

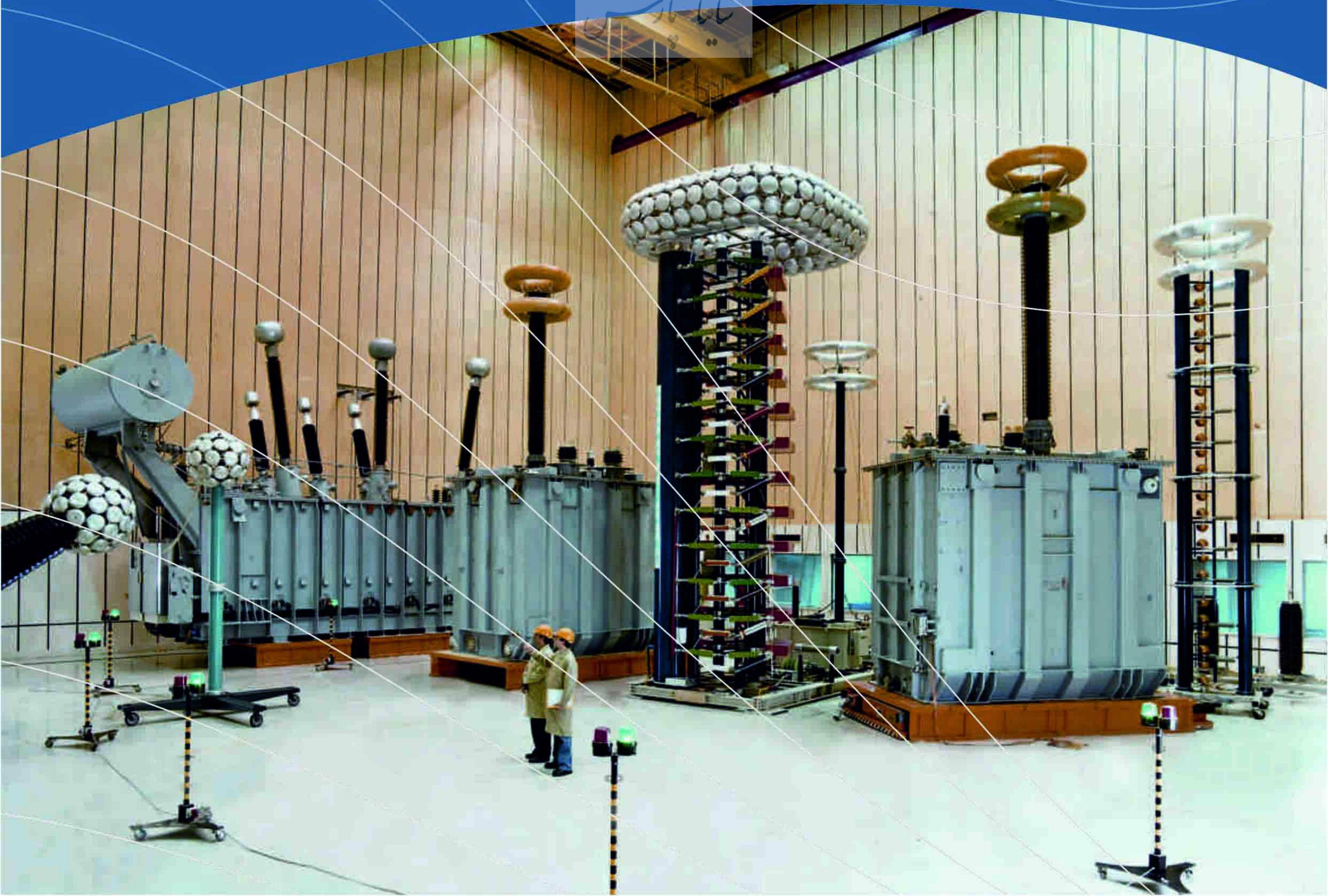


IRAN TRANSFO  
CORPORATION

# Power Transformers



ایران ترانسفو





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**City Power - South Africa**  
45 MVA - 88 / 11 kV



**Furnace Transformer**  
30MVA -30.5KV/406V



**Tana Power Plant - Kenya**  
32 MVA - 71 / 11 kV



**Sangtuda Power Plant - Tajikistan**  
125 MVA - 230 / 13.8 kV



**Mobile Transformer - Iraq**  
25 MVA - 132 / 11.5 kV

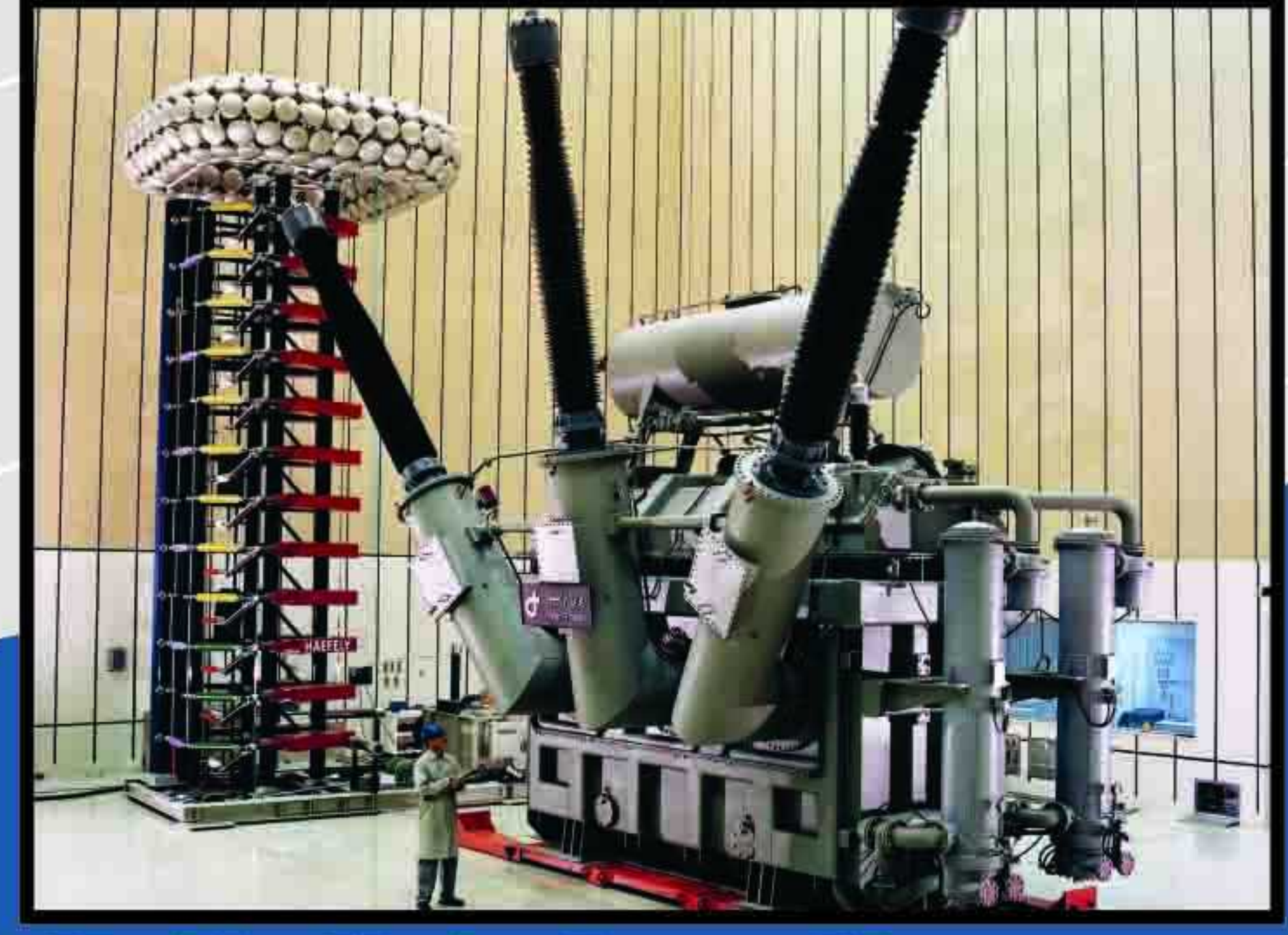


**WAPDA Town Substation**  
40 MVA - 132 / 11.5 kV





**Power Transformer - Fars**  
**315 MVA - 400 / 230 / 20 kV**



**Karkhe Hydro Power Plant**  
**160 MVA - 13.8 / 410 kV**



**Power Transformer - Neiriz**  
**200 MVA - 400 / 66 / 20 kV**



**Tooss Substation**  
**200 MVA - 400 / 230 / 20 kV**



**Karoon Hydro Power Plant**  
**100 MVA - 15.7 / 420 kV**



**Damavand Power Plant**  
**200 MVA - 15.7 / 420 kV**



**IRAN TRANSFO  
CORPORATION**

**Head office:** No.15,Hakim Azam St.,North Shiraz Ave.,Tehran-Iran,

P.O.Box:13145-159

Tel : +98 - 21- 88210 910 - 12

Fax :+98 - 21- 88210 915

**Factory:** 4th Km of Zanjan-Tehran Road, Zanjan-Iran,

P.O.Box:45195-1118

Tel : +98 - 24 - 33790761-69

**Sales & Marketing Dep.:**

Tel : +98 - 24 - 33790579-33790527

Fax: +98 - 24 - 33790773

**Website:** [www.iran-transfo.com](http://www.iran-transfo.com)

**E-Mail:** [sales@iran-transfo.com](mailto:sales@iran-transfo.com)



## Introduction

Iran Transfo Company, now a leading manufacturer of transformers was established in 1967 under the license of Siemens Germany, initially to design and manufacture oil immersed distribution and power transformers.

Over the years we succeeded to obtain modern technologies and know how in conjunction with the world most reputable companies such as Siemens, VATECH (ELIN) and ABB that enabled us to grow the ratings of our products up to 500 MVA and 420 kV alongwith the growth in quantity.

Today our production stands at 30000 MVA per year. Different varieties of power transformers including generator step up, auto or separate windings and multi winding transformers from 5 MVA upwards are designed and manufactured at Iran Transfo.

Iran Transfo products comply with the latest version of IEC standard or any other standard according to the customer specification.



**Aerial view of the Zanjan Plant**



## Design of transformer

Professional and expert design engineers at Iran Transfo are well prepared to tailor-make transformers conforming to international standards such as IEC, BS, ANSI,... this has been achieved by:

- ◆ Continuous and extensive training courses.
- ◆ Cooperation with the most reputable companies.
- ◆ Using up to date design softwares.
- ◆ Experiences gained from international tenders and contracts.

The following calculations are conducted by using special softwares to ensure reliability of the products.

- ◆ Optimum design considering reliability, losses evaluation, temperature rise and noise level.
- ◆ Distribution of impulse voltage, and switching-surge.
- ◆ Electrodynamic forces both transient and steady state.
- ◆ Analysis of temperature distribution in winding and oil.
- ◆ Analysis of electrical stresses and optimum insulation structure design.
- ◆ Calculations of stray losses and thermal effects.
- ◆ Seismic analysis either static or dynamic.
- ◆ Calculation and design of ONAN/ONAF/ODAF/OFWF cooling systems.



## Core construction

Iran Transfo transformers are "Core Type" design. Slitting of the core steel to the required width is done "in house", in order to have full control over the whole process and keep with the required high quality standards.

Cores are manufactured from high quality cold-rolled grain oriented silicon steel laminations, which are coated with insulation. As required by the customer's requirements high-permeability materials are used in order to reduce no load losses and noise. For low loss designs, laser treated silicon steel can be used.

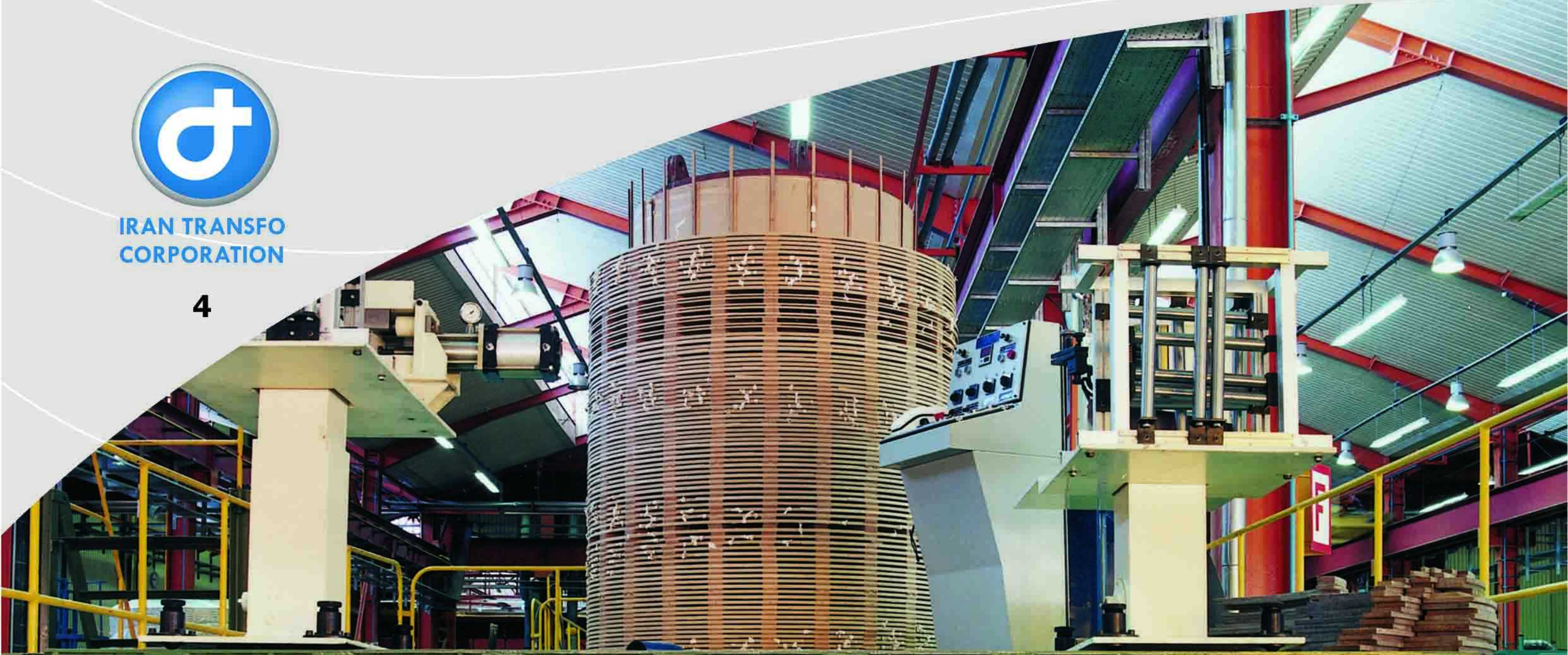
Core leg and yoke laminations are over lap in mitred joints in order to improve the flux distribution, avoid hot spots and reduce no load current losses and sound level.

Either but-lap or step - lap joints are used in power transformers.

Very well organized core cutting lines using state of the art machinery are used to cut the laminations which are stacked in steps, resulting in a circular core shape, which gives the windings the optimum radial support especially during short circuit conditions.



Core Stacking



## Vertical Winding Machine



## Winding

All windings are of the circular type, since this type has the highest strength against short circuit. Depending on the specific design criteria; layer, helical, disc, partly interleaved or fully interleaved windings are also used. For higher voltage levels, electrostatic shields are used at the winding ends. "Drawing to size" and insulation of conductors, manufacturing of insulation cylinders and spacers are all done in Iran Transfo, to ensure the high quality of the products.

For applications which require a very high mechanical strength, resin bounded transposed cable is used. The continuous transposed conductor (C.T.C) is composed of several wires, individually enameled. Eventually the entire conductor is rapped with suitable no. of layers of insulating paper.

Steel winding mandrels are used for tight tolerances. The winding machines are equipped with hydraulic braking devices which ensure that the proper tension is maintained on the winding.

Dovetailed key spacers are employed to give the windings extra strength. Axial and radial cooling ducts in and between sections of the windings allow the free flow of oil around the conductor. Individual coils are dried and hydraulically pressed to size in accordance with the calculated short circuit forces to obtain the design height and to guarantee full short circuit strength.



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## Core and coil assembly

Insulating blocks made of high quality laminated board or compressed wood are used in bottom and upper yoke to support the windings in vertical position. The inner winding is rigidly braced to the core leg by using insulating supports. Pressboard angle rings are mounted between the low and high voltage windings. Outer tie rods and plates provide the necessary clamping pressure on the assembled core and coils. A specially designed hydraulic press is used to apply this pressure. The tie rods are secured through double nutting. All leads and busbars are rigidly supported through the use of transformer board and plastic cover. The entire finished core and coil Assembly will be dried by vapour phase drying process. After the drying process has been completed, the core and coil assembly are retightened to take up all shrinkages. After retightening, the unit will be tanked and filled with heated, degassed oil under full vacuum.

## Transformer under in - Tanking Process







## Tanks

All tanks are made of high quality steel plates that can withstand vacuum as specified by the international standard or customer requirements. The tank base design permits movement of the transformer in all directions, by means of rolls or skids.

Lifting, jacking and pulling facilities are provided on the tank.

All welds are tested to ensure 100% leak proof seams and maximum mechanical strength. The cover is bolted to the tank in order to make easy active part untanking possible if necessary. All openings are provided with raised flanges to prevent water entry into the tank during inspection. All fabricated tanks are shot blasted to point where the metal is free of oxides, weld splatter and mill dust.

Two layers of modified Epoxy resin primer are used before the final finish of modified polyurethane is applied.



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**Transformer Tank**



Oil to Water Cooler



Oil to Air Cooler

## Cooling

In our practice, all transformers are equipped with detachable panel radiators, which are connected to the top and bottom headers, in order to provide the necessary cooling surface (ONAN). If factors such as expected future load growth or exposure to prolonged high ambient temperatures have to be taken into account, then several auxiliary cooling methods will be available to increase the cooling rating of the transformer. Most commonly, air forced cooling (ONAF) is used to accelerate the cooling process.

Cooling fans are activated in one or more stages by the relay contacts of the top oil temperature sensor. Other cooling methods such as oil forced / air forced (OFAF), oil directed / air forced. (ODAF) and oil forced / water forced cooling (OFWF), are also available if site circumstances necessitate or the specifications requested by the customer indicate.



Panel Type Radiator



## Testing

Final testing is the major and in fact most important activity within the quality assurance system.

At Iran Transfo, testing is performed in its H.V labs. Which are equipped with the most modern and up-to date facilities.

Together with advanced equipments, restrict quality management system and skilled testing specialists, assure the performance of the transformers.

In addition to the quality management system "ISO 9001-2008", H.V labs of Iran-transfo are audited and accredited for ISO 17025 certificate.

Upon completion of the manufacturing process, every transformer will undergo electrical tests (routine and type test) according to IEC60076 or any other specification indicated by the customer.



## Mobile Transformer

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### Research & Development

Research & development is an essential requirement for improvement. R&D dept. of Iran transfo is highly engaged in finding ways and improving processes in order to reduce the no load and load losses, noise level and promote the efficiency of products. Enhancement of quality and performance of the products is the prime aim of Iran transfo R&D dept. Many calculation and design softwares have been developed in R&D by using analytical and finite element methods. Using these softwares help us design and manufacture reliable transformers. By electrical field calculation, impulse voltage distribution in windings and stray losses analysis, long life of transformer can be assured. Also electromagnetic dynamic forces are thoroughly studied in design steps.



Shunt-Reactor 400kV 50MVAr

# Quality assurance

Iran Transfo Corporation, has developed quality assurance programs for complying with the most up to date standards, ie ISO 9001:2008 in order to assure its products are designed, manufactured, inspected, tested and delivered in the most efficient manner.

To keep up in the course of quality, and in addition to ISO standards, efforts have been made for obtaining other standards such as environment (ISO14001-2004), and safety (OHSAS 18001-2007).

Furthermore, Iran Transfo H.V. labs have been audited by an international and independent body in accordance to IEC 17025:2005 and certified to carry out tests on power transformers.

In addition to the above standards, samples of Iran Transfo products are tested at independent laboratories. The followings are examples of the short circuit tested items at KEMA lab:

ISO 9001 :2008



ISO 14001:2004+Cor 1 : 2009



BS OHSAS 18001 : 2007



Certificate of short circuit test 26 MVA - 132/11.5kV



Certificate of short circuit test 40 MVA - 132/11.5kV



ISO 17025



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150 MVA - 400 / 63 / 20 kV

## After sales services

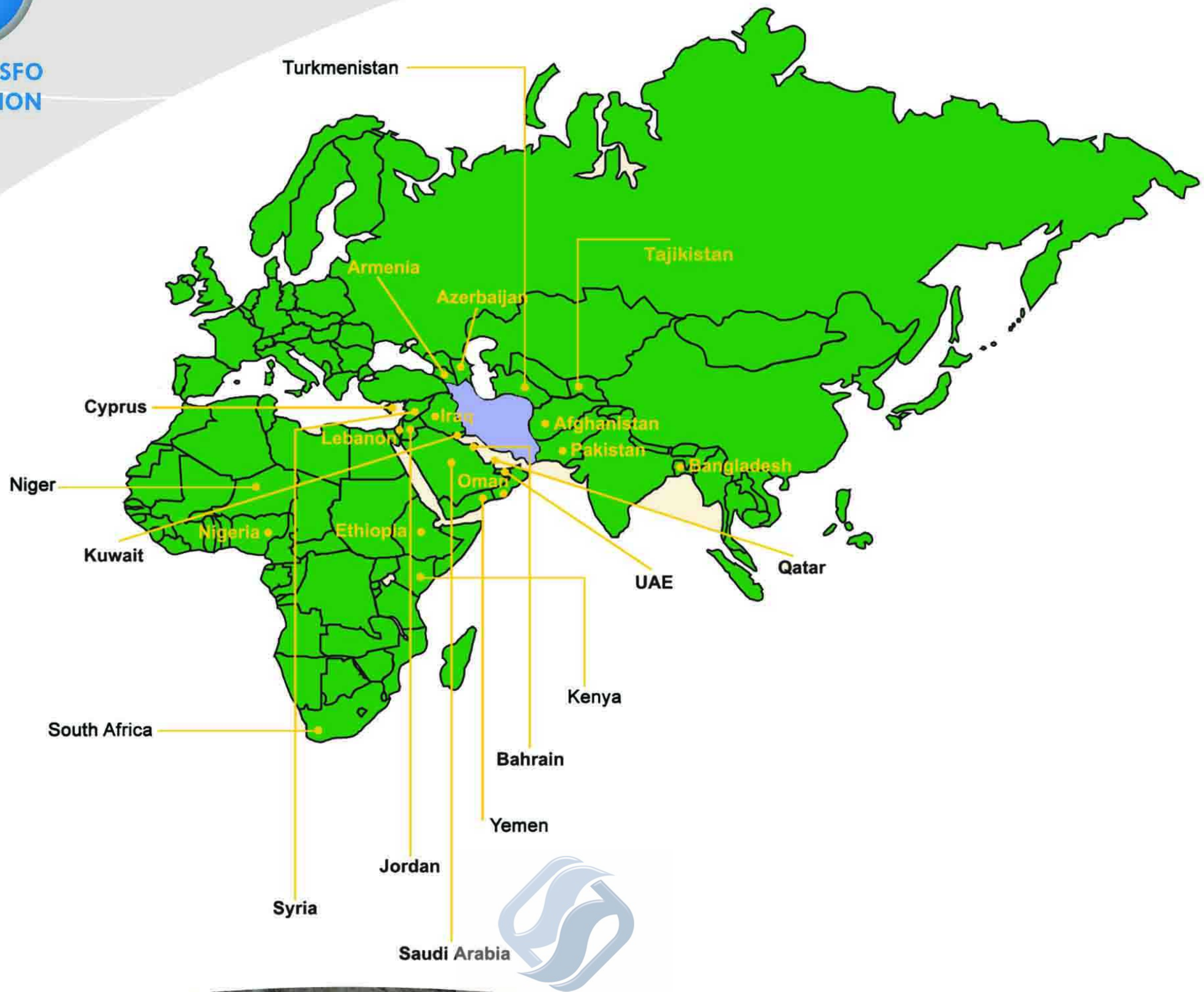
Apart from design and manufacture of transformers, following services are available: Installation, commissioning, on site testing, refurbishment, capacity enhancement, diagnosis and life assessment of oil immersed distribution and power transformers up to 500 MVA and 420 kV.

Very well equipped engineering teams are ready to reach anywhere domestic or overseas on the on-call basis.



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## Global Experiences

Competence and advantages like excellent quality, reasonable prices, professional and widespread network of after sales services helped Iran Transfo company to become a substantial exporter of transformers and accessories to the Asian and African countries. Iran transfo intends to increase exports by executing new expansion plant in the near future.



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