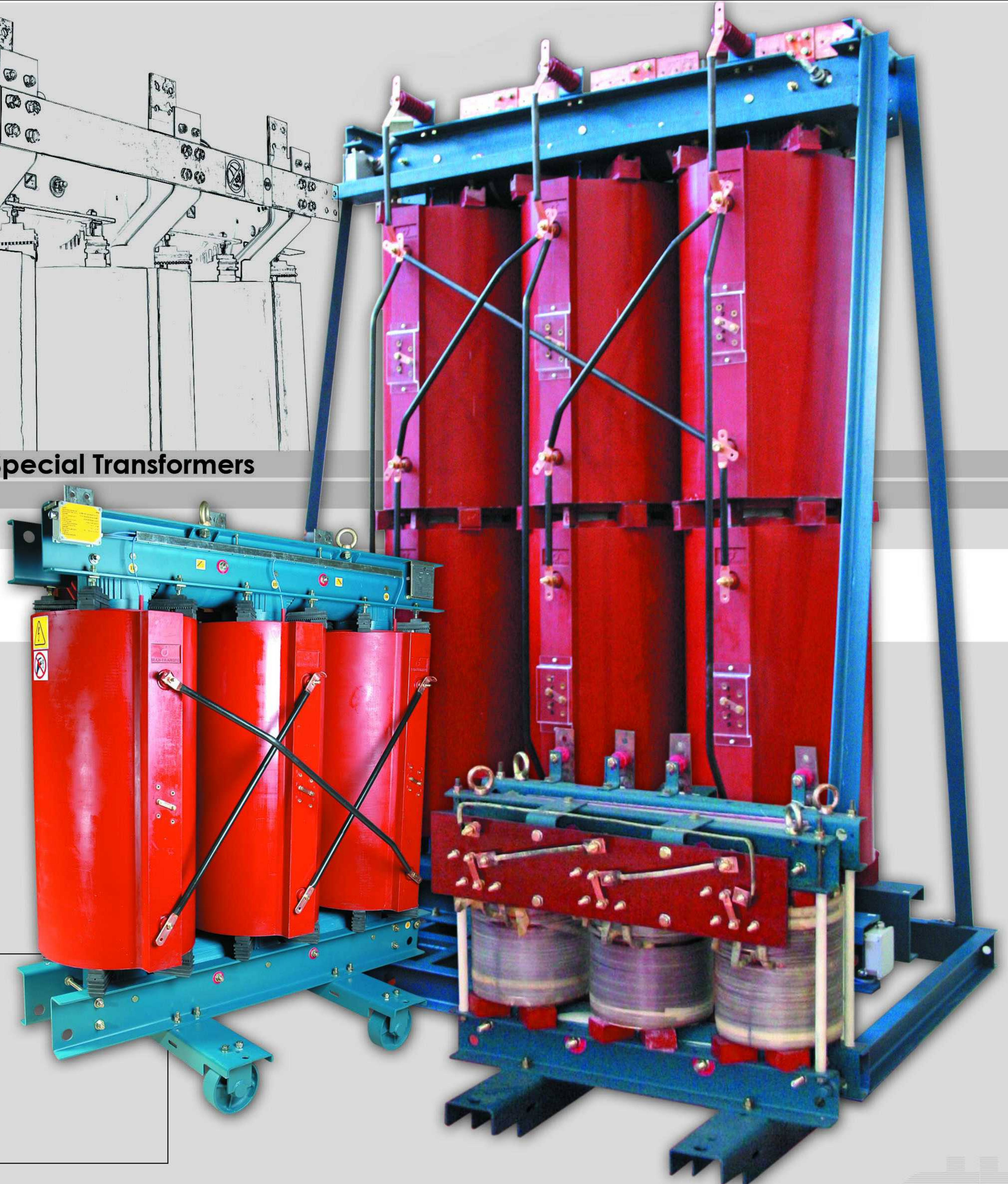
To move the transformer on wheels:

- assemble the 4 wheels supplied in the right direction
- push or pull applying force directly to the trolley structural. It is also possible to pull it by means of the relevant pulling eyes, on lower core frames.
- avoid pushing and/or pulling on other parts of the transformer body and accessories.





Special Transformers



IRAN TRANSFO Standard Housing (enclosure)

IRAN TRANSFO cast resin transformers have been designed for decentralized installation directly at the local centers.

To provide protection for the transformers against environmental influence on the hand and to prevent people from coming into contact with the transformer on the other, we have designed an inexpensive concept to solve both problems at once.

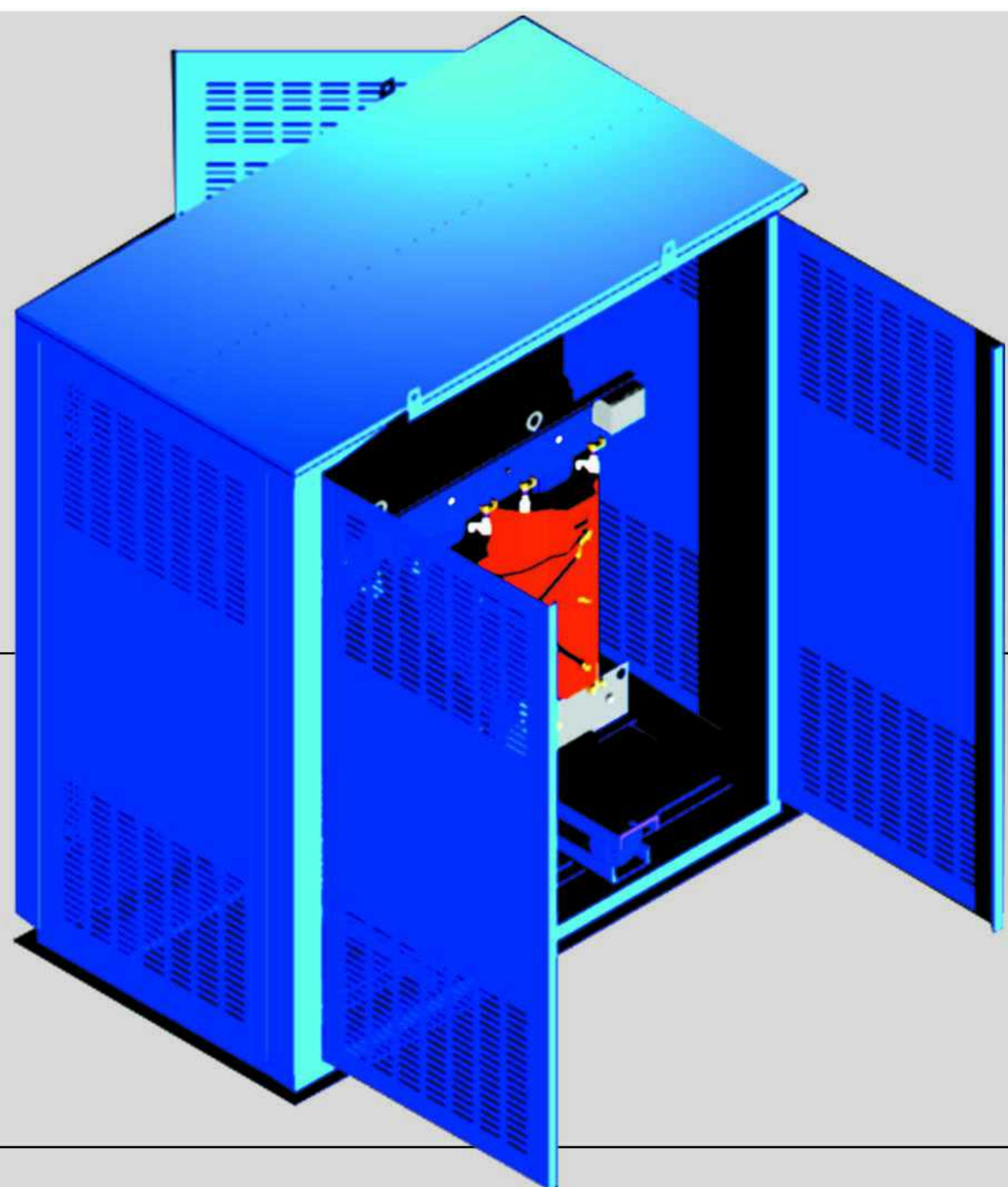
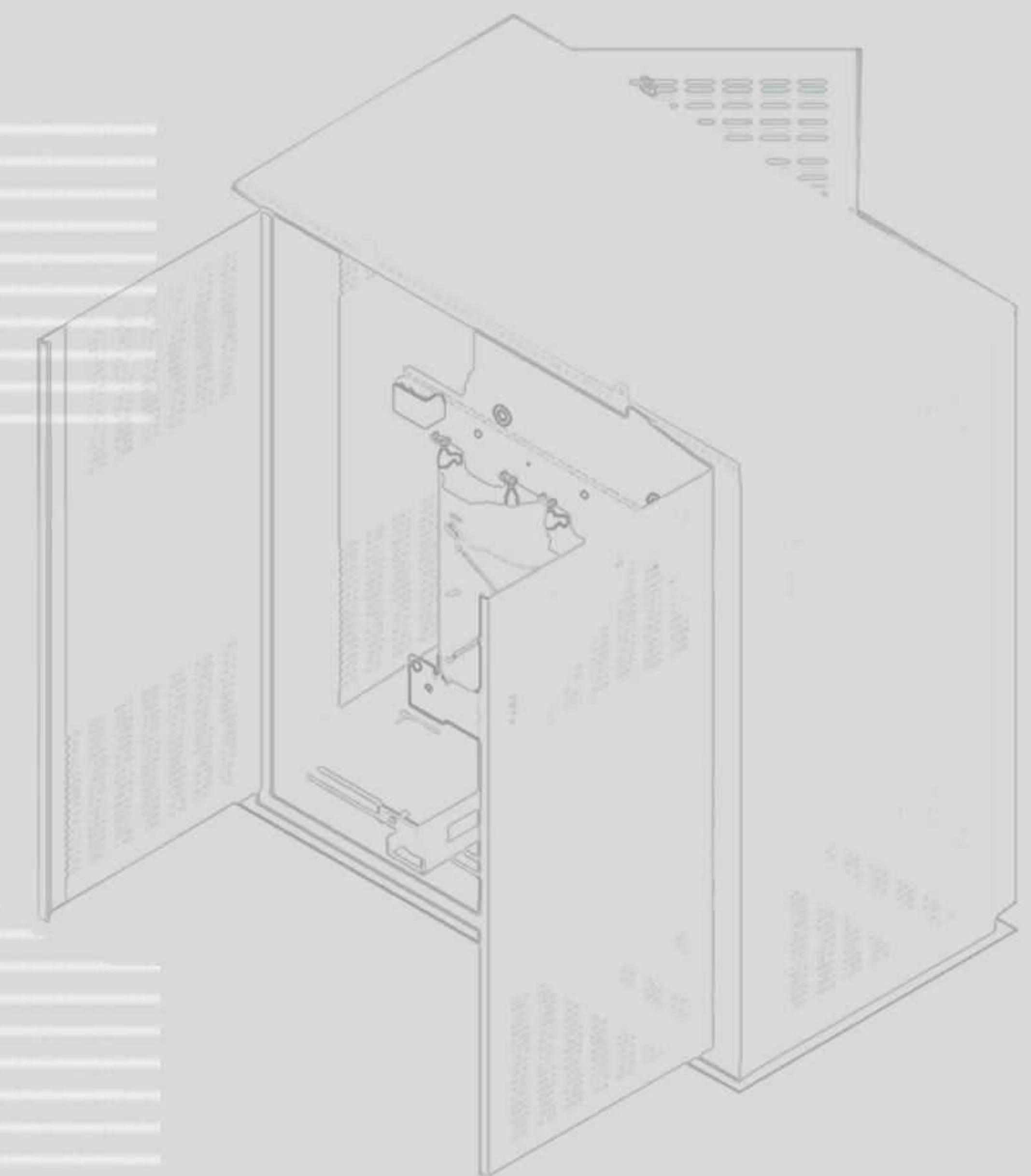
The housing has been designed for free standing cast resin transformers in electrical locations whether installed indoor or out doors.

Cast resin dry transformers are designed as indoor installation in various sheet metal enclosures. The enclosures protect transformer against sunlight, water dropping, access to terminals and winding surfaces.

Different type of enclosures are designed and manufactured in accordance with installation requirements (IP00 is standard production) they are designed so that provides proper air ventilation to cool transformers.

IRAN TRANSFO can design and manufacture outdoor enclosures that cast resin transformer can be used in outdoor installation.

Depending on the application, the transformer can be used without any protecting enclosure (IP00) or can be provided with a protecting enclosure with degree of protection from IP21 to IP45.



- The light weight housing is made of self-supporting sheet – steel components so that it is inherently stable.
- The housing can be assembled within short time without need for any special training.
- For indoor installation sheet – steel parts of IRAN TRANSFO housing have a plastic coating.
- For outdoor installation the sheet – steel of IRAN TRANSFO housing are made of hot – dip galvanized.
- The natural ventilation within the housing has been designed so that the output is not lower than for degree of protection IP 00.
- IRAN TRANSFO housing construction kits are light and compact, which makes them simple and inexpensive to transport.



| Dimension and weights of enclosure for indoor application: | | | | |
|--|--|------|------|----------------|
| Housing type | Maximum housing dimension(mm) (degree of protection IP21) | | | Housing weight |
| | L | W | H | |
| 1 | 1600 | 1050 | 1560 | 210 |
| 2 | 1800 | 1350 | 1900 | 270 |
| 3 | 2000 | 1450 | 2200 | 310 |
| 4 | 2200 | 1450 | 2400 | 360 |
| 5 | 2400 | 1600 | 2600 | 410 |

| Dimension and weights of enclosure for indoor application: | | | | |
|--|--|------|------|----------------|
| Housing type | Maximum housing dimension(mm) (degree of production IP 23) | | | Housing weight |
| | L | W | H | |
| 1 | 1600 | 1050 | 1620 | 225 |
| 2 | 1800 | 1350 | 2000 | 285 |
| 3 | 2000 | 1450 | 2350 | 330 |
| 4 | 2200 | 1450 | 2550 | 390 |
| 5 | 2400 | 1600 | 2850 | 455 |

| Dimension and weights of enclosure for outdoor application: | | | | |
|---|--|------|------|----------------|
| Housing type | Maximum housing dimension(mm) (degree of production IP 23) | | | Housing weight |
| | L | W | H | |
| 1 | 1850 | 1150 | 1820 | 285 |
| 2 | 2000 | 1500 | 2180 | 315 |
| 3 | 2200 | 1650 | 2500 | 410 |
| 4 | 2450 | 1750 | 2750 | 470 |
| 5 | 2700 | 1850 | 3000 | 520 |

General information

- The ambient temperature for the transformer to be within the following limits:
 - minimum: -25°C
 - maximum: +40°C (unless a higher temperature is designed for based on information provided at the time of enquiry).
- The transformer even if provided with housing-shall be installed indoors, except the case where particular requests shall be discussed with the manufacturer.
- The transformer, with or without housing, shall be located so that is possible to reach all, its important parts (LV terminals, HV terminals, HV tapping, windings with thermometric sensors).
- Before to carry out any operation on the transformer, and/or on its parts, check that it has been disconnected from the network and that it has been grounded.
- IP00 transformer shall be protected against direct contacts.
- The protective housing containing the transformer, if provided with cooling grids, shall be placed at least 300 mm away from the room walls.

For adequate ventilation, consider items as below:

- Temperature rise should not exceed the value indicated on the rating plate.
- The transformer should not be installed in small room without inlet and outlet openings.
- The transformer should not be installed in a room where it is considered for other applications particularly for machines working at high temperature for instance: boilers, steam generators and etc.
- All IRAN TRANSFO transformers are covered by a two years warranty against all manufacturing defects that starts from the date of testing. By separate contract the warranty period can be extended.
- The warranty is limited to the repair or replacement of the defective transformer and does not extend the original warranty period under any circumstances.
- Radial flow fans with temperature dependent control can be installed to provide capacity reserves and to cover peak load periods. In this way, the transformer output can be raised by up to 40 %(continuous operations)
- In case of room temperatures greater than 40 °C, installation of an air extractor fan is recommended.

Accessories and protecting devices must be easily readable and reachable



HOW TO CONTACT US

If you need more information about
IRAN TRANSFO products or our production
range, do not hesitate to contact our Sales Dept.
or Technical Dept. Our full address

is indicated below:

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