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# ABOUT US



## About Us

The transformer factory which was established in 1995 as a result of an agreement between Sudan Science and Technology University and Ohan University, took the name of TRANSUDAN by joining Sudanese Electricity Distribution Company (SEDC) in 2012.

With the new investments made in 2016 after the share transfer agreement between SEDC and LMZ ELEKTROMEKANIK LTD STI, the factory has increased the manufacturing capacity using new design based on the latest technology in a 20.000 m2 open and 10.000 m2 closed manufacturing area.

Also, new products in the electromechanical sector are planned to be added to the product range of TRANSUDAN.

Beside the Sudanese market, TRANSUDAN is targeting to export its products of transformer and distribution equipment to several countries in Africa.

TRANSUDAN is providing the following services:

- 33 and 11 kV Distribution Transformers
- Power Transformers
- Steel and Concrete types Transformers Substations
- Mobile Substations
- LV and MV Panels
- Engineering, Testing, Training and Maintenance

# TRANSFORMERS

## Distribution Transformers and Types

### Oil Immersed Distribution Transformers

We are manufacturing distribution transformers with rated power capacity ranging between 50 kVA - 5 MVA, having 36 kVA upper limit, 400 V and around as the lower limit.

We apply routine inspections and tests on each of our transformers in accordance with IEC 60076 (TS 267) within our facilities before dispatching to customers. Upon customer's request, we are able to perform typical tests and special tests with our own laboratories except for the mechanical endurance test against short-circuit which can be done in the overseas test laboratories of the international accredited institutions viz. CESI/Italy/ and IPH/Berlin, Germany, Kema/Holland.

### Transformer with Expansion Vessel

They are produced in power range of 25 - 2500 kVA, up to 36 kV high-voltage level, mono-phased or tri-phased, oily, natural cooler (ONAN), idle level convertor or automatic level convertor under load and in a way that they can be used in externally and internally.

Transformers with expansion vessels are same with hermetic transformers in terms of core and coil structures.

Sizes of expansion vessels of transformers are designed in a way that it shall store expansion of oil increased with temperature as the result of the calculations.

Since transformers with expansion vessel are open to atmosphere, oil pressure changing with the thermic effects, air circulation is ensured by dehumidifying the air by silica gel in the vessel of the transformer and oil pressure changing.

As the result of the air circulation arising out of heat differences depending on the load of transformer with expansion vessel operating, it loses its silica gel characteristics in time and causes that oil is humidified and its structure is spoiled. Thus, there are maintenances in certain periods such as exchanging silica gel and measurement of disruptive voltage by taking sample from the oil.

### Hermetic Transformers

We produced in power range of 25 - 2500 kVA, up to 36 kV high-voltage level, mono-phased or tri-phased, oily, natural cooler (ONAN), idle level convertor or automatic level convertor under load and in a way that they can be used in outdoor and indoor.

Hermetic transformers are produced in factory in a way that they shall not contact with air by setting pressure.

Oil pressure changing because of thermic effects in hermetic transformers are controlled by expansion-contraction of boiler wave walls and they are designed in way that they shall be able to resist these effects.

Since there is no expansion vessel, oil filling process to the boilers must be made in special vacuum rooms in a way that there shall remain no void. Thus, since there is no moisture in the boiler, deterioration in oil because of oxidation is decreased to zero.

Heights of hermetic transformers compared to the transformers with expansion vessel are lower. So, they can be used in smaller areas.

Since oil is not in contact with air in hermetic transformers, oil change is not made in certain periods as it is in transformers with expansion vessel. No maintenance is needed except cleaning of bushings of HV and LV bushings.





### Cast Resin Dry Type Transformers

Cast-resin dry type Transudan distribution transformers are manufactured in accordance with international quality standard ISO 9001.

They are type of transformers whose HV and LV windings are coated with cast resin under vacuum and have rated power ranging between 250 kVA- 25 MVA and rated voltage up to 36 kV. They can be manufactured as equipped with natural cooling (AN) system or forced cooling system with fan (AF). (With the usage of fan, up to 50% power increase can be obtained.)

#### Why dry-type transformers ?

- Epoxy resin casted under vacuum keeps the transformer free from damp and provides protection against unfriendly environments.
- That's why transformers can operate trouble free in humid and dirty environments.
- Since the epoxy resin applied on windings as coating material has fireproof and self extinguishing properties, there isn't any risk of leakage that may cause fire and pollution. That's why they are safe and environment friendly.
- Since the size of dry type transformers are smaller when compared to those of oil-type transformers, they provide such as advantage that they require less space and less construction works.
- They have relatively low thermal and dielectric aging effect in comparison to oil immersed transformers. These features provide transformer with longer service life.
- They are more useful with their high endurance against short-circuits and high capacity boosting overloads.
- They require no maintenance.
- According to IEC 60076-11;
- Climatic C1/C2
- Environment (condensation and humidity)
- Fire behaviour



### Special Transformers

In our research and development departments we are working on many projects regarding out of ordinary transformer designs. Our company is well on its way to become a global brand equipped with technical staff selected from professionals.

A leader and pioneer in the quality of service and products provided, ready for international competition, eager to use the highest technology and newest manufacturing techniques and environment-friendly Transudan without compromising from its work ethics, evaluates

success based on customer pleasures. It provides fast, competitive products that meet their clients' expectations with a dynamic temwork.

Transudan manufactures these type transformers to satisfy rapid response for emergency situations, trailer mounted, self-contained system transformer, HV and LV switchgear in substations, which contains protection and control equipment.

The substations are designed for easy transport and quick connection.

### Special Solutions

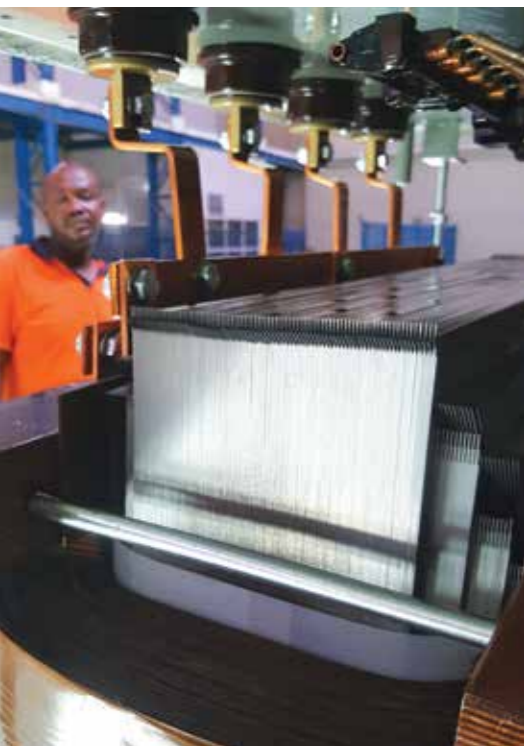


### Power Transformers

We produce power transformers up to 150 MVA 220 kV. We are able to respond fast and accurate to needs of our customers with our highly experienced team. Power transformers that we produce can be seperated 4 main groups as intended usage.

Power transformers may be separated into 4 main groups according to its usage purposes;

1. Generator (step-up) Transformers: They are attached to transmission lines at the side of high voltage winding tied to generator output up to 36 kV of energy power plants. It is important to pay attention to the conditions of warning signs and overload at their designs.
2. Network Transformers: They are usually used as step down transformer at substations. Environmental conditions, overflow demands and conditions of networks stipulate their designs
3. Industry Transformers: They are used as step down transformers in industrial facilities. Since they are often exposed to short circuit in heavy working conditions, it is necessary to take special precaution with their designs.
4. Special Transformers: They are divided as subgroups such as: furnace transformers, furnace reactors, serial-shunt reactors, rectifiers and phase shifter transformers.



# KIOSK TYPE SUBTATIONS

Transudan has experience in manufacturing transformer kiosks. A wide product range is formed with the advantage of such great production experience.

- Sheet Steel Kiosks
- Mono-Block Concrete Kiosks
- Prefabricated Concrete Kiosks

Till the near past, it was used to design and construct regular or special buildings for transformer centers. But due to the time taking construction of such buildings, beside giving permission for such construction only for a certain limited time due to disturbance to the surroundings in this time period, hardly finding the land required for construction especially in large cities and very high nationalization prices, if any land is found. For all the above we offer to our customers the suitable solution with our kiosks. Kiosks are transformer and distribution centers produced since 1981. Designed in compliance with the projects and requirements of our customers, the Sheet Steel kiosks are structures basically used in energy distribution due to their superior technical characteristics, electrical and mechanical strength and long-life use, the facility of easy and quick start-up, minimum maintenance needs. These kiosks are produced in the following standards and technical characteristics:

### Standards

- IEC 62271-202: Prefabricated Transformer Centers
- IEC 60076 : Distribution Transformers
- IEC 62271-200: MV Switchgears
- IEC 60529: IP protection Classes
- IEC 60694: Common Properties in MV Switchgears
- IEC 60721-1 : Outer Environment Classification

### Design Criteria

- Altitude : 2000 m
- Ambient Temperature: -5...+50°C
- Environmental Pollution : Class 3
- Max. Solar Radiation: 1000 W/m<sup>2</sup>
- Earthquake Strength: 0,5 g Vertical and Horizontal

### Nominal Values

- Ur: to 40,5 kV
- Ir: to 1250 A
- Ik: to 25 kA
- Fr: 50/60 Hz
- IAC: AB
- IP Degree: IP23D, to IP 56
- CL: 10

## Production

### Cores

It is core type, manufactured from silicon alloy sheet steels like M5, M4, M3, MOH and ZDHK with directed crystalline orientation (grain-oriented) and having thicknesses of 0,30 mm, 0,27 mm and 0,23 mm. The sheet steel cut to a mitred form of 45 degrees angle at the section where the magnetic flux passes are slitted into intended shape and stacked with CNC slitting machine and packed to form a magnetic circuit. Cutting and packing operations for magnetic circuit are handled with a method known as step-lap which reduces iron losses to a minimum. The core is package by applying step-lap method both crosswise and lengthwise.

The cross sections of leg and connecting cap pieces are the same and multi stepped and theoretically it is assumed to be round cross section.

Core laminations, U-core and connecting cap piece are so compacted by way of steel studs passing through insulated bushings that noise of them are kept minimum.

### Windings

Round or flat electrolytic copper or aluminium conductors with resin or paper insulations are used in the distribution transformers windings as conduction material.

Homogeneous distribution of voltage impulses is obtained by means of applying special winding process to windings exposed to high temperatures and voltages, and increasing the thickness of layer at the coil inlet and outlet. Thus, abnormal stresses on the windings are prevented.

According to the design specifications, the winding configuration could be disc winding or layer winding in power transformers. In order to facilitate the production of the layer windings and eliminate the gaps on the contact surfaces of windings, horizontally and vertically operating winding (and insulation) machines having press-like systems are used.

### Tank

Our tanks used to store and keep the cooling and insulation substance in oil type transformers depending on their available cooling surfaces, are manufactured with corrugated walls for the transformers up to 3150 kVA rated power and equipped with radiator for those greater than 3150 kVA rated power.

CNC plasma shape cutting machine is used in tank production. After finishing the welding works and assembly of tank, it is tested for leakage under pressure in accordance with IEC standards. Tanks with corrugated walls are designed to withstand 0,65 bar vacuum pressure and tanks with radiators are designed to withstand 1 bar vacuum pressure. The finished tanks manufactured in accordance with the customers specifications are sandblasted afterwards.

Cover of the tank is designed in such a way that the winding terminals can go out. There are insulators, phase markings, lifting lugs for taking out the active part, thermometer pocket, grounding bushing and supplementary components on the cover of tank.

There is a possibility of coating the tanks with hot-dip galvanizing, when it is particularly requested to do so. Moreover, again upon request, there is another possibility of providing a safe guard made of sheet steel and assembled on the cover in order to cover and protect bushings pursuant to IEC standards.

### Painting

In our ongoing procedure for painting, a gray colour known as RAL7033 is used as standard, but we can also manufacture with different colours on customer request. Our transformers which are painted by way of spilling and spraying methods are primed once and then painted twice on the automated assembly line. Eventually the paint thickness reaches to an extent not less than 105 microns.





# MOBILE SUBSTATIONS

Transudan is reputable as one of leading companies in designing and manufacturing Mobile and Transferable Substation. Mobile Substations which are designed and manufactured by Transudan are used since 1995 in the field.

Mobile transformer and distribution centers provide easy and flexible solution to the user by means of short manufacturing time and very easy transport facility in cases of:

- Fixed Substations Construction
- Maintenance and Repair of Fixed Substations
- Power Shortage of Fixed Substations Installed.

Mobile substations can be transportable easily and fast to where they are needed and may easily be integrated to the system. They are also used as fixed substation centers in some areas where construction of fixed substations take long time and cost expensive.

Experienced Engineers of Transudan analyze the real necessity and site conditions to design the most suitable Mobile Substation according to the necessity.

#### Main Application Areas

- Emergency Service
- New Services
- Temporary Service Maximum Mobility

Mobile substations are designed considering maximum mobility and maximum operation safety. They are integrated with different types of applications in dimension and suspension structure in compliance with international road/rail/sea regulations and also with the country to use.

Mobile Substations are designed and manufactured tailored according to the necessity of application and/or customer.



#### MV/LV Mobile Substations

Mobile substations are produced in 4 different designs according to its mobility.

- Trailer Type
- Wagon Type
- Vessel Type
- Skid Type

#### MV/MV Mobile Substation

MV/MV Mobile Substations are used in Medium Voltage Distribution networks for power generation or distribution. Mobile Substations are designed and manufactured as tail made with the primary voltage up to 40.5 kV and the secondary voltage up to 24 kV with the power up to 31.5 MVA according to the necessity.

MV/MV Mobile Substations are designed and manufactured as two different forms according to the layout of the transformer. 3 different solutions are available for switching of primary and secondary medium voltage distribution busbars as;

- Air insulated Metal Clad Switchgears
- Air insulated Metal Enclosed
- Switchgears
- Gas Insulated RMUs



#### HV/MV Mobile Substation

Mobile Substations are used in High Voltage Transmission lines and Medium Voltage Distribution networks. Mobile Substations are designed and manufactured as tail made with the primary voltage between 52 - 245 kV and the secondary voltage between 1 - 52 kV while the power up to 31.5 MVA according to the necessity.

The Primary High Voltage level is side Open type air insulated busbars are used in with 2 different switching solutions as;

- Gas Insulated System
- Air Insulated System

#### 3 Different Solutions are Available for Switching of Secondary Medium Voltage Distribution Busbars as;

- Air Insulated Metal Clad Switchgears
- Air Insulated Metal Enclosed Switchgears
- Gas Insulated RMUs

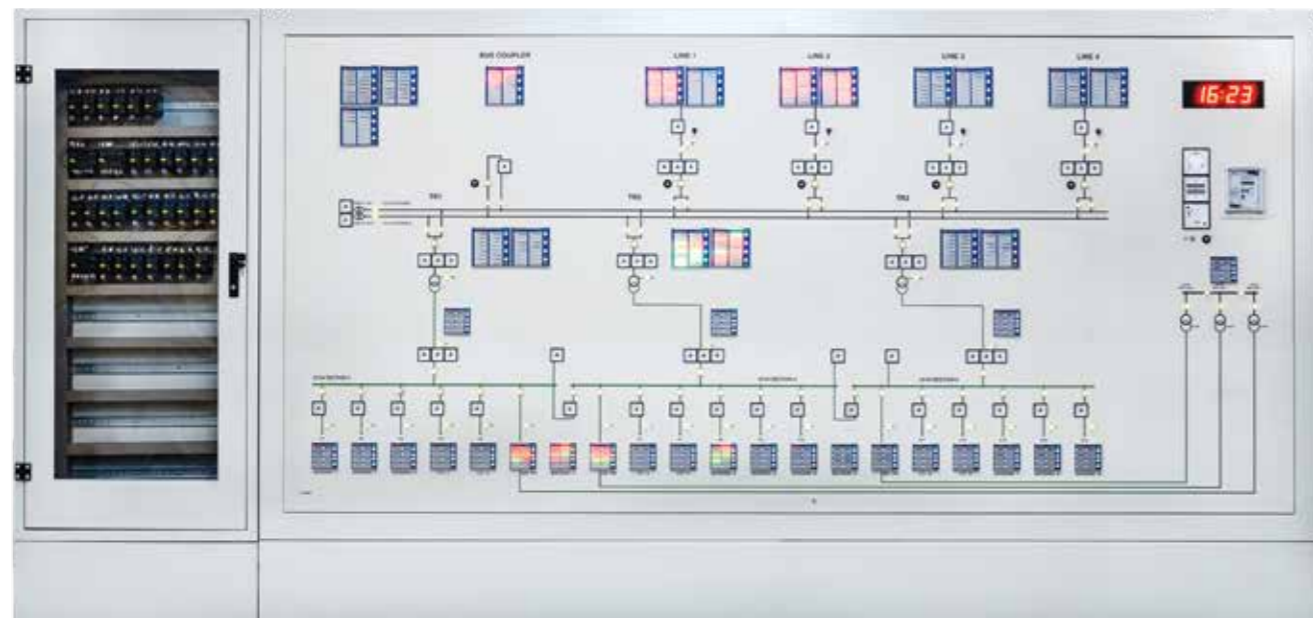




# LOW VOLTAGE PANELS

Transudan find proper solution by analyzing customer demands and budget accordance to aiming to ensure customer satisfaction with using Schneider, ABB and Budgets Local partners products.

- Main Distribution Boards
- Sub Main Distribution Boards
- Final Distribution Boards
- Starters Control Panels
- Motor Control Centers
- Automatic Transfer Switches Centers
- Industrial Plant Control Panels
- Building Management Systems Panels
- Plc Based Controls
- Synchronizing Control Panels
- Feeder Pillars
- Street Lighting Control Panels
- Capacitor Banks
- Capacitor Banks With Harmonic Filters
- Active Filters
- Metering Cabinets
- Grp Panels
- IT Panels
- Security Panels
- Soft Starters Panels
- Variable Frequency Drives (Vfd) Panels
- Weather Proof Isolators
- High Current Disconnecter Panels
- Dc Distribution Panels
- Mosaic Mimic Panels



# MEDIUM VOLTAGE SWITCHGEARS

Metal Enclosed Switchgears are the switching and control equipment between 1 kV and 40.5 kV, manufactured in conformity with IEC 62271-200. Metal Enclosed Switchgears are manufactured by galvanized metal sheet with 2 mm thickness and painted by electrostatic powder paint in colors conforming to RAL coding. Metal Enclosed Modular Switchgears manufactured defined with following features as per IEC 62271-200 standards:

- Air insulated
- LSC 2A Loss of Service Continuity
- PI Partition Class
- AFL Internal Arc Classification
- 3 Accessible Compartments

## Metal Clad Switchgears

The Metal Clad Switchgears are manufactured from steel structures in vertical position as free-standing which contain with drawable/cassette type Circuit breakers, Main distribution and grounding busbars, Current Voltage Transformers, Protection and Control equipment. Main structures consist of 3 mm sheet steels and painted with electrostatic powder paint in conformance with RAL codes.

Metal Clad Switchgears are defined with following features according to IEC 62271-200.

- Air Insulated
- LSC 2B Loss of Service Continuity
- PM Partition Class
- AFLR Internal Arc Classification

Switchgears with double busbar are used for balancing the load for the medium voltage distribution systems that feed from two different sources by taking the capacity into the consideration. Furthermore, it is also used for utilizing the busbar of one source when the other source cannot get energy to its busbar due to a power cutoff. It makes advantage to distribution system for the continuity of energy supply.

## Compartments

Metal Clad Switchgears with double busbar system contain the following compartments which are segregated from each other with grounded metal compartment.

- a- Switching Equipment Compartment
- b- Low Voltage Command Compartment
- c- Busbar Compartments
- d- Cable Compartments



## a- Switching Equipment Compartment

Switching Compartment consists of the following units:

- Switching Equipment (Circuit breaker contactor, etc.)
- Elevator type of withdrawable truck
- Switchgear door contains operating mechanism of truck and earthing switch
- Individual and lockable grounded metal separator

**Switching compartment may have the following Switching Equipment as per the necessity of the project**

Vacuum Circuit breaker

- SF6 Circuit breaker
- Contactor
- Fuses

In order to provide operational safety, The Metal Clad Switchgears are manufactured in line with the criteria defined in IEC 62271-200.

Access to Switching compartment is controlled by integral design of Metal Clad Switchgear to ensure safe operation according to IEC 62271-200 The following mechanic Interlocks are provided as standard:

- The withdrawal or engagement of the C/B is not possible during the C/B is "On" position
- The operation of the C/B is not possible unless it is in service and test position
- It is not possible to open the switchgear door when it is in service position
- It is not possible to close the C/B when switching compartment door is open.
- Closing of earthing switch is not possible if circuit breaker truck is in service position
- The operation of the CB is not possible when earthing switch is closed.



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