

Technology Cooperation Office of the Presidency



Technological Potential
Components of Transformers

By introducing the first issue of «Iran Technological Potential» provided by Technology Cooperation Office of Presidency (TCO), we intend to encourage international cooperation aiming at sharing technological resources with others. We would put forward more publications of such bulletins in different arenas of science and technology in near future.

As a matter of fact, science and technology has a global nature rather than local or even national, so geographic boundaries has been crossed and as a result, exchanging ideas and maintaining joint research activities has become crucial to many scientists and researchers all over the world. In addition, developments of electronic communication tools as well as IT advances facilitate this process as never before.

The main objective of this bulletin is to improve the international community's knowledge about recent advances of Iran capacities and capabilities in Science and Technology and to facilitate technological collaborations with other countries.

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COMPANY PROFILE

Iran transfo co. was established in 1967 Iran transfo co. was established in 1967 under license of SIEMENS-GERMANY as a manufacturer of oil-immersed distribution, power and large power transformers with the primary objective of designing, evaluating and manufacturing of all type of transformers according to the international standards of IEC 76 & VDE 0532. Iran transfo corporation today, is comprised of 12 companies and collaborates closely with more than 100 subcontractors in Iran and other countries for manufacturing; all kinds of substations, insulation materials, ceramic insulators and accessories such as radiators, off circuit tap changers, dehydrating breathers, paper insulated copper conductors, Transformer and industrial Oil and Solvents beside all kinds of oil- immersed and dry-type transformers. Iran transfo has obtained ISO 9001, SIEMENS AG EV TWN IEO, ELIN Transformations GmbH and KEMA short circuit test certificates.

VISION

The following objectives were set as the vision of IRAN TRANSFO CORPORATION:

1. Become a global credible company mainly active in all aspects of transformers and substations manufacturing with emphasis on participating in strategic project of our country.
2. Participation in project investment and promoting foreign direct investment in development of transformer sales and marketing.
3. Expanding of company activities in the fiend of O & M and after sales services.

MISSION

- Development of managerial capabilities in manufacturing and provision of improving all management and techniques such as management and implementation optimization.
- Improvement of competitiveness by cost reduction and the lowering time taken in manufacturing of transformer.
- Building on and extending engineering knowledge and improving the quality and executing capabilities in development of the latest technology in this respect.
- Creation and development of design and manufacturing capabilities for local production of

main raw material and equipment.

- Participation in investment and promoting financial resources for transformer industry.
- Establishing and development of O & M and after sales services.
- Management and execution of national/ international project in the context of international project in the context of transformer and substations.
- Development of local subcontractor's abilities in undertaking the construction of the various islands and utilizations of national resources to improve their executed capabilities in benchmark levels.

IRAN TRANSFO CORPORATION SUBSIDIARY COMPANIES:

Iran Transformer Research Institute, Iran Transfo Co., Iran Transfo Rey Co., Iran Transfo Distribution Co., Kooshkan Transformer Co., Trans Post Pars Co., Zangan Industrial Oil Refining Co., Zanzan Sadaf Gostar Insulator Co., Pars Electrical Insulation Co., Iran Transfo Substation Development Co., Iran Transfo Commercial Co., Ashna Rahe Sama Transportation Co. and Saba Insurance Services Co..

Insulation Materials

Rars Electrical insulation Company as a member of Iran Transfo Corporation is an internationally operating manufacturer of power, distribution and special transformer insulating system components on the basis of Transformer board (Pressboard & Press paper) and Transformer wood (Laminated Compressed Wood) and special insulation papers. Our expertise in electric insulation materials laid the foundation for an internationally reputed enterprise. Special forming and pressing procedures are employed in the manufacturing technique of the pressboard components. To monitor the processes and check the product quality, periodic mechanical, physical, optical, material and electrical tests in accordance with the relevant standards of IEC: 60641-1, 606641-2, 60763-2, 6106, 60895.60641-1, 606641-2, 60763-2, 61061, 60895 are carried out.

Following categories of products are in range of our activities:

Machined - Milled , Wrapped - Metallized , Formed – Shaped, Moulded which include the components as bellow: Cylinders , Shield rings , T-strips ,Blockwashers, Rectangular strips , Angle rings , Radial spacers , Caps , Pressure rings , Snouts , Helical endings, Barrier cylinders, Edge protection angle rings + caps, Strips , Blocks, Wrappings, , Crossover insulation , Oil guiding segments , Clack band ,Spacer Rings, Clamping Plates and Rings , Distribution transformer insulation parts

Porcelain Insulators

Zanjan Sadaf Gostar Insulator Company as a member of Iran Transfo Corporation, founded in 2000, now is one of the leading producers of porcelain insulators in Iran. The company is certified by ISO 9001:2000 from SGS Switzerland. Our company success in producing the high quality insulators is due to our customer's support and the local raw material suppliers.

We offer a wide range of products including low, medium and high voltage insulators up to 36 kV insulation class including transformer bushings and distribution line insulators. The company is prepared for immediate commencement of production of new products according to customer's specifications.

Aiming at the customer satisfaction and assuring the desired product quality, all the sample and routine tests according to the international global standards IEC, DIN & ANSI are performed.



The following tests are performed on the insulators in the high voltage lab:

Sample tests Routine tests

Porosity test Electrical test

Temperature cycle test Verification of dimensions

Mechanical test Visual examination

Mechanical - electrical test

The ceramic physical laboratory is established for the purpose of improving the mechanical and electrical strength of the insulators with high tech equipment. Mechanical & electrical tests



such as bending strength test, green bending strength, open porosity test, thermal shock,

electric strength, slurry density, slurry plasticity and grain sizes are performed on insulator's body, glaze and cement.

Radiators

Iran Transfo Corporation can supply Radiators for cooling system of oil immersed distribution and power transformers and reactors. Cooling capacity of Radiators is defined according to the number and dimensions of their radiating elements. Radiators are produced in accordance with DIN 42559. We don't use seam welding for radiator headers, that being the main advantage and specific feature of our radiators. It cause a smooth surface without any leakage and extra works. Radiators with the following specifications could be supplied:

Dimensions: Length of elements 800 – 3500, Width 520 mm, No. of elements in each radiator 4-28, Elements spacing 45 mm, Flange or joint pipe; alternatively



Materials for production of:

- Shell: Cold rolled steel St 37-2 acc. to DIN 1541/1623 thickness 1.25 mm
- Header Pipe: Welded support roller pipe acc. to DIN 2394
- Separating Irons: Round steel St 37-2 acc. to DIN 1013, diameter 8 mm
- Flange: Flat steel 150×20, acc. to DIN 1017, St 37-2

The welded radiators are leakage tested under a pressure of approx. 2 bars. According to customer needs and environmental conditions either adhesive coat with two pack paint on epoxy resin basis or hot dip galvanizing acc. to DIN 50976 or BS 729 are used for protection against corrosion. An internal varnish is also applied to interior surfaces.

For quality control:

- All raw materials are checked by Iran Transfo laboratories.

- In production line quality control team make the following tasks:
 - Visual tests.
 - Measure all necessary dimensions and welding thickness and control them with drawings and technical documents.
 - Fill check lists for each order.
 - N.D.T tests on finished surfaces like thickness, gloss and visual.
 - D.T tests on sample surfaces like cross cut, scrap adhesion and hardness.
- All radiators are packed on wooden pallets or boxes and fastened with steel strips.

Continuously Transposed Cables:

Continuously Transposed Cables (CTC) is essential for making high quality high power transformers. CTCs have been successfully employed for more than 40 years in power transformers. Iran Transfo Corporation has the know-how and all necessary instruments for producing continuously transposed cables with up to 66 single conductors. The following technical information gives a general view about the standard used for production and possible diverse in construction of continuously transposed cables. Should any planned lay-out go beyond the limits given here, please contact us. We are certain that we can nearly always suggest an appropriate solution. The choice of single conductor dimensions should generally be made acc. to DIN 46451 part 1, so that a production without problems and easy workability of the continuously transposed cables is ensured. When choosing the dimensions, factors of special significance are:

- The number and dimensions of single conductors
- The pitch in the continuously transposed cable
- The copper condition
- The suitable ratio of height/width
- Type of insulation has been utilized

Our product range in case of number and dimensions of elementary conductors is:

Quantity:	Min: 5	Max: 66
Dimension:	Min: 1.2*3.0	Max: 2.5*12.0

The standard production is based on a copper conductor of E-Cu 58 F20 acc. to DIN 40500. Should transformer winding with higher strength be required then continuously transposed



cable with strain hardened copper can be used. The PVA enamel, 0.110 mm thin, with thermal class 120 is normally used for single conductor insulation. On request any specific characteristics could be supplied. The purchaser shall define all parameters for the layout of the overall paper insulation, and tune them with us if there are any special conditions. As a regular practice, insulating papers are employed, but we can also use special kind insulation made of braiding material. Thermally upgraded paper, consisting of sulphate cellulose according to DIN 6741 for all paper layers with all layers butt lapped and the two last layers interleavedly wound is used in our standard practice. Other types of paper wrapping are possible according to order. To improve the axial pressure strength of the continuously transposed cables, normally an inter-column separator is inserted between the two rows of conductors. The CTCs are strictly quality controlled in different production process steps beginning from enameled conductor and insulation material to conductors' short circuit check and final controls.

A test certificate will be issued containing the following information: dimensions of the copper conductor: specified value/actual value, increase value of the insulation: specified value/actual value, type of insulation, number of paper layers, dimensions of the insulated wire and yield point $R_{p0.2}$. The product is delivered on wooden reels, uniformly distributed and tightened.

Accessories

ITSD Company a member of Iran Transfo Corporation manufactures following accessories for oil immersed distribution transformers: Off-Circuit Tap Changers, Dehydrating Breathers, Thermometers and Oil Level Indicators

Off-Circuit Tap Changers:

Off-Circuit Tap Changer is a device fitted to transformers with capacity up to 1000 kVA, in case of our product range, for regulation of the output voltages to required levels.

General specification:

Off-Circuit Tap Changers are produced according to IEC76 in three types: 3, 5, and 7 taps



Components of Transformers

Quality control:

Following tests are carried out on our tap changers: contact temperature rise test, mechanical life-time test, lightning impulse test, power frequency voltage test, and manual operation test

Material:

Shaft of the shafted pinion are made of galvanized free cutting steel.

All other steel parts are made of galvanized steel.

- Lower part of the bearing, shaft pinion, control knob, lock nut head and body are made of polyamide.
- Positioning ring and protective cover are made of aluminum.
- Fixed contacts are made of copper E-CU F25.
- Insulation parts are made of paper phenol-plastic resin based laminates.

Types

No	System Voltage (KV)		I (A)	Code No.	Number of position
1	36	30		TA55550	5
2	36	63		TA57550	5
3	24	63		TA37367	3
4	24	63		TA57455	5
5	24	63		TA77563	7

Dehydrating Breathers:

Dehydrating Breather is used to remove moisture from the air that enters the conservator. It helps the oil maintain its insulating properties. It is filled up with silica gel which can absorb moisture equivalent to 20% of its own weight. Dehydrating breathers should be checked to ensure that they are free from restriction and have not absorbed excessive moisture. When dry, the silica gel has a blue color and when saturated with moisture the color changes to a pale pink. This indicates that it is time to replace the silica gel with new one.

General specification:

Dehydrating Breathers are produced according to DIN 42567

Components of Transformers

Material:

- Top section: Casted aluminum
- Bottom section: Casted aluminum
- Standard painting: Electrostatic coating
Other painting method is possible acc. to order
- Container cylinder: Polycarbonate
- Oil bowl: Polycarbonate
- Oil bowl holder: St37
- Bolts, Nuts, Washers: Galvanized steel
- Rubber gaskets



Types

Product code	Sillicagel capacity(Kg)	h (mm)	Capacity Max.(cm ³)
TA18215	0.5	215	900
TA36295	1.0	295	1600

Transformer oil capacity(Kg)	Range of application	Conservator Pipe dia(mm)
1800	UP TO 630 kVA	15
3600	800 TO 2000 kVA	15

Thermometers:

Thermometers are used for indicating oil temperature in hermetic and expansion conservator type distribution transformers. They are equipped with two electric switches and maximum indicating pointer. The thermometers operate efficiently under very hot and cold weather conditions.

General specifications:

- Ambient temperature: -40 °C to 80°C
- Pressure: -50 kPa to 200 kPa
- Insulation test: 2000 V, 50 Hz to earth, 60 Sec.
- Protection class: IP 54

Components of Transformers**Material:**

- Case: casted aluminum
- Paint: electrostatic powder coating
- Window: poly carbonate
- Thermowell: stainless steel
- O-ring: nitrile

Types

Type	A	B	C	D	E	Contact
TA1015	R½	104	117	12	15	2
TA1517	R¾	106	117	12	17	2
TA2017	R1	106	117	12	17	2

•Oil Level Indicator

Oil Level Indicator is used particularly to indicate oil level in transformers. Our products could be used in distribution transformers with capacity up to 2000 kVA for the purpose of monitoring. All parts of indicator have no contact with oil. The oil level indicator do not allow oil leakage in temperature of 110 °C and 0.5 bar effective pressure and vacuum. They are produced according to DIN 42269.

**Material:**

- Case: Casted aluminum
- Case paint: Electrostatic (shaded acc. to order)
- Indicator dial: Aluminum
- Pointer: Brass paint indicator dial yellow and black indicated
- Pointer shade: yellow or red
- Indicator glass: polycarbonate

Types:

Order No.	Ø	A	G	L	H
TAL 160	160	68			75

Components of Transformers

TAL 200	200	80	88
TAL 250	250	102	107
TAL 315	315	124	130
TAL 400	400	156	160
TAL 500	500	195	200

Quality Assurance:

Quality assurance as one of the most important sections of the factory has accurate supervision over calculation and manufacturing procedure of transformers. Specifications of applying materials will be controlled according to IEC, DIN and BS standards; also the section's personnel have supervision over all the procedure of designing, manufacturing, packing and shipment.

Different parts of quality management system are HV (High Voltages) labs, material and manufacturing control lab that control different procedures of manufacturing. Performances of Iran Transfo's laboratories are supervised by Transformer Research Institute.

To achieve a world-class quality in products, in all the factories of IranTransfo three different types of final tests are performed. These tests are performed to confirm the reliability of transformers and also to assure the ability of withstanding the conditions; they will be exposed to, during their service. Tests are carried out according to IEC76, VDE 0532 or any other international standard. Routine tests are performed on each individual transformer to establish performance characteristics of every transformer:

Measurement of voltage ratio and check of phase displacement, measurement of winding resistance, measurement of no-load loss and current, measurement of short-circuit impedance and load loss, dielectric routine tests, tests of on-load tap changer, where applicable.

Type tests are performed on a random sample from a batch of manufactured transformers, to demonstrate that these transformers comply with specified requirements that are not covered

by routine tests:

Temperature-rise test and dielectric type test:

Special tests are performed according to the agreement between the manufacturer and the customer: dielectric special test, determination of capacitance windings-to-earth, and between windings, determination of transient voltage transfer characteristics, Measurement of zero-sequence impedance on three-phase transformers, determination of sound levels, measurement of the harmonics of the no-load current, measurement of the power taken by the

fan and oil pump motors(if any), measurement of insulation resistance to earth of the windings, and/or measurement of dissipation factor ($\tan \delta$) of the insulation system capacitance. Regarding mentioned tests, there are HV labs in IranTransfo, factories which are equipped with modern and accurate calibration equipments and in which all the required tests for different types of transformers can be carried out.

Purchase Advantages:

We offer Iran Transfo products and services because of: High Quality & Reliability of our products, 40 years Experience supporting us, our competitive prices, our satisfactorily After Sales Services, continuous upgrading of the Technology, We are located close to the market countries, we offer tailor made products to meet the customer requirements, We get the raw materials from certified, well reputed suppliers of the world, utilizing state of the art equipments and technology for production and test, Our wide spread network of representatives both domestic and worldwide.

Certificates:

Irantransfo has achieved these certificates; Siemens AG EV TWN IEO Certificate, ELIN TransformatorenGmbH Certificate, International Five Stars for Quality Certificate, KEMA Certificate for Distribution Transformer, KEMA Certificate for Power Transformer, SGS Certificate (ISO 9001:2000), SGS Certificate (ISO 9001:2000), BVQi ISO Certificate.

Opportunities for cooperation:

Iran Transformer Research Institute (ITRI) as a member of Iran Transfo Corporation is active in applied research, technology development and technology transfer in the field of oil immersed and Dry-type transformers. The activities are aimed at product optimization, engineering services and training. We can offer the following services to our customers:

- Research and development for all types of oil immersed and cast resin dry-type transformers
- Design and engineering services for all types of transformers
- Investigations about power and distribution transformers in the networks
- Carrying out the feasibility studies project in transformer industry
- Development and technology transfer in transformer industry