

Advanced Oil Treatment & Regeneration Technologies

Complete Systems for Re-Refining,
Purification, Polishing & Regeneration



50 t/day Used Lubricant Re-Refinery, delivered by Enviroflex



Mobile Transformer Oil Purification & Regeneration Plant – ReGenX-2000

German Quality & Austrian
Innovation – Delivering
Maximum Performance,
Compliance and Profitability



Enviroflex
Used Oil Treatment &
Re-refinery Technology

Enviroflex at a Glance

Enviroflex GmbH (based in Vienna, Austria) and **Enviroflex Altöltechnik GmbH** (based in Heide, Schleswig-Holstein, Germany) combine engineering and manufacturing expertise to deliver advanced systems for **used lubricating oil re-refining, transformer oil purification and regeneration, base oil polishing and finishing, and industrial oil purification** worldwide. Our know-how cover separation, vacuum processing, distillation, adsorption and regeneration technologies, with a focus on reliable performance, resource recovery and long service life.

Our core portfolio includes the engineering, design and manufacturing of used oil re-refining systems "**ReLubeX**", base oil polishing and finishing plants "**POLISHLUBE**", high-performance vacuum oil purifiers "**RePureX**", transformer oil purification and regeneration systems "**ReGenX**", and our proprietary reactivatable adsorbent "**TURBOSORB**". From complete process lines to modular treatment units, our systems can be configured according to feedstock quality, required product specifications, plant capacity and site conditions.

From compact mobile units to full-scale industrial installations, **Enviroflex** combines Austrian engineering and innovation with German manufacturing quality and proven process know-how - delivering efficient, reliable and commercially viable solutions with international compliance, high process performance and long-term operating value.

Technology & Services for Used Lubricant Re-refinery **ReLubeX™**



ReLubeX is **Enviroflex's** proven technology that re-refines used lubricants into high-quality base oils, fuels, and by-products.

Products

- Base-oil cuts (**API Group II / I+**) with stable color & low odor
- Light/heavy distillate fuels (naphtha, diesel) as by-products
- Residual asphaltic solids suitable for pavement/industry

Process (step by step)

1. Pre-filtration & heating – coarse -> fine
2. Alkaline treatment & water removal – neutralize acids/halides; dewatering by heat/vacuum
3. Vacuum batch distillation (tower) – staged cuts of light & heavy fuels and light base oil
4. Wiped-Film Evaporation (1–2 stages) – short-path finishing to separate heavier base oils
5. Post-treat (optional) – second alkaline neutralization and optional clay/contact treatment
6. Polishing – reactivatable adsorbent **TURBOSORB™** for color, odor, sulfur & aromatics reduction; media reactivated **200–500 cycles** before replacement

Specifications / Capacities

- * Max process temperature $\leq 305\text{ }^{\circ}\text{C}$; short-path WFE prevents cracking
- * Deep vacuum up to **0.2–0.3 mbar(a)**
- * Multi-fraction base oil by adjusting vacuum & temperature per distillation stage
- * Typical quality: **Sulfur < 300 ppm; TAN < 0.05 mg KOH/g; Color < 1.0; CCS @ $-25\text{ }^{\circ}\text{C}$ < 3500 mPa·s**
- * Plant feed capacities **1–100 t/day**
- * Closed-loop emissions control – environment-friendly, zero discharge

Economically Feasible Project

Short Investment Payback Period (1-3 years)
High Internal Rate of Return

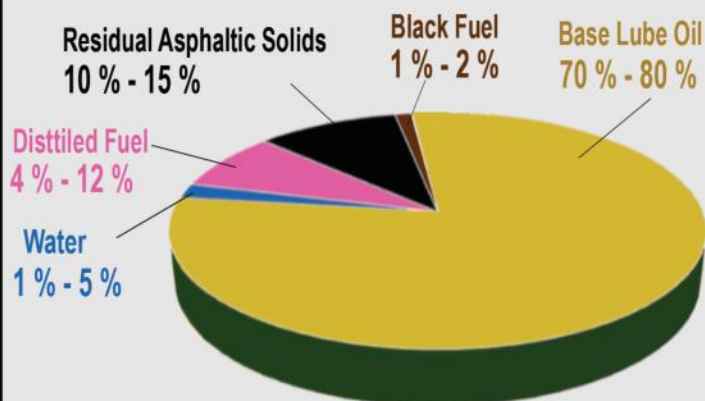


Re-refined base oil samples recovered from used lubricant

Environment Friendly Process - Zero Discharge



Typical percentage of extracted products of used lube oil Re-refining project



Base Oil as per API Group II & I+



POLISHLUBE™

Base Oil Polishing & Finishing Plant



POLISHLUBE Plant Layout (15 tons/day)

Treatment & Polishing of
Base Oil as per API Group II

The **POLISHLUBE** plants are advanced systems developed by **Enviroflex** for the treatment, upgrading, and polishing of a wide range of oils. They are designed to process distilled lube oil through our proprietary activated adsorbent **TURBOSORB**, available in capacities from **0.2 to 100 tons per day**. Beyond conventional distilled black base oil polishing, **POLISHLUBE** plants are also applied for:

- * Upgrading of base oil to API Group II or Group I+ quality
- * Polishing of diesel and distilled fuels to improve clarity and stability
- * Treatment and decolorization of dark paraffinic oils
- * Regeneration of hydraulic oils and other industrial lubricants

All plants are engineered and manufactured in Germany to meet stringent performance standards. They deliver the following key results:

- * Significant reduction of sulfur content
- * Improvement of color, from dark to light yellow
- * Reduction of aromatic compounds and complete removal of unpleasant odors
- * Effective neutralization of acidity
- * Removal of esters
- * Improvement of **Cold Cranking Simulator (CCS)** values at -25°C , important factor for production of **0W** and **5W** engine lubricants
- * Elimination of particulate matter and dirt

What sets **Enviroflex POLISHLUBE** plants apart from conventional polishing systems is their **continuous cyclic operation**. Using an automated program, the adsorbent inside the reactors is regenerated automatically after each polishing cycle. This enables the same adsorbent to be reused many times – typically **150 to 500 cycles before replacement**. The process consists of three main stages:

1. Oil Polishing
2. Adsorbent Reactivation

This innovative design enables:

- * **Stable operation** with minimized operating cost
- * **High reusability** of adsorbent, reducing consumable requirements
- * **Consistent product quality** without interruptions

A typical **POLISHLUBE** system is composed of several integrated modules:

- * Oil Polishing Modules (Banks)
- * Feed & Discharge Module
- * Adsorbent Reactivation Module
- * Control Module

Additionally, **POLISHLUBE** plants can be configured with **jacketed reactors** (boiler-grade steel) or **simple columns**, depending on the application and the quality of feedstock. Where required, pretreatment steps can be added downstream of the polishing unit to adapt the process to different types of used oils or feedstocks.



POLISHLUBE PLANT, 3 Bank, 36 Jacketed Reactors, Contains 6500 kg **TURBOSORB** Adsorbent, 15 ton/day

Typical Quality Achieved After Polishing*

(*depending on feedstock quality and number of passes)

- ✓ Sulfur content: < 300 ppm (ASTM D2622)
- ✓ Color: < 1.0 (water-white to light yellow) (ASTM D1500)
- ✓ Acidity (TAN): < 0.05 mg KOH/g (ASTM D974)
- ✓ Aromatic content: reduced to 2–5% (ASTM D2007)
- ✓ Ester content: reduced to near zero
- ✓ Odor: neutral, no unpleasant smell
- ✓ Cold Cranking Simulator (CCS at -25°C): < 3500 mPa·s (ASTM D5293)
- ✓ Particulate matter & dirt: fully removed

As per API Group II or Group I+

The **operational cost** of our **POLISHLUBE** plants is exceptionally low. For example, a plant in Europe with a feed capacity of **20 tons/day** (**≈6,000 tons per year**) has the following typical cost structure:

- * Approx. **8 EUR/ton** for adsorbent and other consumable materials & spare parts
- * Approx. **15 EUR/ton** for energy consumption
- * Approx. **15 EUR/ton** for operational staff
- * Total cost: **about 38 EUR/ton**, equal to a maximum of **42 US\$/ton** (**≈228,000 EUR per year**)

During the final stage of adsorbent reactivation, a small fraction of high-sulfur oil (referred to as **Scrap-Oil**) is separated. The amount of Scrap-Oil is typically **no more than 2% of the feed oil** to the polishing plant.

Importantly, this Scrap-Oil is **not considered waste** – it can be:

- * **Reprocessed** in the distillation unit of the re-refinery, or
- * **Blended** with black fuel or with the heavy residue fraction from the distillation process.

This ensures zero waste generation while maximizing product recovery and sustainability.



**Polishing Module, 30 Columns
5400 kg TURBOSORB**



Polishing by
Activated Adsorbent
"TURBOSORB"

Up to **500 times**
Reactivations before
Adsorbent Replacement

Delivered Plant to
a Re-refinery in
Germany

Design with Jacketed
Reactors or simple
Columns

With Adsorbent
Reactivation Unit

0.2 to 100 Ton per day,
Feed of distilled Oil

TURBOSORB™

Activated Adsorbent (Reactivable)

TURBOSORB is our proprietary **reactivable adsorbent**, developed for efficient purification, decolorization, **sulfur removal**, and upgrading of a wide range of oils. It is successfully applied in transformer oil regeneration, distilled black oil polishing, base oil upgrading, and treatment of diesel, distilled fuel, naphtha, jet fuel and paraffin. By removing sulfur, color bodies, impurities, and oxidation products, **TURBOSORB** significantly improves oil quality, stability, and appearance. **TURBOSORB** is available in **two standard mesh sizes (10/30 and 20/50)** to provide optimum performance in different polishing and regeneration applications.

The material offers **high surface area (205–251 m²/g)**, low moisture, and excellent adsorption capacity. With controlled particle size distribution, high bulk density, and low fines content, **TURBOSORB** ensures efficient flow, low pressure drop, and long service life in polishing columns.



BX-B2050



BX-T1030



Key Features

- * **Main duty:** sulfur removal from oils and fuels
- * **Applications:** transformer oil regeneration, distilled black oil polishing, base oil upgrading, and treatment of diesel, distilled fuel, naphtha, jet fuel and paraffin.
- * **Mesh sizes:** **10/30** (mean diameter 1.65 mm) and **20/50** (mean diameter 0.74 mm)
- * **High surface area:** 205–251 m²/g for maximum adsorption efficiency
- * **Bulk density:** 0.87–0.90 g/cm³ for stable packing
- * **Controlled abrasion resistance** for reactivation and reuse
- * **Consistent chemical composition:** rich in Al₂O₃ (89%) with minor Fe₂O₃, SiO₂, TiO₂, and natural alumina minerals (Böhmite, Gibbsite, Corundum, Hematite, Kaolinite)
- * **Supplied in big bags or paper bags;** other grit sizes available on request

By combining high adsorption performance with the possibility of **Thermal Reactivation**, **TURBOSORB** provides a **sustainable, cost-effective solution** for long-term oil purification & regeneration – trusted in both **industrial and high-spec fuel applications** such as jet fuel.

ReGenX™

Transformer Insulating Oil Purification & Regeneration Plant

Purification

Purification of transformer insulating oil is a well-recognized preventive maintenance practice performed regularly; typically every few months; to ensure the reliable performance of electrical apparatus such as power transformers, tap changers, circuit breakers, and bushings. Over time, insulating oils absorb moisture, gases, and solid contaminants, which can significantly impair their dual role as a dielectric insulator and cooling medium. If left untreated, these impurities may lead to electrical failures, reduced insulation resistance, and overheating. The purification process includes controlled heating, filtration, and vacuum degassing to remove dissolved gases and moisture. The oil is circulated through fine filters to eliminate solid particles and sludge, followed by vacuum treatment under high vacuum conditions. A coalescing filter is typically integrated to enhance water removal efficiency. This process restores the oil's dielectric strength, reduces oxidation risks, and extends the life of both the insulating fluid and the transformer.



Purification

- * Water Removal
- * Combustible Gas and Air Removal
- * Particulate Matter and dirt Removal
- * Tan Delta Improvement
- * Dielectric Strength increment



ReGenX-2000, Mobile in 20-foot Container, 6 Columns - 2000 l/h

3 to 24 Columns
500 l/h to 10000 l/h



Regeneration

Aging Transformer Oil forms sludge contains aldehydes, acids and proides. Sludge attacks the cellulose insulation, inhibits oil flow, and traps heat inside the transformer. Eventually the dielectric gap is bridged, resulting in failure of the transformer. Enviroflex Transformer-Insulating Oil Regeneration Unit removes acidity, sludge and soluble oil decay products with our adsorbent called TURBOSORB. When the treatment is complete, the regenerated oil meets or exceeds international standards for new oil with lower acidity and improved tan delta, interfacial tension, and oxidation stability. The cellulose insulation and internal components of the transformer also benefit from the flushing affect of multiple passes of hot reclaimed oil, which helps remove decay products and sludge from surfaces.

- * Regular regeneration treatments every seven to twelve years:
- * Reduced risk of unplanned outage and costly downtime
- * Reduced maintenance costs



Regeneration

- * The increment of Interfacial Tension & Oxidation stability
- * The reduction of Power Factor and gassing tendency
- * The removal and reduction of Acidity, Silicon content, Sulfur Odor & Color

The ReGenX Plant can be delivered in two configurations: for **Regeneration** only, or for **Combined Purification and Regeneration** of transformer insulating oils. Depending on customer requirements, the system is available as a **Stationary Installation** or a **Mobile unit**. Mobile versions are custom-engineered and delivered in roadworthy trailers, semi-trailers, containers, or industrial cabins, allowing flexible operation on-site or across multiple transformer locations. Processing can be carried out **off-load** or **on-load** (energized transformers), or from storage tanks, drums, or IBC containers, depending on the operational setup. In the combined version, the oil is first preheated and prefiltered, then passed through regeneration columns filled with **TURBOSORB** adsorbent for the removal of aging by-products, acidity, and sludge. This is followed by further heating, fine filtration, and final degassing and moisture removal in a high-vacuum chamber operating at pressures below 1 mbar absolute, equipped with a coalescing filter to ensure optimal dryness and gas-free oil before returning it to service. An oil desludging mode is also available, operating at elevated temperatures around 85 °C, to effectively separate suspended and settled contaminants. Through the integrated control panel, the operator can easily select from different operating modes: purification only, regeneration only, combined purification and regeneration, or desludging; offering full process flexibility to match specific site or oil conditions.

"ReGenX keeps transformers efficient, reliable, and protected – while minimizing downtime and costs."

RePureX™

Vacuum Oil Purifier

The necessity for regular purification of electrical insulating fluids in electrical apparatus has been recognized for a very long time. Moisture, solids and gaseous contaminants can seriously affect the function of electrical insulating fluids as a coolant and insulator. This specification describes the equipment as supplied by **Enviroflex** for the processing (degassing, dehydration, filtration and de-acidification) of transformer insulating oil. **Enviroflex** purifiers are designed for processing transformer Insulation oil in workshops or in the field, in storage tanks, drums or directly in transformers. Purification of oil in transformers can be carried out off-load or on-load, depending on customer's preference. For purification of oil in the field, a mobile type Vacuum Oil Purifier, mounted on a roadworthy trailer and covered by a weatherproof canopy, is recommended.

Process Description

Enviroflex process of treatment is based on the available technology:

Heating:

Oil Heating is done by indirect electric heaters with low density electric ceramic heaters (Max. 2 watt/cm²) and exact temperature control.

Filtration:

Insulating oil is drawn in by an Inlet Pump, and is heated up in the Heater and filtered by Fine Filter before it reaches the Processing Vacuum Chamber, where water and gases contained in the oil are thoroughly exposed to vacuum by efficient spreading and removed through a Vacuum Pump. Filtration cartridges constructed of non-migration type glass fiber material featuring a large surface area and dirt holding capacity obvious advantages of cartridge type filters, and no loss of oil or time for back washing etc.

Spreading of Oil, Water & Gas remover:

Oil degassing & water removal is done in the Vacuum Chamber with coalescing filters which installed inside the Vacuum.

Spreading of Oil is vital for easy release of moisture and gaseous contaminants, is accomplished by porous media cartridge, called a coalescer. In this process, heated or unheated oil passes through the layer of bonded fiberglass, where millions of sharp edges shear oil and expose it to the effect of the vacuum in very low pressure range of 0.1 to 3 mbar a. Spreading of oil by passing through porous media is so efficient that oil can be treated at temperatures as low as 20°C.

Vacuum Chamber connected to 1-Stage Vacuum Pump (Rotary Vane or Screw Dry) or 2-Stage included Vacuum Pump and a Booster (Roots Vacuum Pump)

Two Stages Vacuum Pumps, (Vacuum pump & Booster) less than 1 mbar a, for Oil Degassing Process

Environmentally Friendly Electrical Power Systems Using Mineral Adsorbent for Oil Regeneration

300-500 times Adsorbent Reactivation Befor replacement

TEST DESCRIPTION	METHOD	UNIT	INITIAL OIL CONDITION	SINGLE PASS QUALITY
MOISTURE	IEC 733	PPM	< 100	5
BREAKDOWN VOLTAGE	IEC 156	Kv/2.5 mm	< 20	> 70 (up to 100)
ACIDITY	IEC 296	mg KOH/g	<0.20	<0.03 (up to 0.01)
Power Factor @ 100°C	ASTM D-924-15	%	> 1	< 0.4
TAN DELTA (90 degrees C)	IEC 247		<0.01	<0.005
INTERFACIAL TENSION	ASTM D-971-20	Dynes/cm	<15	>35 (up to 50)
COLOUR APPEARANCE		VISUAL	BROWN/CLOUDY	CLEAR LIGHT YELLOW
GAS CONTENT	ASTM D-2945	%v/v	8	> 0.01
OXIDATION	IEC 74 164 HOURS		DEPLETED	RESTORED

Analyze of Transformer Oil before and after treatment



Capacity

900 to 18000 liter per hour in different models

Types

Mobile or Stationary

Models

RePureX-900
RePureX-1350
RePureX-1800
RePureX-2700
RePureX-4500
RePureX-6000
RePureX-9000
RePureX-12000
RePureX-18000

(The numbers after RePureX refer to flow rate in l/h)



Identification Codes

Each models may have different options and Specification that showed as codes in below:

ENF-RePureX-L-n-m-XX-S-W-f

Code Description:

L: Flow rate in l/h

n: Quantity of coalesce filter Cartridges

m: Quantity of Vacuum Chamber

XX: VB (Rotary Vane & Booster Vacuum Pumps)

DB (Screw Dry & Booster Vacuum Pumps)

V (Only Rotary Vane Vacuum Pump)

D (Only Screw Dry Vacuum Pump)

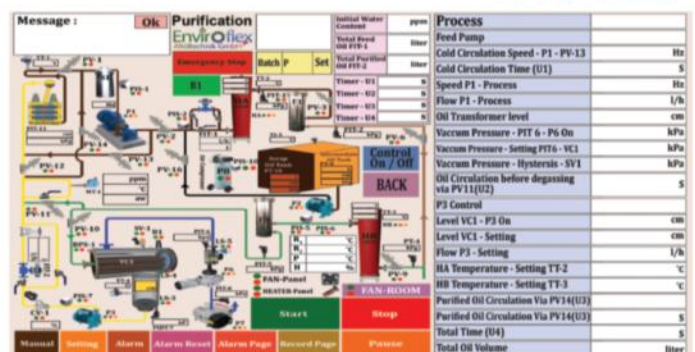
S: Vacuum Pump or Booster Suction in m³/h

W: Total Power of Heaters in kW

f: Quantity of Filtration Stages



Mobile Vacuum Oil Purifier (RePureX)



Control Page - Purification - HMI - Laptop

ReLubeX™

POLISHLUBE™

ReGenX™

RePureX™

TURBOSORB™
TURBOSORB

Enviroflex trademarks for oil treatment and re-refining solutions.



(HSE-MS)



ISO 9001 2015



<https://enviroflex.at>

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