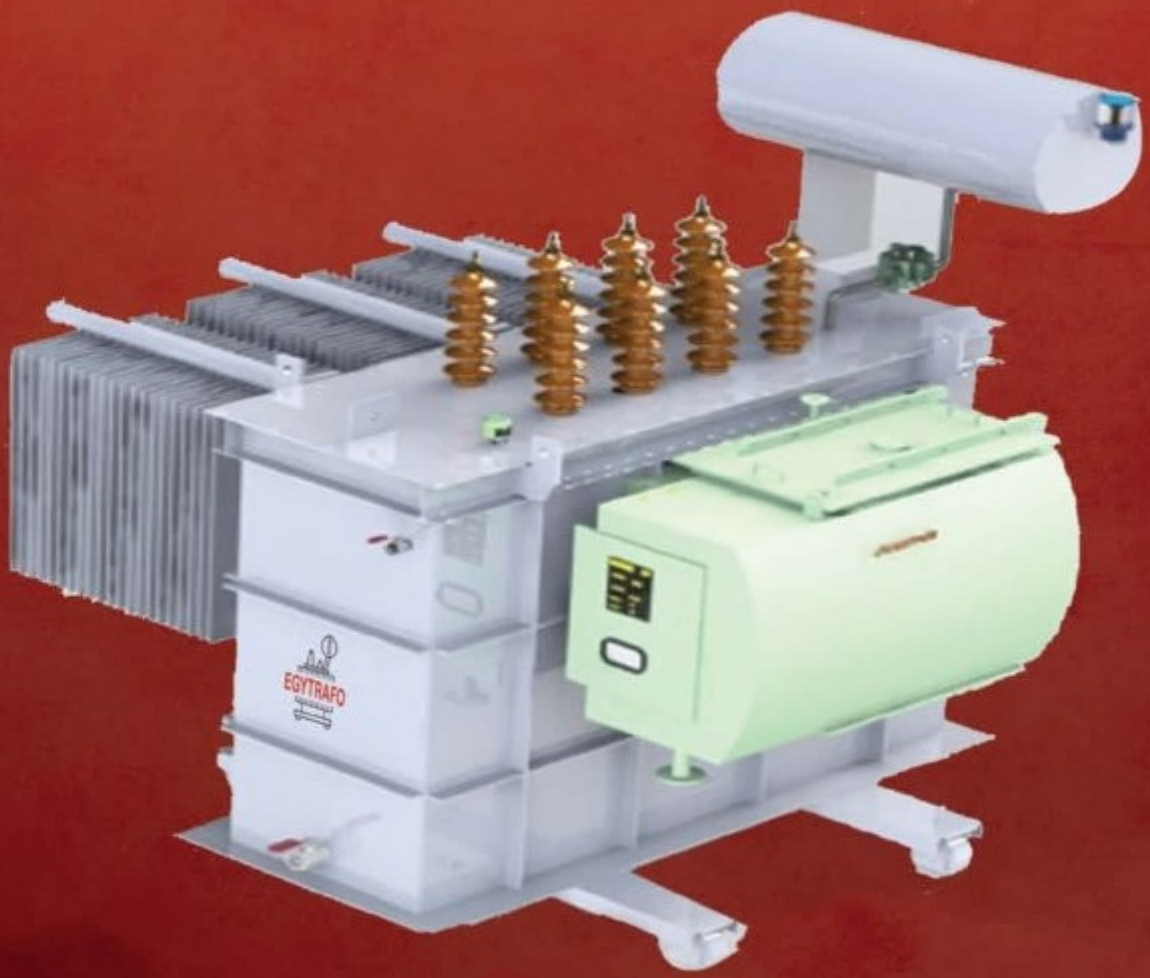
EGYTRAFO

3-Phase Automatic Voltage Regulator (AVR)



ISO 9001 OHSAS 18001 ISO 14001

Mission

Being market leader in manufacturing of transformers and Nickel Cadmium batteries and its services locally and globally.

EGYTRAFO

Objective

Maintain continual improvement in our business and manufacturing procedures with persistent staff development taking into consideration operational health and safety in all stages.

Vision

Customer focus through high quality and reliable products / services with competitive price and on time delivery.

PROUDLY MADE IN EGYPT مصر

E-4100-E-02-20

EGYTRAFO

Different Power Vission

Dear Group Members;
Dear Valued Customers;

First of all, I would like to thank EGYTRAFO's Group staff for their dedication and our clients whom we have been dealing with since 1979, for their trust and success that we have achieved, looking back on the previous years and remembering every moment of hard work, deadlines met, challenges and competitions, those were the significant stimulants that enhanced our emerging experience since we began.

Our history started since we established our trading company ETCO in 1979 in which we were trading in electrical equipment as Transformers, HRC fuses, lighiting arrestors and Nickel Cadmium Batteries. Due to our strong beliefs towards the Egyptians' qualifications and the importance of locally produced products. EGYTRAFO Group was established in 1994 which became a leading manufacturer of Oil Transformers up to 15 MVA, 33KV and Nickel Cadmium Batteries up to 800 Ah

The success that EGYTRAFO Group proved to all its customers as well as perceiving exactly the market requirements encouraged us to step forward towards our dream in 2007 where we launched the first local Dry Type Cast Resin transformers factory in the Egyptian market that produce ratings up to 3.6 MVA,33 KV

In 2013, we have also established "TrafoTech manufacturing PLC" factory in Ethiopia for the production and maintenance of Oil Transformers.

As we always believe in meeting the market requirements, EGYTRAFO Group launched the first Off Load Auto Transformer in the Egyptian electrical network in 2013 due to the EDC complain of the voltage reduction in some locations in the network. Later on, in 2019, EGYTRAFO Group has improved its product by adding some features and now the product is an Automated Auto Transformer, provided with On Load Tap Changer that can be manually, remote and automatically operated.

Our most important key factors of reaching this success are our product's quality and the team's dedication to compete locally and globally. Therefore, our quality assurance team ensures the compliance of the latest IEC and ISO standards for our products to be internationally accepted. Our Oil and Cast resin transformers are "KEMA" certified. One of our main objectives is to maintain continuous quality improvement and staff development along with safety regulation.

Clients trust, experience, high quality and success are our main driving factors that we depend on in making our future business.

Last but not least EGYTRAFO Group's main goal is to grow and expand our activities in order to increase its market share. We do believe that our mission never ends.

Grp. Chairman
Atef A. Moniem

Introduction

The 3 phase automatic voltage regulator are used as voltage regulator to compensate the voltage drop in the electrical network, so that customers at the line end receive the same average voltage value as those closer to the source.

The voltage value reduction affects the operation quality of the rotating machines and increases the losses due to the higher current drawn due to the voltage reduction. It also affects the quality of illuminating system.

EGYTRAFO Group produces 3phase automatic voltage regulator with rating up to 600A & 9 tapping positions. The OLTC is flange mounted (ON TANK) or (IN TANK) type according to the rating of the transformer and provided with an automatic voltage regulator (AVR) and a remote tap changer control cubicle (RTCC).

Technical Specifications

A- Rated Voltage ratio:

- 12 KV voltage system: The rated voltage ratio at no load 9.625/11 KV at mid. tap
- 24 KV voltage system: The rated voltage ratio at no load 20.625/22 KV at mid. tap or as per the customer requirements

B- Tapping:

- 12 KV system voltage: The mid – tap: 9.625 KV
- 24 KV system voltage: The mid – tap: 20.625 KV
- The manual position of the OLTC: local (L) and remote (R)
- The On Load Tap Changer is provided with Automatic Voltage Regulator (AVR) and Remote Tap Changer Control Cubicle (RTCC)
- Each transformer has an On Load Tap Changer with nine tapping steps

For system voltage 12 KV:

8.325, 8.650, 8.975, 9.300, 9.625, 9.950, 10.275,
10.600, 10.925, or as per the customer requirements

For system voltage 24 KV:

17.555, 18.11, 18.665, 19.22, 19.775, 20.33, 20.885,
21.44, 21.995 or as per the customer requirements

C- Rated current:

The rated current of transformers at the mid tap: 100, 200, 300, 400, 500 A.
The transformers deliver the rated power continuously without exceeding the permissible temperature rise limits according to the latest IEC 60076 - 2.

D- Connection symbol:

The connection symbol of the transformers should be: (Y auto / Yn 0)

E- Impedance voltage:

Impedance voltage of the transformers at rated power should be less than 0.5 % of the rated voltage (11 KV or 22 KV) according to the latest IEEE C57.15 or up to (1%) as per customer's requirements.

F- No load current:

The no – load current of the transformers is not more than 0.5% of rated current.

G- Short – circuit duration:

The 3 phase automatic voltage regulator (AVR) should be designed and constructed to withstand the mechanical and thermal stresses produced by external short circuit without damage of at least 25 times the base RMS symmetrical rated load current.
The short circuit withstand duration should be not less than 2 seconds.

H- Over load capacity:

General the 3 phase automatic voltage regulator (AVR) is manufactured in accordance to IEC 60076 The transformer shall withstand permissible over load capacity 20 % for 1.5 hr (Without exceeding the permissible heating).

I- Losses at 95°C

24 KV System		12 KV System		Rated current A
Load losses (W)	No Load losses (W)	Load losses (W)	No Load losses (W)	
3815	**576**	**3815**	**576**	**100**
6430	825	6430	825	200
9450	**1222**	**9450**	**1222**	**300**
11700	1500	11700	1500	400
13860	**1785**	**13860**	**1785**	**500**

J- Temperature Rise Limits:

- Transformer shall be able to deliver its max. continuous ratings, without exceeding the permissible temperature rise limits (over the ambient temperature):
- Top oil temperature rise: 45 K
- Winding temperature rise: 55 K
- Hot spot temperature: 60 K

K- Noise Level:

The core joints should be properly interleaved: precaution should be taken to keep the level of (48 – 56) dB according to rated capacity and measured at distance of (one) meter, at mid tap.

L- Harmonics level:

The Transformer should be designed such that Total Harmonic Distortion in Voltage waveform THDV does not exceed 5%.

Construction:

Core:

The core is made of high permeability, low loss, cold rolled silicon steel laminations with thickness not more than 0.3 mm. It is constructed and assembled in such a way in order to have the minimum no load loss, no load current, voltage harmonics, especially the third harmonics and to withstand the mechanical and thermal stresses.

Winding and terminal

The winding is manufactured from high conductivity electrolytic copper complying with the IEC standard the maximum flux density in the yoke should not exceed 1.6 tesla.

Tank:

The 3 phase automatic voltage regulator (AVR) tank is made of welded sheet steel or boiler plate steel with suitable thickness to withstand the different mechanical stresses occurring during operation or drying process of transformer insulation

The tank cover is bolted and sealed to the tank and provided with thermometer pocket, lifting lug terminal bushing, connection pipe to the conservator and if necessary, with pressure relief device, oil filling valve and air taking plugs.

The tank base is fitted with oil drain and sample valve, earthling screws and pulling plates

The tank is provided with suitable cooling radiators and transformer name plate frame.

Conservator:

- The 3 phase automatic voltage regulator (AVR) should have an oil expansion conservator fabricated from steel sheet of suitable thickness and should be connected to the tank through the connection pipe on the tank cover
- It is fitted with dehydrating silica – gel breather, oil level indicator, oil drainage plug and oil filling plug

Standard and Optional Accessories:

- Oil level indicator
- Thermometer.
- Buchholz relay.
- Four wheels: which are suitable move the transformer in two perpendicular direction
- By pass Disconnector (optional)
- Dehydrating breather
- 6 Surge arresters (optional)

Transformer oil:

- The 3 phase automatic voltage regulator (AVR) is filled with new dry and pure oil comply with IEC 60296
- The chemical and electrical characteristics of the transformer oil comply with the latest relevant applicable IEC standard.

On Load Tap Changer Specification:

- The On Load Tap Changer may be on Tank Type or In Tank Type according to the auto transformer's size
- The On Load Tap Changer may be operated
  A - Manually from the tap changer control cubicle.
  B - Remote operated from remote terminal control cubicle (RTCC)
  C- Automatically using automatic voltage regulator (AVR)

ON LOAD TAP CHANGER (ON TANK)

ON LOAD TAP CHANGER (IN TANK)

Transformer testing:

All tests are performed according to IEC 60076

A- Routine tests:

- Measurement of transformer ratio and vector group
- Measurement of transformer winding resistance
- Separate source high voltage withstand test
- Induced over voltage withstand voltage
- Measurement of no load losses
- Measurement of load losses and impedance voltage

B- Type tests:

- Withstand lightening impulse test
- Temperature rise test

C- Special tests:

- Withstand short circuit test
- Oil leakage test which is performed under adequate pressure

Changer features:

A- General:

- Less cu losses
- Small size as the 3 phases in one tank
- Less weight
- Smooth Variation of voltage
- The capability of measuring voltage at any tap

B- Transformer operation

- It may be operated manually from the Tap Changer Local Cubicle
- It may be Remote operated using Remote Tap Changes Control Cubicle (RTCC)
- The RTCC is located in the medium switch gear room the distance between the RTCC and the transformer may be up to 1000 meter
- It may be operated automatically using AVR located in the RTCC
- The AVR is direct supply from the network using potential transformer
- It can be remote operated using wireless system. EGYTRAFO Group will provide the system but the customer must have internet connection
- It has self-auxiliary supply see attached figure

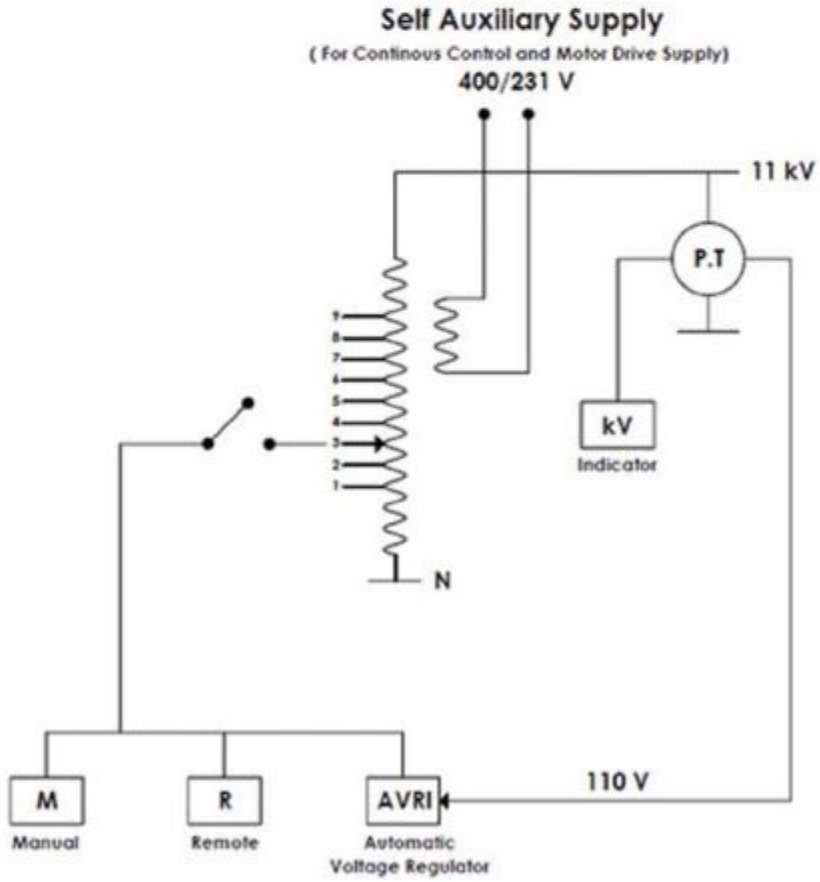


Diagram of 3-phase automatic voltage regulator (AVR) Connection

Transformer operating instructions:

A- Before entering service

1- Perform all site electrical tests including:
- Turns ratio
- Oil dielectric strength
- D.C resistance for high and low voltage windings

2- Before energizing, make sure that the tap changer is adjusted on the required position according to the network voltage at the side of transformer erection and as shown on the name plate

3- Check the operation of the OLTC manually before energizing and check the oil level in the OLTC chambers

4- Clean the bushings and connecting bars for both low voltage and high voltage sides

5- Check that the oil level is enough (it should not be less than the lowest level indicated on the oil indicator) if the level is low, the transformer oil must be completed with oil of the same grade

6- The protective devices such as thermometer and buchholz relay must be checked and the buchholz must be evacuated

7- Check the silica gel crystals color, if it changed, it must be replaced by a new one

8- For indoor installation the dimension of room must be suitable to transformer size in order to have good ventilation

9- Check the earthing connections to the transformer tank (earthing wire should not be less than 95 mm , and the resistance should not exceed 0.5 Ω)

10- In case of using a circuit breaker at the medium voltage side, be sure that the protective equipment is operating well

11- In case of using insulating switch at the medium voltage side, be sure that the contacts are in proper conditions

A bad contact between moving and fixed contacts leads to unbalance voltage on the transformer primary and this sometimes cause failure in windings and bushings

B- Monitoring of transformer during service

It's necessary to check the following periodically:

1- The value of primary voltage (Input voltage) and ensure that it conforms with the tap changer position voltage to avoid the effect over excitation

2- The temperature rise of oil and if it's over the allowable value, the transformer oil must be investigated and compared with the standard value

3- All properties of oil including electrical, chemical, physical and Gaseous must be investigated yearly

4- Clean the bushings and the tank body

5- Check the oil level in the expansion conservator for transformer and the OLTC

6- Connections between the transformer bushings terminals (L.V and H.V terminal) and the source (T.L, cables or busduct) must be properly tightened to avoid overheating

7- Be sure that the earthing connection is connected to the transformer body

8- Check the operation of isolation switch and make sure it works properly

Considered precautions toward the 3-phase Automatic Voltage Regulator (AVR):

A- Protection against short circuit:

As the impedance voltage is small, the short circuit current is high so the fuse element for the isolating switch must be conformed with the rated current limits

B- Protection against over voltage:

The transformer must be protected against surges, and transient condition

Surge arrestor must be erected before the transformer incoming

C- Length and cross section area for transmission line or underground cables must conform with the standard values

After sale services provided by EGYTRAFO Group:

1- Our concept is to ensure safety, efficiency and prolonged life of the transformer, consequently reduces operational risk

- EGYTRAFO Group can provide a comprehensive service and maintenance to support their customers including transformers produced by others

2- Customers training on the operation and maintenance procedures

3- Following up the status of the transformers under operation at customers sites

4- Providing the needed spare parts if requested

5- Providing periodic maintenance for the transformer at site:

A- Oil investigation and purification

B- Upgrading the transformer dielectric

C- Maintenance of the transformer protection system

D- Replacement of defected transformer bushings

E- Changing oil at site

F- Performing all site tests:

- Turns ratio and polarity
- Insulation resistance (Megger test)
- Measuring of (DC) resistance
- Measuring of oil dielectric strength

6- Repairing transformers during and after warranty period at site and in our factory

7- Yearly maintenance contracts as per request

8- Engineering design and upgrading of old transformers for replacement

Preventive maintenance contracts:

EGYTRAFO Group can conclude technical contracts with any company for performing a protective maintenance for oil and dry transformer.
The preventive maintenance aims to the extend the life time of the transformer and to attain the proper operation of them

EGYTRAFO

Quality Assurance & Achieved Certificates:

The quality assurance is systematically performed at all stages starting from the materials arrival, production process up to final delivery and extended to after sales service.

All processes are monitored and analyzed. Actions are taken for any discrepancy for continual improvements and deliver error free products on time.

СИСТЕМА СЕРТИФИКАЦИИ РУССКОГО РЕГИСТРА
RUSSIAN REGISTER CERTIFICATION SYSTEM

CERTIFICATE

This is to certify that the Quality Management System of

EGYTRAFO

EGYTRAFO Group

has been assessed and found to be in accordance with the requirements of

ISO 9001:2015

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RUSSIAN REGISTER CERTIFICATION SYSTEM

CERTIFICATE

This is to certify that the Environmental Management System of

EGYTRAFO

EGYTRAFO Group

has been assessed and found to be in accordance with the requirements of

ISO 14001:2015

СИСТЕМА СЕРТИФИКАЦИИ РУССКОГО РЕГИСТРА
RUSSIAN REGISTER CERTIFICATION SYSTEM

CERTIFICATE

This is to certify that the Occupational Health and Safety Management System of

EGYTRAFO

EGYTRAFO Group

has been assessed and found to be in accordance with the requirements of

OHSAS 18001:2007

KEMA

TIC 2207-11

TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE

IEC 60076-5

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