

# WAYS OF ENERGY

Electrical Engineering Division  
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**ELECTRICAL ENGINEERING  
DIVISION**



**EGE**



## EGE COMPANY PROFILE

EGE is a group of companies assembled in an internationally operating holding company, which offers primarily deliveries of special equipment for the power engineering industry. Main spheres of business of parent company EGE, spol. s r.o. are three-fold: generator outlets – isolated phase bus ducts, line and neutral generator cubicles special high-voltage electrical technology, and lattice towers for transmission & distribution lines. EGE provides its own development, design, engineering, manufacture, assembly, and service for all its own products.

Our company is supported solely by Czech capital. It has proprietary know-how, uses its own production facilities, employs about 550 people, including specialized design teams and seasoned installation crews, and has revenues exceeding 58 million EUR.

Quality has been a key target to all of EGE's activities, and the company has been certified on quality in accordance with ISO 9001, ISO 14001, ISO 3834, ISO 1090 and OHSAS 18001 standards. The quality level established by these standards has been adhered to through demanding audits which have covered the entire scope of EGE's business activities.

EGE's global customers benefit from our vast experience and tradition of over 65 years in quality production, from our expert and reliable services, and from our flexibility in meeting customer-specific requirements. Our goal is the greatest possible satisfaction of our customers' needs.



## ELECTRICAL ENGINEERING DIVISION

The division manufactures a range of products for the power industry, in particular important components for HV/MV switching stations. Production centres around devices for neutral point grounding in distribution networks.

### Scope of supply:

- Earth-fault arc suppression coils /Petersen coils/ – ASR
- Earthing transformers – ETR
- Neutral earthing resistors for MV networks – NER
- Auxiliary resistors for arc suppression coils – SR, SRA
- Resistor controllers – ARS
- Three-phase shunt reactors – TKFC
- Steplessly adjustable three-phase shunt reactors – TKPR
- Voltage symmetrization system – SVS
- Faulty phase earthing – SGR
- Ripple control coupling transformers – VTVS
- Multifrequency current injection – MCI

Among the most significant items produced are **steplessly adjustable arc suppression coils**, which are used for compensating capacitive currents in MV and HV systems in instances of ground faults and made in compliance with the IEC 60076-6 international standard.

EGE has more than 60 years of experience in designing and producing **arc suppression coils**. The expertise garnered by the division enables staff to develop new models and react flexibly to any requirements such devices must meet.

### The main features of all products manufactured by the Electrical Engineering Division are:

- High quality anti-corrosive protection
- Excellent operational reliability
- Components as monitoring instruments, motor drives etc. are being purchased from the most prestigious companies

The division's products are sold to many countries worldwide.

### Significant references:

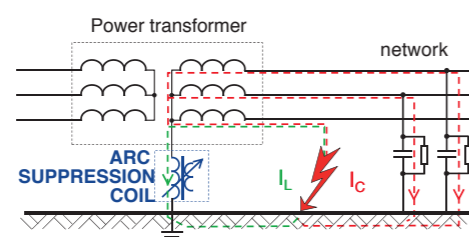
Centralschweizerische Krafwerke AG, Netze BW, TAURON Polska Energia, Caruna Oy, Bayernwerk, TEN Thüringer Energienetze, Elektrilevi OÜ, Latvenergo, ENEA, Elektrizitätswerke des Kantons Zürich, RWE, Vattenfall AB, edistribuzione S.p.A., Western Power Distribution, Elektro Ljubljana, E.ON Hungaria, PGE Dystrybucja, Helsingin Energia, BKW Energie AG.





PRODUCTS  
OF ELECTRICAL  
ENGINEERING  
DIVISION

ARC SUPPRESSION COILS – ASR



Continuously adjustable arc suppression coils – ASR are used for capacitive current compensation during earth-faults in electric networks. They are to be connected between the neutral transformer point and the ground of MV and HV networks.

If a continuously adjustable arc suppression coil is set to the capacitive current then the current which passes through the ASR 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.

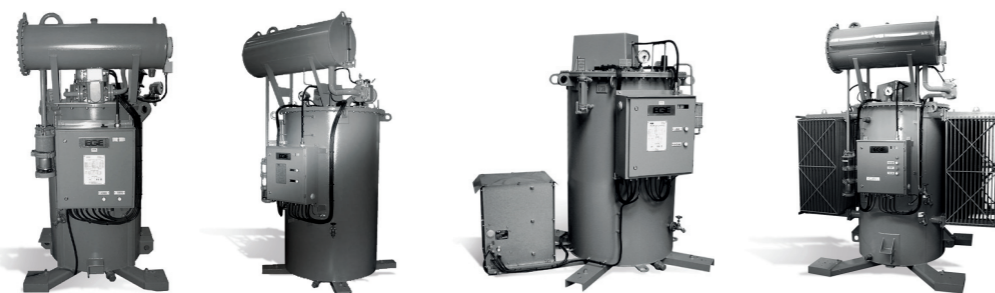
**Advantages of using arc suppression coils:**

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 different situation

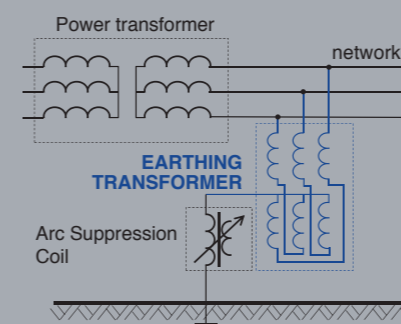
compared with the situation in a network with isolated neutral in which voltage recovery is rapid and the consequence is high overvoltage. In case of permanent earth-fault it is not necessary to trip the faulty feeder immediately, it is possible to operate the network until the earth-fault is located and cleared. Expected field of application of high impedance earthing with an arc suppression coil are overhead line and mixed overhead line - cable networks of medium and high voltage.

**Typical parameters of arc suppression coils ASR:**

- Rated voltage from  $6/\sqrt{3}$  up to  $110/\sqrt{3}$  kV
- Rated power 125 kVA up to 19 000 kVA
- Rated frequency 50 Hz ev. 60 Hz
- Duty – short time /KB-2h/, continuous duty /DB/
- Continuous adjustment standardly in range of 10 – 100% of nominal current



EARTHING TRANSFORMERS – ETR

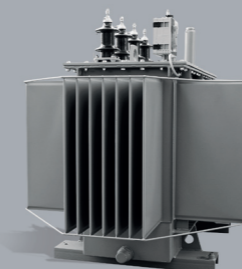


ETR earthing transformers are used to create an artificial neutral in distribution electrical networks.

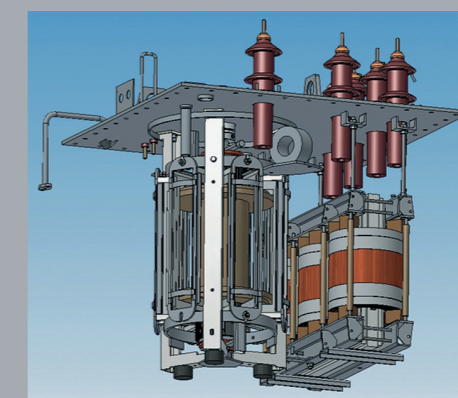
**Typical parameters of ETR earthing transformers:**

- Voltage of networks from 6 kV up to 52 kV
- Rated power from 200 up to 8 000 kVA
- Connection group ZN, ZNyn 11 or other variants based on customer's wishes
- Rated power of secondary side from 50 kVA up to 2 000 kVA

Typical ETR earthing transformers are placed in a corrugated wall tank and hermetically sealed or equipped with an expansion tank and an air breather. Transformers with higher nominal rating or with seismic durability can be placed in a smooth tank with radiators.



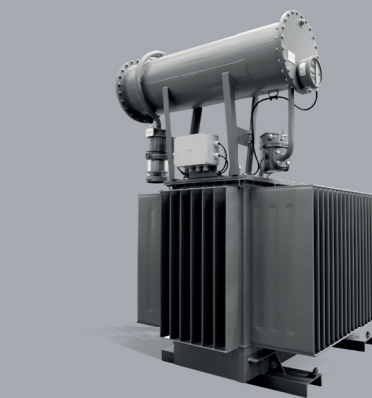
COMBINED ARC SUPPRESSION COILS – ASRC



Special design of arc suppression coil is **combined arc suppression coil – ASRC** which consists of fluently adjustable arc suppression coil and earthing transformer. Both devices are placed in a common tank. Advantages of combined arc suppression coils are compactness and lower dimensions in comparison to two separate devices.

**THREE-PHASE SHUNT REACTORS – TKFC**

Three-phase shunt reactors – TKFC are used to **compensate the reactive power**. Three-phase shunt reactors are designed for the fixed value of the reactive power. They can also be

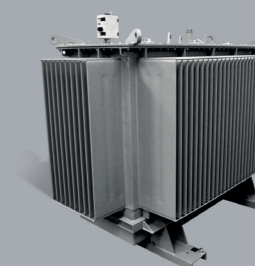


equipped with an off-load tap changer to change the power tap, standardly three taps are available – 80, 90, 100% of rated power.

**Typical parameters of the TKFC three-phase shunt reactors:**

- Networks of 6, 10, 15, 20, 35 kV
- Rated power up to 9 000 kVAr
- Connection group Y or YN

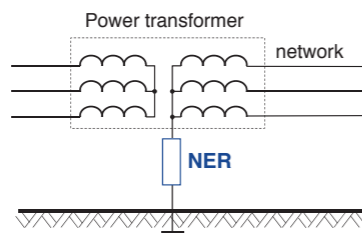
Typical TKFC reactors are placed in a corrugated wall tank and are hermetically sealed or equipped with an expansion tank and an air breather. TKFC reactors with higher nominal rating can be placed in a smooth tank with radiators.



**STEPLESSLY ADJUSTABLE THREE-PHASE SHUNT REACTORS – TKPR**

Three-phase shunt reactors – TKPR are used to compensate the reactive power. TKPR three-phase shunt reactors are equipped with three steplessly adjustable active parts and a motor drive which consists of three coupled gear boxes and a motor placed on the reactor's cover controlled by control circuits in a control box. The three steplessly adjustable active parts enable continuous change of power setting and adjustment to a required power within specified power range.

**NEUTRAL EARTHING RESISTORS – NER**

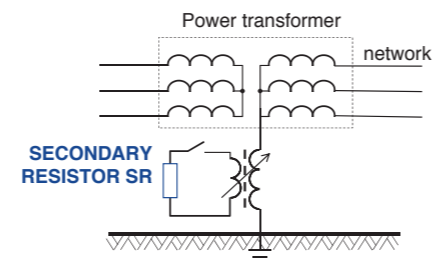


NER are used for the connection between the neutral point of a transformer and the ground in medium voltage networks operating with resistor-grounded neutral points. The purpose of resistance earthing is to reduce overvoltage during ground-faults and provide enough current for protections which are used for quick disconnection of affected electric network section. Expected field of application for electrical networks with resistance earthing are cable networks of industrial centres.

Special design of neutral earthing resistors is **combined neutral earthing resistor – NERC** which consists of neutral earthing resistor and earthing transformer. Both devices are placed on a common undercarriage. Advantages of combined neutral earthing resistors – NERC are compactness and integration of two devices into one.

**SECONDARY RESISTORS – SR**

Due to action of arc suppression coil at the moment of an earth-fault the current flow in the circuit is limited, which makes function of protections difficult as well as location of faulty feeder.



The secondary resistor – SR is designed for short term increase of active current in the arc suppression coil circuit to enable safe location of the feeder affected by earth-fault. Function of the resistor may be controlled by automatic controller which evaluates the need for activation and consequently provides connection of the resistor to the auxiliary power winding of the arc suppression coil. In addition, the automatic system may simulate heat pattern of the resistor and generate blocking conditions for its next activation.

Alternatively, secondary resistors may be used for their permanent connection to the auxiliary power winding of arc suppression coil in failure-free state when the resistor is used for damping of asymmetry in the network. Secondary resistor can be placed on the common undercarriage with arc suppression coil.

Special design of secondary resistor is **Automatic Secondary Resistor type SRA** which makes possible to fit the resistance of the device to the character of the earth fault with ARS resistor controller and thus enhance reliability – sensitivity of ground-fault protection relays.



**MULTIFREQUENCY CURRENT INJECTION /MCI/**

The MCI device is designed for auto-tuning of adjustable arc suppression coils /ASC/ in combination with an A. Eberle controller REG-DP/A/. Even under the most difficult conditions MCI enables the precise tuning of the arc suppression coil thanks to the accurate measuring of the network characteristic.

**Basic Features:**

- reliable tuning in very large or very damped networks
- precise evaluation of network characteristics even in case of very detuned ASC
- not sensitive to rapidly changing NVD due to load crosstalk or other reasons
- continuous evaluation of network parameters during ASC tuning / position change/
- reliable tuning and detection of network characteristics in case of more parallel operating coils without communication between their controllers
- no need of use of external VT or use of open delta VT measuring from the substation
- very low demand on power supply
- compact dimensions of the device

**DISTRIBUTION NETWORK OPERATION DEPARTMENT**

The Distribution Network Operation Department focuses on analyses of the distribution networks operation. The department is staffed by experienced team with a long history of involvement in solving problems in the operation of distribution grids. The Distribution Network Operation Department provides expert services and customer support including:

- **Operation of neutral points of distribution networks**
  - Neutral point earthing, dimensioning of arc suppression coils, secondary resistors and neutral earthing resistors
  - Solutions for arc suppression coils tuning and correct switching of auxiliary resistors
  - Coordination of earth fault protection according to the neutral point operation
- **Balancing of voltages of distribution network**
- **Solving problems in MV industrial networks**
- **Reactive power decompensation and solving of unwanted reactive power flow**
- **Measuring of electrical quantities in LV and MV networks**
- **Lectures and training courses focused on distribution network operation**

