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Tablotier

Command - control & protection,
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Servicii de proiectare

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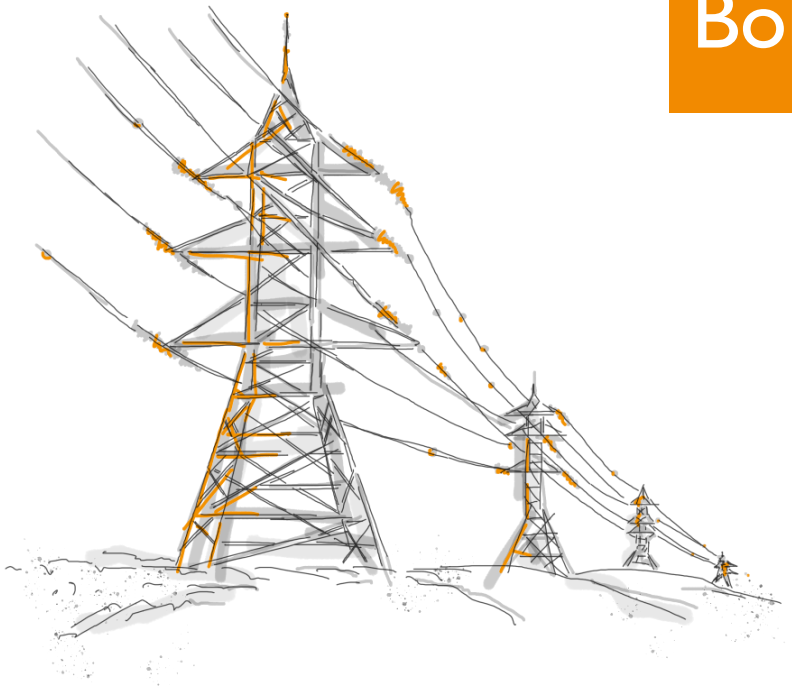
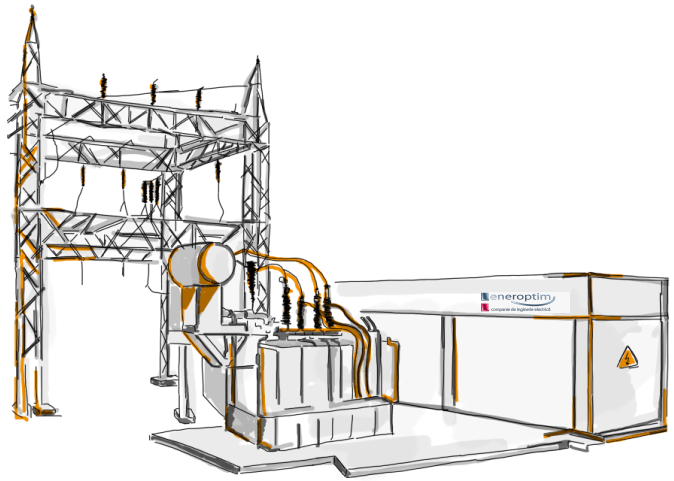




Bobina de stingere EGE

01	Constructie semiermetica, cu perna de aer
02	Constructie cu conservator si releu Bucholtz
03	OPTIONAL, poate fi echipata cu injectie de curent tip MCI
04	OPTIONAL, poate fi echipata cu rezistor auxiliar pt cresterea componentei wattmetrice a curentului de defect

Echipare cu conservator

Constructie semiermetica, cu perna de aer

Injectie de curent, tip MCI

INFORMATION ONLY

ARC SUPPRESSION COILS

Application:

Network with high impedance earthing using arc suppression coil.
If earth fault occurs in a network with arc suppression coil, voltage of faulty phase can drop almost to zero and the value of voltage of sound phases increases almost to the value of phase to phase voltage (similar to the network with isolated neutral).
Voltage occurs on arc suppression coil. If a **continuously adjustable arc supression coil** is set to the capacitive current then the current which passes through the arc suppression coil is equal to the capacitive current (in the ideal case). The vectors of the two currents are of opposite direction which means that the capacitive current is compensated by the inductive current. In that situation conditions for arc suppression are excellent.
If the earth fault is transient then it will come to arc suppression **without necessity of faulty feeder tripping** and following voltage recovery in the faulty phase is slow. It is a quite different situation compared with the situation in a network with isolated neutral in which voltage recovery is rapid and the consequence is high overvoltage.
In case of permanent earth fault it is not necessary to trip the faulty feeder immediately, it is possible to operate the network until the earth fault is located and cleared.

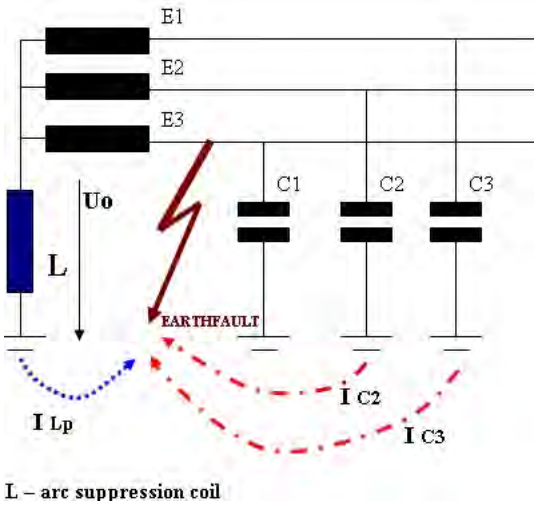


Fig 1
arc suppression coil L is connected to the neutral point and phase to earth fault occured in the network. Capacitive currents I_C and current passing through the arc suppression coils I_{Lp} are shown. I_{Lp} compensates capacitive currents I_C

Following vector diagram shows the situation in a compensated network during an earth fault in a more detailed way:

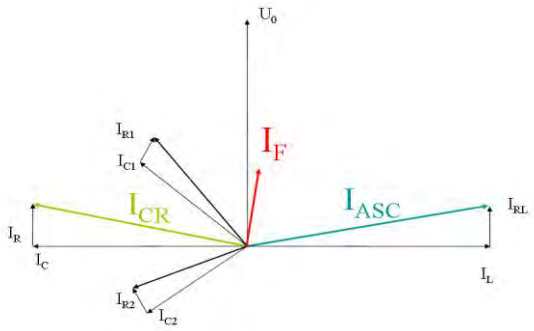


Fig.2
I_{CR} ..... *capacitve current*
I_{ACS} ..... *inductive current*
(current which passes through arc suppression coil)
I_F ..... *fault current*

Design:

EGE arc suppression coils are produced and tested in complience with the international standard IEC 60076-6.

EGE arc suppression coil consists of several basic parts:

- active part with: windings, magnetic circuit and current transfomer
- motor drive unit
- tank with:
  - radiators (for continuous operation)
  - valves for oil sampling, oil filling
  - undercarriage
- cover with a gear box and a motor
- bushings
- expansion tank (if required)
- air breather
- condition monitoring devices (thermometer, Buchholz Relay, oil level indicator etc.)
- transformer oil

Fig.3
arc suppression coil – short time duty – standard design

Fig.4
arc suppression coil - short time duty – without expansion tank (air cushion betweentransformer oil top level and ASC cover)

Fig.5
arc suppression coil – continuous duty – standard design (with expansion tank and radiators)

Active part

So called “active part” consists of several main components:
- windings
- magnetic circuit (with a movable part)
- frame

The active part is placed in a tank filled with transformer oil and fixed to the ASC cover. The active part is the “heart” of the coil and assures proper ASC operation.

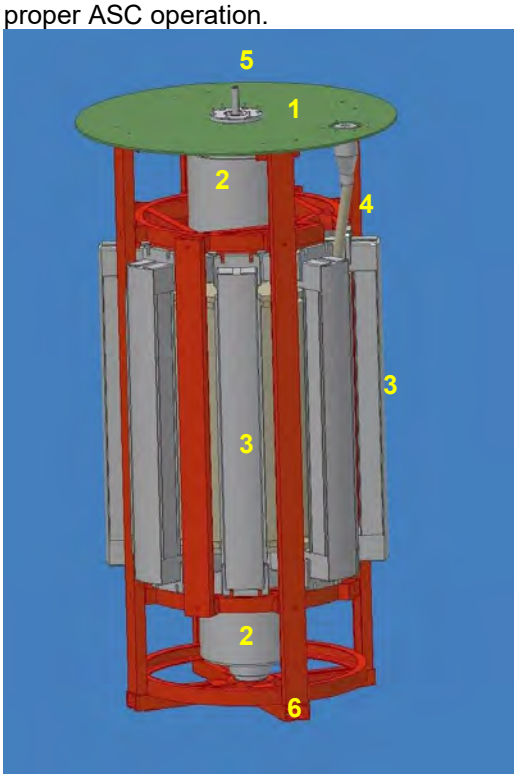


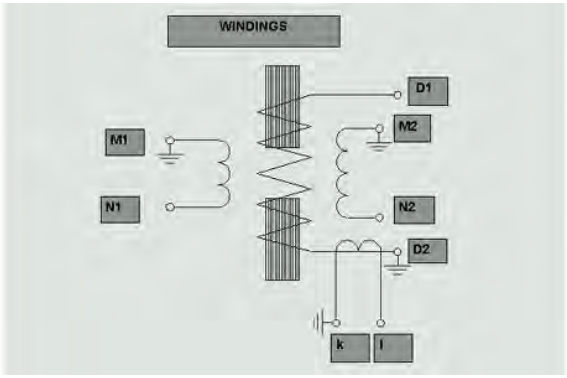
Fig.6 Active part
1…….cover
2…….core – movable part of the magnetic circuit
3……yokes – fixed part of the magnetic circuit
4……main winding
5……main screw shaft
6……frame

Magnetic circuit

Magentic circuit build following parts:
- fixed yokes produced of insulated metal sheets
- movable “cores” which are of cylindrical shape made of insulated metal sheets

Windings:

arc suppression coils are standardly equipped with three windings:
- main winding - design is based on:
  - rated voltage
  - rated power
  - type of operation
- measuring winding (MW):
  - MW is used mainly for ASC automatic control. It provides the information about the value of zero sequence voltage (Uo).
  - standardly it is dimensioned for 100V (3A)
- power auxiliary winding (PAW):
  - PAW is standardly used for switching on an auxiliary resistor for a certain time to increase the wattful component of the fault current (used in connection with certain types of protection devices)
  - standardly it is dimensioned for 500V, 10% of rated power and 90 seconds



D1, D2 main winding / rated voltage /
M1, N1 measuring winding / 100 V +/- 10 %, 3A /
M2, N2 auxiliary power winding / 500 V +/- 10 % /
k, l current transformer

The material of ASC windings is copper.

Current transformer (CT):

CT provides a possibility of measuring the current passing through an arc suppression coil. It is placed at the ground end of the main winding and connected to the bushings placed on the cover. Standardly the bushings are marked k,l. Standard parameters of current transformers used in EGE coils are:
- max. ASC current/5 A or max. ASC current/1 A
- class 1
- 30 VA

Fig.7
Current transformer type BD00 – for arc suppression coils with full insulation on both sides

Stepless regulation

Stepless regulation means accurate ASC current adjustment. It is enabled by a movable part of the active part which consists of:

- movable cores
- main screw shaft
- motor drive (which is not the part of the active part)

Motor torque is transmitted to the main screw shaft. The main shaft bears two “cores” which move from or towards each other. This causes a continuous change of ASC magnetic circuit resulting in continuous (stepless) change of ASC impedance (stepless current adjustment).

Motor drive MD 3

Description:

EGE arc suppression coils are standardly equipped with a motor drive MD3.

Motor drive MD3 consits of following main parts:

- control cabinet
- mechanical indicator of ASC current adjustment
- motor
- gear box
-

Motor drive MD3 is produced in EGE. This enables to adopt it to various customer´s requirements above all requirements concerning devices in a control cabinet (transducers, auxiliary contacts etc.)

Fig.8
Arc suppression coils with the motor drive MD 3
A…..control cabinet
B…..mechanical indicator
F…..flexible shaft

Motor, main gear box, auxiliary gear box

Motor torgue is transmitted through the gear box (D) to the main screw shaft bearing cores.

The motor (C) is fixed to a flange of the main gear box. The gear box is placed on ASC cover and equipped with a flat and Simmering gaskets.

The auxiliary gear box (E) placed on the main gear box is connected through a flexible shaft (F) with a mechanical indicator (B). The auxiliary gear box is equipped with a potentiometer (make Megatron), which is electrically connected with the terminals in the control cabinet. Potentiometer provides the information about ASC current adjustment. Limit switches with auxiliary contacts are also placed on the auxiliary gear box

Fig.9
Motor drive MD 3
C…..motor
D…..main gear box
E…..auxiliary gear box

Mechanical position indicator

Mechanical position indicator (B) is piaced in a control cabinet (behind a window in a door) showing ASC current adjustment. The scale is calibrated in ampers.

Fig.10
Motor drive MD 3 – control cabinet
B…..mechanical indicator

Control cabinet

The control cabinet is mounted on the front side of arc suppression coil. Its cover grade is IP 54. Heating (1) inside the control cabinet (heating resistor elements) is controlled by a thermostat. There are push-buttons (2) placed on the door of the control cabinet for manual ASC current adjustment. The control cabinet is equipped with mini circiut breakers (3), auxiliary contacts, right phase order control relay (4), terminals (5), contactors (6).

Fig.11
Motor drive MD 3 – control cabinet
1…..heating element
2…..push buttons
3…..mini circuit breakers
4…..phase order controller
5…..terminals
6…..contactors

Motor drive cover

Motor, main and auxiliary gear box are protected by a cover (G).
LV bushings of a current transformer and measuring winding are also placed under a cover .

Fig.12
Motor drive MD 3 – cover

Technical data:

Motor	
Motor output	0,55 kW
Nominal power voltage	3x400V / 230Vca ±10%
Nominal power current	1.4A
Motor speed	1405 min-1
Main gear box:	
Type	Lenze GSS05-2MHAR 071C42
Moment at the gearbox outlet	Max. 400Nm
Auxiliary gear box:	
Type	Lenze SSN31-1M HAR

Bushings:

HV - Bushings:

EGE arc suppression coils can be equipped with various types of HV – bushings:

- porcelain DIN bushing
- Euromold bushing
- CONNEX transformer bushin

Porcelain

Euromold

Connex

The size and type of HV – bushings is chosen according to the rated voltage and corresponding insulation level

LV - Bushings:

LV – bushings for:

- auxiliary power winding (500 V) are 1 kV porcelain bushings produced according to DIN 42530

LV – bushings for:

- measuring winding (100 V)
- current transformer

are in a form of 4 pole bushing plate

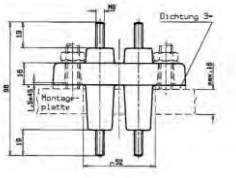


Fig.13
Bushing plate f. KUVAG

Tank

The tank of EGE coils is of cylindrical form, standardly made of 4 mm thick metal sheet, the bottom is made of 8 mm thick metal sheet. Tanks of such a form and wall thickness are compact and suitable for various manipulations on site.
The tank is equipped with an upper flange to which ASC cover is fixed (using bolts). The sealing system - so called „ O – ring“ consists of a groove in the flange and round gasket placed in it , which is regarded as the most reliable solution. Tanks of arc suppression coils dimensioned for continuous duty are equipped with radiators (DIN 42559).

Fig.14
Tank – flange with a groove – O-ring sealing system

Lifting, towing lugs

Tanks of EGE arc suppression coils are equipped with lifting lugs for arc suppression coil lifting and towing lugs

lliftings lugs

towing lugs

Lifting lugs are standardly placed on the side wall of the tank.

Valves:

Tanks of EGE arc suppression coils are standardly equipped with one valve for oil sampling and one or two valves for oil draining. The valves correspond to the standard DIN 42568 (oil sampling valve) or DIN 42551 (oil drain valve). On demand it is posible to produce a tank with additional valves (gate valves).

oil draining valve

oil sampling valve

Wheel base:

EGE arc suppression coils are equipped with a wheel base (welded to the tank). EGE offers two types of wheels:

- smooth wheel
- rail wheels

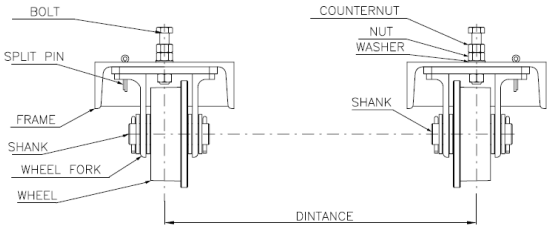


Fig.15
Wheel frame with rail whells

The wheel base enables the lengthwise or tractive movement.
The distance of smooth wheels is standardly 960 mm, 1070 mm and 1505 mm.
Suitable wheel base is chosen according to the arc suppression type.
The standard distance of rail wheels is 1435mm.

Expansion tank (conservator):

The expansion tank is fixed to ASC cover. The expanding transformer oil (due to temperature changes) gathers there. The conservator is equipped wit an air breather (acc.DIN 42562 or DIN 42567) through which air flows out or in when the volume of transfomer oil changes. The air breather removes moisture from the air flowing into the conservator which prevents the transformer oil against losing the dialectric strength. The conservator can have one removable side for maintanance purposes (if required by a customer). The other side is standardly equipped with an oil level indicator. The conservator is equipped with a filling neck (DIN 42553- D) placed on the top and with an oil drain valve according to DIN 42551

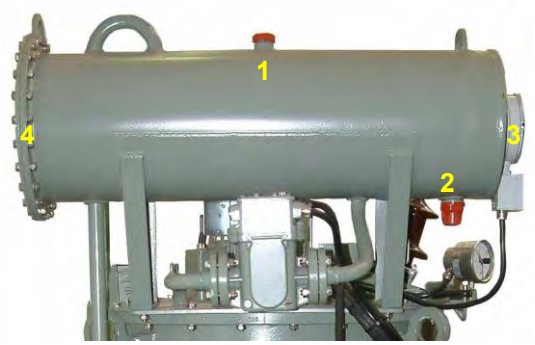


Fig.16
Conservator – stanadard design
1…..filling neck
2…..oil drain valve
3…..oil level gauge
4…..removable side

Conditions monitoring instruments:

Oil level gauge:
EGE arc suppression coils are standardly equipped with two types of the oil level gauge which is mounted on the conservator:

a) magnetic oil level indicator:
- magnetic oil level indicator consits of the flange and float drive mechanism (part inside the conservator) and the indicating part - scale with the pointer. The float follows the oil level. The float´s motion is transmitted by direct lever action. The driving magnet adjusts itself automatically. The driving magnet controls the opposite polarized dial magnet with the pointer. There is no problem of sealing a rotating driving axle due to the magnetic clutch. The indicator is equipped with two changeover switches indicating that the max. and min. oil level has been reached.

b) glass tube oil level indicator
the oil level indicator consists of of a glass tube and pipes connecting the indicator with the conservator. The oil level is seen in the glass tube. The indicator is not equipped with any switches.

Fig.17
Oil level indicators

glass tube design

magnetic oil level indicator

Oil temperature monitoring:
Thermometers:
EGE arc suppression coils are equipped with thermometers from well known quality suppliers (Jumo, Messko), suitable for measuring of oil temperature.
Thermometers are equipped with two micro switches.
Pt100, thermostat
EGE arc suppression coils can also be equipped with other oil temperature monitoring instruments:

- resistance thermomether Pt100
- thermostat with one signal contact (set to a required temperature)

Fig.18
Oil temperature monitoring instruments

thermostat

thermometer

Buchholz Relay
Application:
The Buchholz relay is a protective unit to supervise liquid-insulated appliances with expansion tank, such as transformers or arc suppression coils. Design of the relay is such that it responds in the event of troubles inside of appliances to be protected. The Buchholz Relay used on EGE arc suppression coils is produced according to EN50216-2.

Fig.19
Bucholz Relay on an arc suppression coil

Types of troubles monitored by Buchholz Relay:
a) *Decomposition gases* are produced rapidly or even vigorously as a result of High-energy discharges. The result pressure waves cause a strong flow of insulation level towards the expansion vessel.

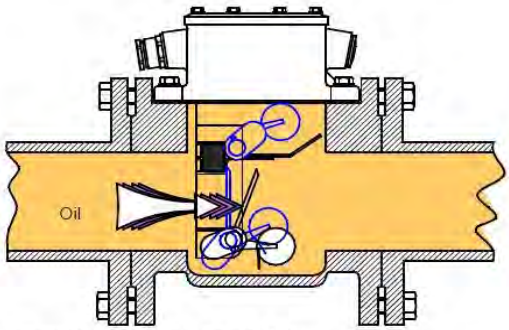


Figure 6: Insulating liquid flow

Reaction:
The flow meets the damper arranged in the fluid flow. If the flow velocity exceeds the responsiveness of damper, the latter moves abruptly in flow direction, thereby forcing the lower float into its response position so that the contact is operated. Normally a cut-out signal is thereby released.

b) *Local overheating* provokes gradual decomposition of liquid and solid insulation material plus formation of gas

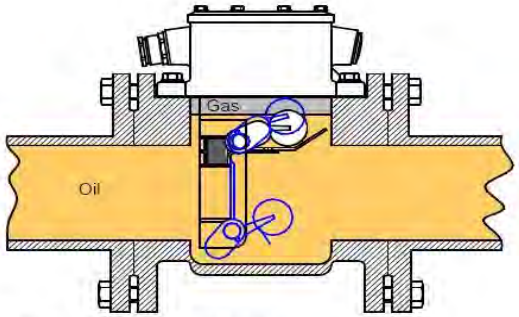


Figure 4: Gas accumulation

Reaction:
Gases move to the top, accumulate in the Buchholz relay and displace the insulation liquid. The liquid level falls and the upper float comes down as well. The permanent magnet coupled to this float slides along a magnet contact tube. A contact is operated by the permanent magnet as soon as the magnet reaches its response position. Normally a warning signal is released

c)
Leaks causing loss in insulation liquid

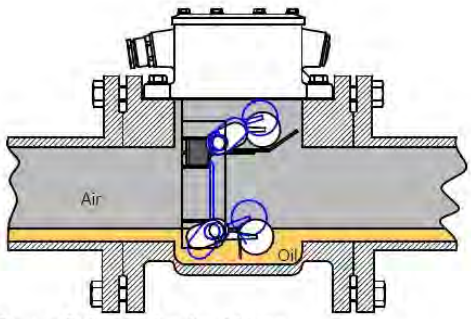


Figure 5: Insulating liquid loss

Reaction:
The upper float moves down according to falling liquid level. The switching system operates on the same principle known from gas accumulation. If the liquid loss continues, expansion vessel and connection tube get discharged through the Buchholz relay. The falling liquid level cause drop of the lower float. The latter is coupled to a permanent magnet that slides along a magnet tube. When the lower float reaches its response position, a contact is operated by the permanent magnet. Normally a cut-out signal is released.

Corrosion protection

Special attention is paid to the corrosion protection of EGE´s arc suppression coils. EGE applies several coating systems from one quality supplier warranting the proper protective features of the whole coating system. In the table below is an example of a standard corrosion protection system:

The screw stock being exposed to environmental effects is made of non-rusting materials.
Protective layer is suitable for C5M environment of offshore according EN ISO 12 944.

A: TANK, COVER, CONSERVATOR			
	Marking / producer	Shade	Layer [μm]
Zincing	Metallizing		100
Ground coat	FEYCOPOX RAL 6019	RAL 6019	60
Top coat	FEYCOPUR EG RAL 7033 Feycolor GmbH	RAL 7033	60

Total thickness of the anticorrosive protective layer > 220 μm

B: RADIATORS			
	Marking / producer	Shade	Layer [μm]
Zincing	Hot galvanized		55
Ground coat	CHING - EMC 182 CHING - EMD 307		40 40
Top coat	CHING AD 407	RAL 7033	40

Total thickness of the anticorrosive protective layer > 175 μm

C: OIL RESISTANT PAINT			
	Marking / producer	Shade	Layer [μm]
Ground coat	283.3012 RELANOL Feycolor GmbH	RAL 3012	30