REACTORS AND COILS

REA

TRANSFORMING THE FUTURE

SEA has been designing and manufacturing liquid immersed, cast resin and air insulated transformers, positioning itself among the industry leaders since 1959

IQTRAFOTEC®

Innovative construction solutions, modern and technologically advanced processes,
detailed checks throughout the entire design and construction chain asssure the total quality of the product.
SEA has established procedures to assure the TOTAL QUALITY of its products availing itself on its own know-how and adapting it to innovative manufacturing processes and strict control procedures. This type of technology has been identified by SEA with the name IQTRAFOTEC®, a brand guaranteeing a continual commitment to improve the product and its manufacture, considering 4 main areas such as:

- **Safety of the working environment**
- **Quality of the product**
- **Saving of materials and reduction of waste**
- **Lowest environmental impact during manufacture, maintenance and after use**

REA High Quality Standards

MANAGEMENT SYSTEM

The Quality of our products is achieved by processes that are continuously refined, combining experience in the electromechanical sector since 1959 with the most modern technologies, and approved in accordance with the most important Standards concerning the Quality (EN ISO 9001) and Environmental (EN ISO 14001) Management System. Moreover, REA Reactors and Coils comply with the IEC and DIN standards, with the possibility of correspondence with other International Standards or Customer Specifications (BS, ANSI, IEE, GOST, etc...).

PRODUCTION QUALITY

The high reliability of the products results from a continuous perseverance in achieving high quality standards during all “supply chain” phases. Especially during the production cycles there is a strict compliance with the implemented control parameters, which assure both the suitability of the assembled components and the performance of the finished product, all this even through tests carried out at our internal laboratories equipped with the most modern instruments available for type-testing or special testing, if the customer requests it.

There are some electrical aspects that affect the transfer of energy in the HV lines and in cable systems; depending on the features involved and on the ultimate goal of their variation, it is suggested the use of a certain reactor rather than another one

Here are some considerations with regard to the previously mentioned aspects and to the most commonly used types of reactors.

THE REACTIVE POWER

The reactive power is generated in the long high voltage lines and in the cable systems as a result of the capacitance between the ground and the line itself; in order to balance it and reduce the energy losses it is necessary to use SHUNT REACTORS, which - by absorbing the reactive power - increase the efficiency of the entire system.
They are also used as means to control voltage under light load conditions.

THE LOW LOAD CONDITIONS

Along the energy transmission line, when there are low loads, there is also an increase in SHUNT REACTORS reduce the voltage increase and allow stabilizing the system within suitable values. Usually, they are shunt connected with respect to the line to compensate for the capacitance of the long transmission lines when they work precisely at reduced load with the objective of avoiding a voltage increase right at the end of the line itself.

THE SHORT CIRCUIT CURRENT

In high-power transmission lines, short-circuit current appears to be quite high, which implies the need to use switches with high costs due to the high breaking capacity that is needed. CURRENT LIMITING REACTORS are installed in series in order to remedy this problem and reduce costs.
In case of short circuit downstream of the reactor, they limit the current to a predetermined value.

THE ACTIVE POWER

The renewable energy sources, which, as we know, are increasingly growing as an alternative source of energy compared to the traditional ones, generate a fluctuating and not well definable active power.
SHUNT REACTORS are the most suitable tool to compensate for these variations.

THE ARC CURRENT

In high voltage systems, there is a certain likelihood for ground single-phase faults to happen.
These may arise due to transient over-voltages, often in association with a reduced dielectric strength resulting from contaminated insulators or from the presence of animals, such as birds, mice, etc.; such arcs cause capacitive currents. If the current is higher than given levels, the arc can last long time and cause wire breakage and damages to materials such as insulators, up to the possibility of fire. The purpose is to reduce the arc current as electric arcs are extinguished under 5-10 A and this can be done through the PETERSEN COILS.

SEA produces a wide range of reactors: single-phase, three-phase, dry and liquid immersed

SHUNT REACTORS (UP TO 40MVAR)

They are shunt connected with respect to the line.
They are usually made with a magnetic gap core with normal pack for low powers and radial pack for higher powers.
The design of the core and gaps must be made with utmost care, to ensure the stability of the rated performance along the time and avoid the occurrence of abnormal noise and vibrations.

- OSR-Oil-Filled Shunt Reactor
- DSR-Dry-Type Shunt Reactor

LIMITING REACTORS FOR SHORT CIRCUIT CURRENT

Usually, these are large single-phase coils without magnetic core, possibly grouped in three-phase banks series connected to the line.
The installation requires a series of precautions because the magnetic field in the vicinity of these coils is sensitive; therefore, the foundation and segregation structure must be designed with care. For small powers, it is also possible to realize three-phase reactors immersed in mineral oil, achieving a considerable saving of space and much more freedom in the installation because the magnetic field in the vicinity of the reactor becomes negligible.

- OLR-Oil-Filled Current Limiting Reactor
- DLR-Dry-Type Current Limiting Reactor

NEUTRAL EARTHING REACTORS

They are shunt connected with respect to the line.
Typically, they consist of a three-phase core with a zig-zag pattern winding on each column.
In this way, a false neutral is created, which can be connected to ground either directly or via a resistor, according to the customer's system needs.
The construction immersed in oil allows obtaining a very compact machine, facilitates the installation of any toroidal current transformers and can be realized with a case for cable inlet and protection against accidental contacts.

- ONER1-Oil-Filled-1-Ph-Neutral Earthing Reactor
- DNER1-Dry-Type-1-Ph-Neutral Earthing Reactor

REACTORS FOR SPECIAL APPLICATIONS

SEA can design and produce in air and liquid immersed reactors for special applications (e.g. filter or laboratory reactors) according to customer specifications.

- OFR-Oil-Filled Filt Damp Reactor
- DFR-Dry-Type Filt Damp Reactor

PETERSEN COILS

These are single-phase reactors (with or without magnetic core) that are connected between a machine star center and the ground. If the value of the reactance of the Petersen coil is calculated in a suitable manner, the current of a possible ground fault in the network can be remarkably reduced and, therefore, the immediate tripping of the protections can be avoided.

PETERSEN PLUNGER TYPE COILS

From the point of view of system engineering, they actually have the same function of fixed Petersen coils, but the reactance value is adjustable within a certain range. Therefore, the circuit is tunable based on the characteristics of the fault and of the network, thus reducing even more the fault current itself. The adjustment is performed by moving the core axially within the coil. The movement is controlled by an electric motor connected to an appropriate reducer, which ensure high precision and reliability of the mechanism. In 2004/2005, the Petersen coils of SEA were subject to the strict validation protocol of ENEL (Italian Board of Electricity) obtaining the related approval.

- **OASC-Oil-Filled-Arc Suppression Coil**
- **DASC-Dry-Type-Arc Suppression Coil**

OUR TARGETS

Performance and overload
Efficiency studied to optimize the system.

Economy
During the operations, purchasing and maintenance.

Silence
Often these transformers are installed close to towns.

Compactness
Designed for very low dimensions in width.

Eco+POWER
Specifically designed to meet the new requirements in the renewable energy production.

Resistance
Very robust and treated to withstand to extreme conditions.

The construction technology since windings, tank, insulation up to the principles of internal connection are the same as those applied in the transformers

This does not mean that the different customizations requested by our customers are not taken intoconsideration. The operating conditions require specific analysis, depending on factors such as the installation temperature, humidity, voltage fluctuations and the environment in which the reactor will be placed.

All reactors are tested in our laboratories with the most modern equipment that is available, in order to ensure the withstanding caused by disturbances in the network.

All these factors make SEA reactors particularly suitable for the most varied applications, always having as primary target the reliability of our product.

An example of a fixed single-phase coil

10 MVar reactor in Botswana

A particular example of core separated by air gaps

An example of Petersen Coil application

THE TRANSPORT AND THE SITE ASSEMBLING

SEA can deliver the transformer everywhere in the world

Thanks to the experience gained over many years and to its qualified personnel SEA performs the shipping and reassembling on site, agreeing from time to time with the customer on the most appropriate approach.

For shipments carried out to particularly critical sites or if requested by the customer SEA can equip the transformers with a sophisticated “impact recorder” that allows to keep the quality of the transport monitored.

SERVICE

SEA is able to meet your needs with a modular and flexible intervention plan through which you can take care of your transformer, keeping it in perfect working order

In addition you can count on a clear and defined price, including labor and spare parts, which shelters you from any surprise. A qualified Technical Service is made available for any questions or needs that may arise during assembly or operation of all our products.

Transport, unloading and positioning on site
Thanks to its team of technicians SEA is able to deliver the transformer in a “turnkey” solution to the end customer.

Assistance to commissioning
One of our technicians will personally assist you during normal control operations prior to the first commissioning of the machine.
The verification of the correct assembly of all accessories and some simple routine checks are essential for a reliable operation and the long life of the transformer.

Hiring of transformers

Diagnostics and Consultancy
Using sophisticated portable equipment, SEA is capable of monitoring and recording the most relevant electrical quantities for the transformer and the system: voltage, currents, harmonics, impulsive overvoltages and noise, oil dielectric strength, temperature and noise. Data recording can be of great help in the diagnosis of a failure or to suggest to the customer changes and improvements to its system.

Routine and extraordinary maintenance
Many repairing and assistance works (replacement of accessories and seals, repairs of small leaks that require welding without the need to empty the oil tank, oil checking and processing, paint touch-up, oil top-ups) can be performed directly on site, thus saving time and avoiding the risks and inconveniences that may result from the movement of the transformer.

Supply of spare parts
Supply or supply and assembly on site of transformer accessories.

Support Services
Specifically designed to give the customer the possibility to get always the best performance from its transformer.

SEA S.p.A. reserves the right to improve its products at any time, without notice. Data and images are not binding and are subject to changes.

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