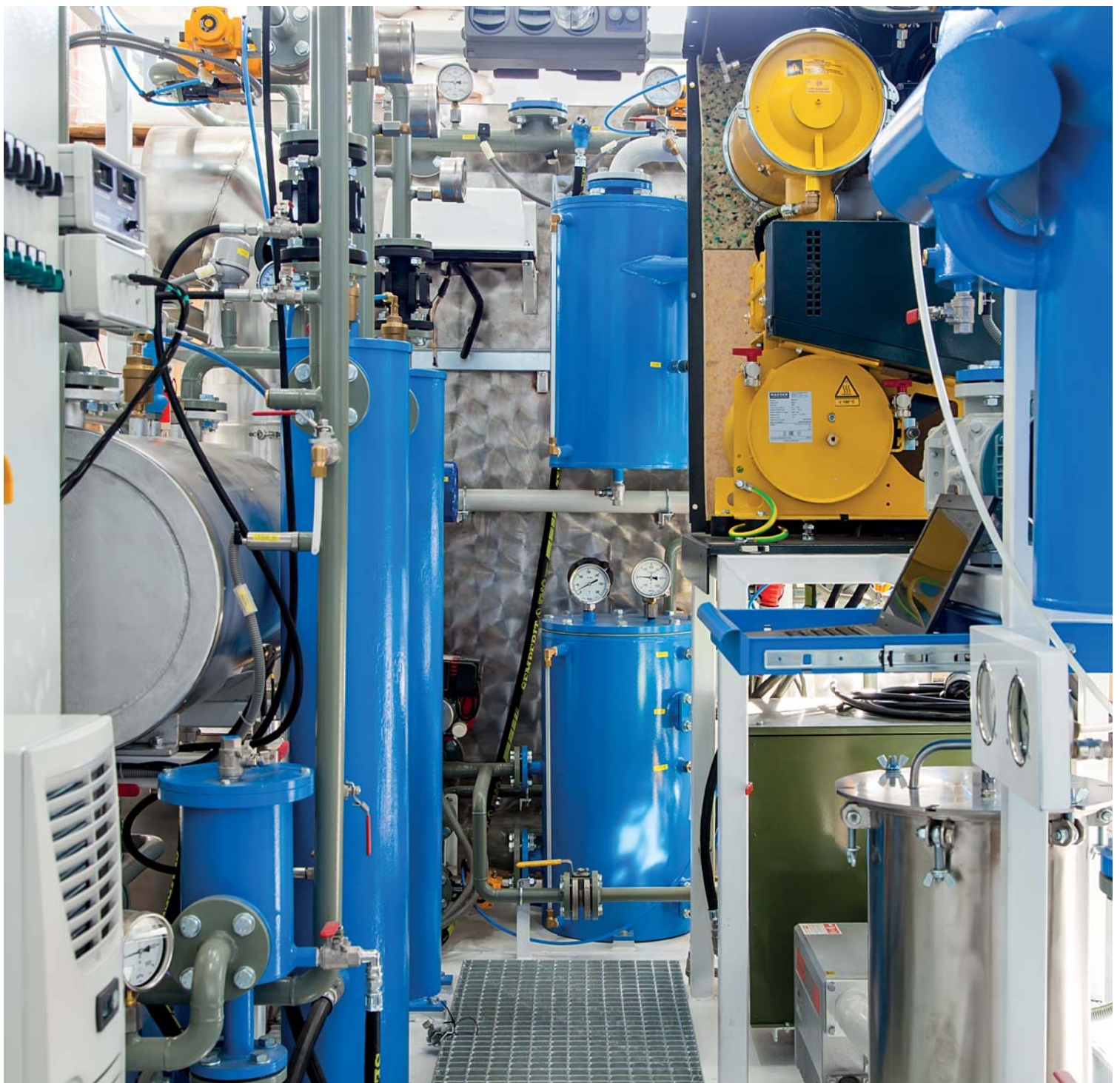


REOIL® Transformer

Oil regeneration plant



Ekofluid expert in transformer oil treatment

Ekofluid is a manufacturing and servicing company specializing in high vacuum oil treatment and oil regeneration equipment. The company has an ISO 9001 certified quality system as well as ISO 14001 certified environment system. Servicing unit also holds the SCC safety management system certification. Since its establishment, Ekofluid has been focused on the mid-market segment providing a broad range of high-quality components. Its products are being used by all energy sectors such as transmission and grid operators, power generation companies, transformer servicing companies as well as



numerous industry customers. The technology of oil regeneration and oil treatment has been originally developed at Fluidex (South Africa), more than 30 years ago. Thanks to research and dedication, at Ekofluid we have taken one step further to innovate and improve significantly on the existing Fluidex design of oil regeneration and oil treatment equipment establishing our REOIL and FILOIL brands.

Product range

Ekofluid currently manufactures oil regeneration equipment with sorbet reactivation capability as well as coalescer based oil treatment plants. Oil regeneration plants are of modular design with a variable number of columns housing the regeneration sorbent. Regeneration plants are built with or without the degassing section allowing them the possibility to be combined with oil treatment equipment. Oil treatment plants are available in different oil flow ranges from 1500 l/h up to 12 000 l/h. Oil treatment plants feature highly efficient coalescer technology specially designed to achieve the most efficient dehydration and degasification effect. Oil treatment equipment uses double stage high vacuum technology together with a variable flow to efficiently control the oil speed.

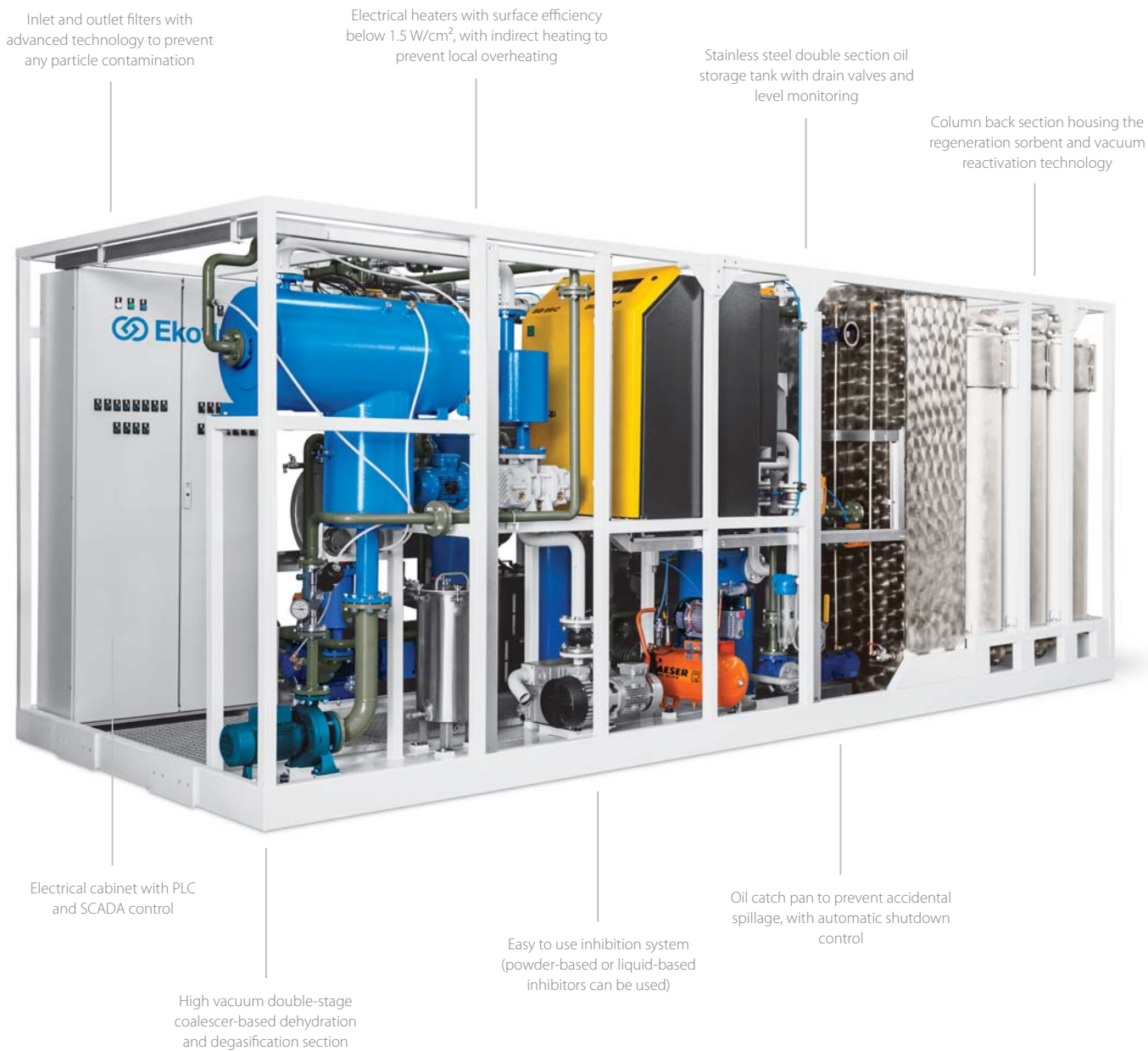


Description of oil regeneration process

Most power equipment is using transformer oil for its dielectric properties for cooling, insulating, and protecting the active parts. Transformer oils are highly refined oils that consist mainly of a mixture of hydrocarbons. Over time, oxidation byproducts start to form in the oil. Increases in oxidation byproducts result in the increase of acidity (neutralization number) and decrease the interfacial tension of the oil. At this stage, sludge starts to form, and oil is losing its dielectric properties because it is getting old. To prevent further deterioration of oil and possible damage to the active part of the transformer, oil needs to be regenerated. Oil regeneration equipment regenerates oil in steps. At the inlet of the equipment, oil is filtered through a coarse filter to prevent any particles from entering the equipment. It is then heated to the desired temperature to elevate the regeneration effect. After the oil has been heated, it enters the back section of the equipment. Oil is pumped through the back section which houses columns with sorbent media. It is in this section where the oil is stripped of impurities and ageing byproducts. Oil is then pumped through a vacuum breaking valve into the degassing section where



it is dehydrated and degassed. Treated oil is then pumped back to the transformer by the outlet pump. After a given period, sorbent in the back section of the equipment achieves full saturation and is no longer able to regenerate oil. At this stage, the sorbent needs to be reactivated (restored to its original state) to be able to regenerate oil again. Reactivation stage starts by draining the columns in the back section of saturated oil. After the oil has been drained, a vacuum is created and maintained throughout the whole reactivation process in the back section. Then by selective use of heating elements on the top parts of individual columns, the reactivation process is initiated. During the process, the impurities are removed from the sorbent which restores it to its original state. This entire process can be repeated many times until the sorbent starts to lose its properties and needs to be replaced.



Technical characteristics of oil regeneration equipment

Oil regeneration equipment is sophisticated. Its inlet pump is a positive displacement rotary pump. The outlet pump is a centrifugal closed coupled high suction pump. For degassing the rotary vane, a vacuum pump and vacuum booster roots pump are used. For the reactivation phase, a rotary piston roots pump is used. All valves across the equipment are automatic ball valves, which are pneumatically controlled. Equipment is fully automatic, controlled by PLC logic and interfaced with a SCADA system. Numerous safety features are introduced throughout the unit to ensure the safety of the equipment as well as the operating personal. Aeration valves, overheating protection, and automatic level switches guarantee the safety of the equipment as well as its ability to identify a possible risk and to power down to prevent any accidents.

No. of columns	Length (mm)	Width (mm)	Height (mm)	Weight (kg)	Oil flow (l/h)	Piping (DN)	Power (kW)
3	4600	2150	2150	6000	1000 / 6000	32	51
6	5200	2150	2150	7000	1000 / 6000	32	102
9	5800	2150	2150	8000	1000 / 6000	32	164
12	6400	2150	2150	9000	1000 / 6000	32	168

Performance values of oil regeneration equipment

The level of contamination differs from transformer to transformer. The ageing process, as well as the utilization of a transformer, make it difficult to determine when and how will oil age to the point that it loses its dielectric properties. Regardless of the level of contamination, oil regeneration always delivers the result required by the IEC 60422 standard for mineral insulating oils in electrical equipment. However, our REOIL regeneration technology goes one step further and significantly improves on the values required by the IEC 60422 standard, with the returning oil having properties almost identical to those put into the transformer for the first time.

Property (Unit)	IEC 60422	Before regeneration	After regeneration	10 years after regeneration
Breakdown voltage (kV/2,5 mm)	>60	49	95	81
Dielectric dissipation factor at 90 °C	<0,01	0,0823	0,0008	0,0029
Acidity (mg KOH/g)	<0,03	0,15	0,010	0,018
Water content (ppm)	<10	35	6	9
Interfacial tension (mN/m)	>35	27	49	41



REOIL plant uses highly efficient, fast pneumatic control valves to ensure high reliability of operation throughout the lifetime of the plant.



Fully automatic operation of the REOIL units is controlled by PLC while the operation is ensured by a SCADA system installed on a laptop.



Double stage high vacuum system ensures that regenerated oil is also properly dehumidified and degassed when it leaves the REOIL unit and flows back to the transformer.



The back section of the REOIL unit where regeneration columns house sorbent, which ensures that all properties of the oil are sufficiently restored.



All electrical wiring across the REOIL units conforms to the highest European standards and consists only of high-quality components to ensure the reliability of the unit.