LUBE OIL
ENCYCLOPEDIA

ERDÖL RAHMEN ENGINEERS PVT LTD

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What is Lube Oil?

Lube oil is a specialized fluid used to reduce friction, wear, and heat between mechanical components that are in motion relative to each other. It forms a thin, protective film on the surfaces of parts like engines, gearboxes, and bearings, enabling smoother movement and reducing the chances of damage due to friction or contact.

Lube oil is typically composed of:

- Base Oil: The base oil constitutes 70-99% of the lube oil. Which can be mineral oil (derived from crude oil), synthetic oil (chemically engineered), or a blend of both.
- Additives: Chemical compounds added to enhance the performance of the base oil. These include anti-wear agents, detergents, dispersants, antioxidants, viscosity modifiers, and more.

Classification of Lube Oil

- SAE Viscosity Grades

  It refers to the classification system for Lube oils defined by the Society of Automotive Engineers (SAE), primarily based on their viscosity characteristics. These grades help users select the appropriate oil for different operating conditions and temperatures. Mainly Lube oils are classified in two SAE Viscosity Grade:

  ✓ Single-Grade Oils: Labelled as SAE 10, 20, 30, etc., these oils maintain a consistent viscosity at a specified temperature. They are typically used in stable temperature environments.

  ✓ Multi-Grade Oils: Labelled as SAE 5W-30, 10W-40, etc., these oils have viscosity modifiers that allow them to perform well across a range of temperatures. The first number (e.g., "5W") indicates the oil's viscosity in cold conditions (W stands for winter), while the second number (e.g., "30") indicates viscosity at high operating temperatures.

- API Service Categories

  IT refers to classifications defined by the American Petroleum Institute (API) that indicate the performance standards of Lubricating oils, which helps to select the Lube oil according to required performance by vehicle or machinery in which oil is to be used. For example, Lube oils can be classified as below API Categories:

  ✓ API Service Categories for Gasoline Engines (S Category)

  ✓ API Service Categories for Diesel Engines (C Category)

  ✓ API Service Categories for Gear Oils (G Category)

Type of Lube Base Oils

API (American Petroleum Institute) has classified Base Oil in 5 Groups – Group I, II, III, IV, V according to their purity levels.

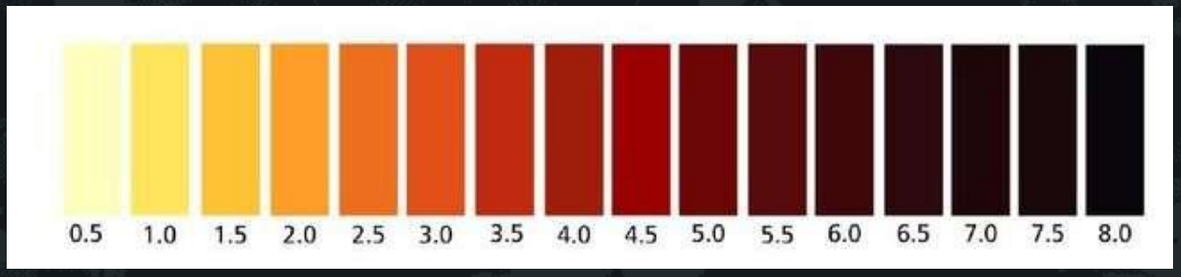
API Group	Refining Process	Viscosity Index	Sulphur Content	Saturation	Applications
Group I	Solvent-refined	80-120	> 0.03%	< 90%	General-purpose lubricants, older engines, industrial oils
Group II	Hydrotreated or Hydrocracked	80-120	< 0.03%	> 90%	Modern engine oils, industrial oils
Group III	Severely Hydrocracked / Hydro isomerized	> 120	< 0.03%	> 90%	High-performance lubricants, often marketed as synthetic
Group IV	Polyalphaolefins (PAOs)	> 130	NA	Nearly 100%	High-performance synthetic lubricants
Group V	Non-standard oils (e.g., Esters, PAGs)	Varies widely	Varies	Varies	Specialized applications, biodegradable oils, fire-resistant fluids

General Properties of Lube Oils

1. **Color**

   The color of base oil refers to its visual appearance, the color of base oil can range from water white to yellow or even darker shades, depending on its refining process and purity level.

   ASTM Test Method: D1500



2. **Density**

   Density is the mass of base oil per unit volume, usually expressed in kilograms per Liter (kg/L) or grams per cubic centimeter (g/cm³). Density is usually measured at a standard temperature of 15°C.

   ASTM Test Method: D1298

3. **Flash Point**

   The flash point is the lowest temperature at which the vapors of the oil can ignite momentarily in the presence of an open flame.

   ASTM Test Method: D92

4. **Viscosity**

   Viscosity is the measure of a fluid's resistance to flow. In the context of lube oils, it indicates how thick or thin the oil is at a given temperature. Base stocks are primarily manufactured and sold according to their viscosities at either 40°C or 100°C.

   ASTM Test Method: D445

5. **Viscosity Index**

   The viscosity index is a dimensionless number that indicates the change in viscosity of a lube oil with temperature. A higher VI means the oil's viscosity is less affected by temperature changes, ensuring consistent lubrication performance across a wide range of temperatures.

   ASTM Test Method: D2270

6. **Pour Point**

   The pour point measures the highest temperature at which a base stock no longer flows.

   ASTM Test Method: D97

7. **Cloud Point**

   The cloud point is the temperature at which wax crystals first form as a cloud of microcrystals.

   ASTM Test Method: D2500

8. **Aniline Point**

   The aniline point is the lowest temperature at which an equal volume of aniline and lube oil are completely miscible (able to mix). It is an indicator of the oil's aromatic content and solvency.

   ASTM Test Method: D611

9. **Sulfur Content**

   Sulfur content is the amount of sulfur present in the lube oil, usually measured as a percentage by weight. Low sulfur content is preferred for better oxidation stability and reduced emissions.

   ASTM Test Method: D4951

Type of General Additives for Lube Oils

Lubricant additives are essential chemical compounds blended with base oils toenhance the performance, longevity, and protective qualities of lubricants. Here are some of the most common types of lubricant additives:

1. **Viscosity Index Improvers (VIIs)**

   These additives help maintain the lubricant's viscosity across a wide range of temperatures, ensuring it remains effective whether the equipment is operating in extreme cold or hot weather condition. It prevents the lubricant from becoming too thin at high temperatures or too thick at low temperatures, providing consistent protection and performance.

   Example: Polyisobutylene

2. **Anti-Wear Agents**

   These additives form a protective film on metal surfaces, reducing wear and tear on engine components and other moving parts. It extends the life of machinery by minimizing metal-to-metal contact and reducing friction.

   Example: Zinc Dialkyldithiophosphate (ZDDP)

3. **Detergents**

   Detergents clean and neutralize deposits, preventing the build-up of sludge and varnish in engines. It keeps engines clean, enhancing their efficiency and reducing the risk of damage caused by contaminants.

   Example: Calcium Sulfonate

4. **Dispersants**

   Dispersants keep contaminants, such as soot and dirt, suspended in the oil, preventing them from clumping together and forming harmful deposits. It ensures a clean engine by preventing sludge formation and maintaining the oil's ability to flow freely.

   Example: Polyisobutylene Succinimide

5. **TBN (Total Base Number) Booster**

   A TBN (Total Base Number) booster additive is a specialized chemical added to lubricant oils to increase their alkalinity, measured as TBN. The TBN of an oil is a critical indicator of its ability to neutralize acidic byproducts that are formed during the combustion process in engines. These acids can be harmful to engine components, leading to corrosion, wear, and reduced engine life.

   Example: Overbased Calcium Sulfonate

6. **Corrosion and Rust Inhibitors**

These additives protect metal surfaces from corrosion and rust by forming a protective barrier. It prolongs the life of engine components, especially in harsh environments or when the equipment is not used regularly.

Example: Amine Phosphates

7. **Anti-Oxidants**

Anti-oxidants slow down the oxidation process, which can cause oil to thicken and lose its lubricating properties over time. It extends the life of the lubricant and improves its performance under high-temperature conditions.

Example: Phenolic Antioxidants

8. **Friction Modifiers**

Friction modifiers reduce friction between moving parts, improving fuel efficiency and reducing wear. It enhances the smooth operation of engines and machinery, contributing to energy savings.

Example: Molybdenum Disulfide (MoS_2)

9. **Anti-Foaming Agents**

These additives prevent the formation of foam in the lubricant, it ensures consistent lubrication by maintaining the lubricant's ability to form a continuous film on surfaces.

Example: Polydimethylsiloxane (PDMS)

10. **Extreme Pressure (EP) Additives**

EP additives provide additional protection under high-load conditions by forming a protective film that prevents welding and scuffing of metal surfaces. It protects gears and bearings from extreme pressure, especially in heavy-duty applications.

Example: Sulfurized Olefins

11. **Pour Point Depressants**

These additives lower the pour point temperature. It ensures that the lubricant remains fluid in cold conditions, providing reliable protection during start-up.

Example: Ethylene-Vinyl Acetate (EVA) Copolymers

12. **Seal Conditioners**

Seal conditioners prevent seals from hardening or shrinking, which can lead to leaks. It extends the life of seals and prevents oil leaks, maintaining the integrity of the lubricant system.

Example: Esters

Technology Provider in Lube Oil Blending Used Motor Oil Recycling, Sulphur Removal and more....

As a technology-driven innovator, we are at the forefront of developing cutting-edge solutions that elevate production quality, enhance automation, and reduce costs across lubricants and oil recycling sectors. From **Lube oil blending plants** to **Used motor oil and Transformer oil recycling plants**, we engineer advanced systems that optimize every process of the production. Our expertise extends to semi-automatic **Loading and unloading stations** in tank farms, **Lube oil polishing systems**, and sophisticated **Sulphur removal technologies** for Diesel, Mixed hydrocarbon oil and Petroleum products. Additionally, our **Air pollution control systems** are designed to meet the stringent demands of modern refineries, ensuring a cleaner and more efficient operation.

Whether it's a small-scale application of **2 tons** per day or a large-scale operation of **100 tons** per day, we are persistent in our commitment to creating production plants that deliver enduring reliability. Over the years, we've carved out a distinguished place across industries, with our groundbreaking technology leading the market.

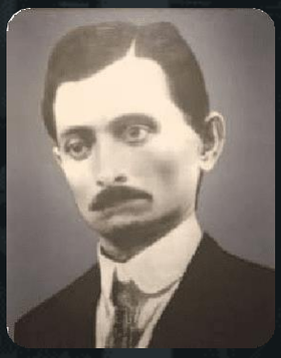
ERE has not only set the standard domestically but has also expanded its influence across borders and continents, solidifying our reputation as a **Global supplier of choice.**

18 +	70 +	127 +	39 + Years
Countries	Customers	Installations	Experience

Genealogy of ERE

Zaverbhai Karsanbhai Jadwani (Late. 1942)

Was a skilled mechanic with a keen expertise in oil lubrication systems, playing a vital role in ensuring the smooth operation of cotton ginning machines. His work was crucial in maintaining the efficiency and longevity of these machines.

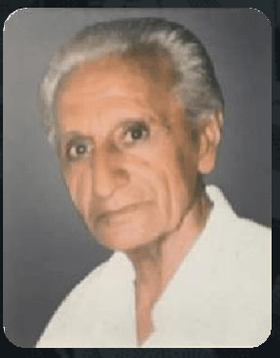


Pitambardas Zaverbhai Jadwani (Late. 1971)

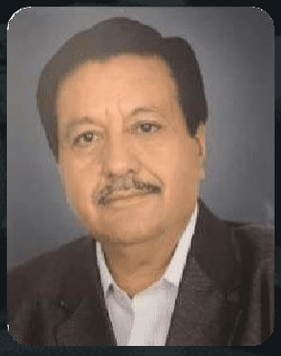
Was a qualified **Boiler engineer** during the British-India era. In the 1910s, he worked as a senior engineer in British-Indore. His expertise and vision eventually led him to establish his own ginning industry in the Bhavnagar State, marking a key milestone in the family's industrial legacy.

Himmatbhai Pitambardas Jadwani (Late. 2009)

Was a skilled **Businessman** who, at a very young age, took over the family ginning business and propelled it to new heights. However, after independence, this industry began to collapse and on other side demand for crude oil in India was on the rise. Seizing this opportunity, Himmat Bhai pivoted to the crude oil business and became the sole distributor of Burmah-Shell Oil in the region.



Pravinbhai Himmatbhai Jadwani (Late. 2016)



began his career in 1975 by venturing into the fabrication of chemical process plants. With his genetics expertise, he pioneered the development of Used Motor Oil Recycling Plants and Lube Oil Blending Plants. In 1985, he founded ERE (Erdol Rahmen Engineers) in Ahmedabad. Under his leadership, the company expanded its reach beyond the local market, growing to a national level and solidifying its presence in the industry across India.

Milestone

1984

In 1984, Our journey began with the establishment of our first manufacturing workshop, laying the foundation for future innovations.

1986

Just two years after starting, we manufactured our first Liquid Paraffin Oil Plant, marking our entry into the oil industry.

1889

Our innovation continued with the creation of our first Lube Oil Blending Plant, setting a new standard in the industry.

1992

We ventured into new territory by manufacturing our first Barrel Decontamination Plant, showcasing our commitment to environmental

1994

introduction of our first Used Oil Recycling Plant using vacuum and clay treatment—a groundbreaking development in the industry.

1996

Innovation never stopped. We developed our first Diesel/Mixed Hydrocarbon Oil Desulfurization Plant, pushing the boundaries of what's possible.

2005

We responded to evolving government norms by manufacturing our first Used Oil Recycling Plant using ultra-high vacuum distillation.

2002

Our expertise crossed borders as we made our first export of a Lube Oil Blending Plant, introducing our technology to the world.

1997

Our first Waste Oil/Slop Oil Dehydration Plant came to life, reflecting our dedication to solving complex industry challenges.

2011

We integrated load cell technology with a PLC system in our first blending plant, staying ahead of the curve in technological advancements.

2015

Innovation met precision with the creation of our first Continuous In-Line Blending Machine using a PLC system.

2017

We manufactured our first Used Oil Plant featuring a Thin Film Evaporator (WFE) and a 2000 MT storage farm, setting new industry benchmarks.

2024

Today, we celebrate the completion of over 31 Blending Plants, 47 Used Oil Recycling Plants, 12 White Oil Plants, 23 Waste Oil/Slop Oil Dehydration Plants, and 44 Barrel Decontamination Plants worldwide—a testament to our relentless pursuit of excellence.

2022

Our first Used Oil Recycling Plant with zero clay treatment for Oman exemplified our commitment to sustainable practices.

2018

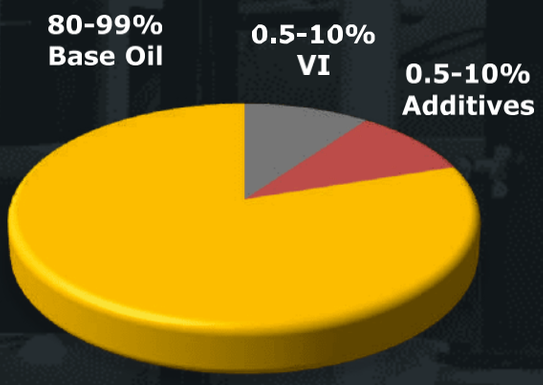
Our first fully automatic Used Oil Recycling Plant with solvent treatment, utilizing SCADA+PLC systems, marked a new era in automation.

Lube Oil Blending Plant

Lubricant oil is basically blend of Base oil with Additives & Viscosity Improvers. These special additives & Viscosity Improvers are selected as per performance requirement of final Lube oil. Engine Oil, Gear Oil, Hydraulic Oil etc. are manufactured by using their particular additives.

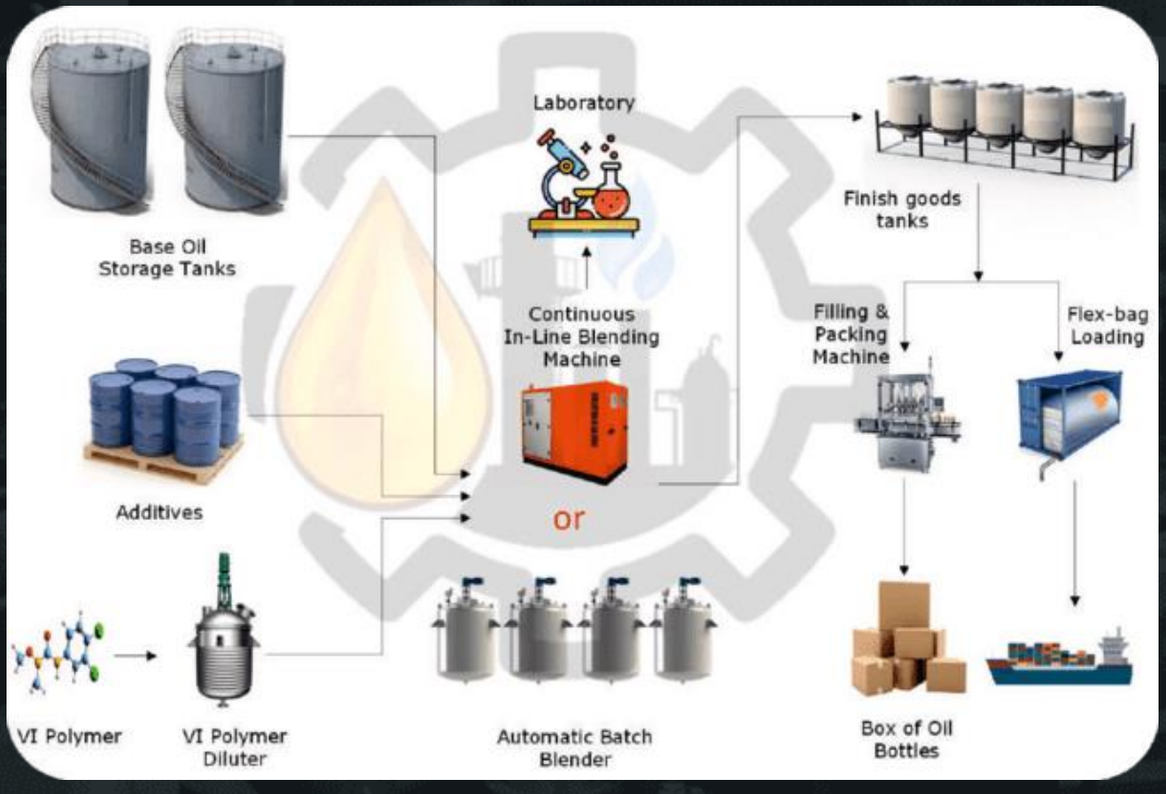
Lube Oil Blending process is carried out in 4 stages:

1. **Loading:** Base Oil, Additives & Viscosity Improver are transferred to Lube oil blenders According to requirement.
2. **Heating & Mixing:** After feeding blending process takes place under highly accurate mixing mechanism under controlled temperature.
3. **Testing:** Once mixing is completed sample is carried to laboratory tests.
4. **Filtration:** In final stage lube oil is passed through fine filters of 149 Micron and moved to finish storage tanks, from which it is packed into bottles or drums and distributed in market.



Composition Of Lube Oil

Process Flow Diagram for Lube Oil Blending Process



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Available Technologies for Lube Oil Blending

ABB – Automatic Batch Blending

- ✓ ABB-Automatic batch blending plants are best where numbers of products are wide.
- ✓ ABB ensure precise measurement and mixing of ingredients. By automating the blending process, the need for manual labor is significantly reduced.
- ✓ Automatic control system detects all real-time data and shuts off automatically in case of any error thereby enhancing workplace safety.
- ✓ ERE's ABB plants can be easily scaled up or adjusted to accommodate different production volumes and formulations, making them versatile and adaptable to changing needs.

Available Capacity: 4 TPD to 100 TPD

ILB – In-Line Blending

- ✓ ILB systems are game changer where continuous and consistence production is required.
- ✓ ILB systems feature advanced real-time flow monitoring and control capabilities, ensuring the blending process stays within desired parameters and maintains consistent quality.
- ✓ The compact design of ILB systems requires less floor space.
- ✓ Inline blending systems can store up to 100 formulations, enabling quick production of various products.

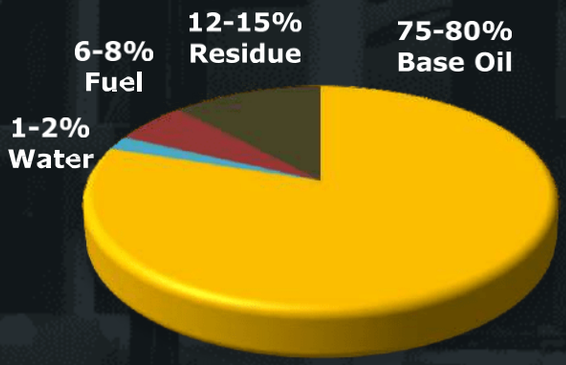
Available Capacity: 1000 Liters/Hour – 5000 Liters/Hour

Used Lube Oil Recycling Plant

Used lube oil is contaminated lubricating oil that has lost its effectiveness. It contains up to 90% valuable base oil that can be recycled. Recycling it transforms waste into a resource, protecting the environment, conserving energy, and reducing hazardous waste. It's a smart, sustainable way to turn old oil into new opportunities for a greener world.

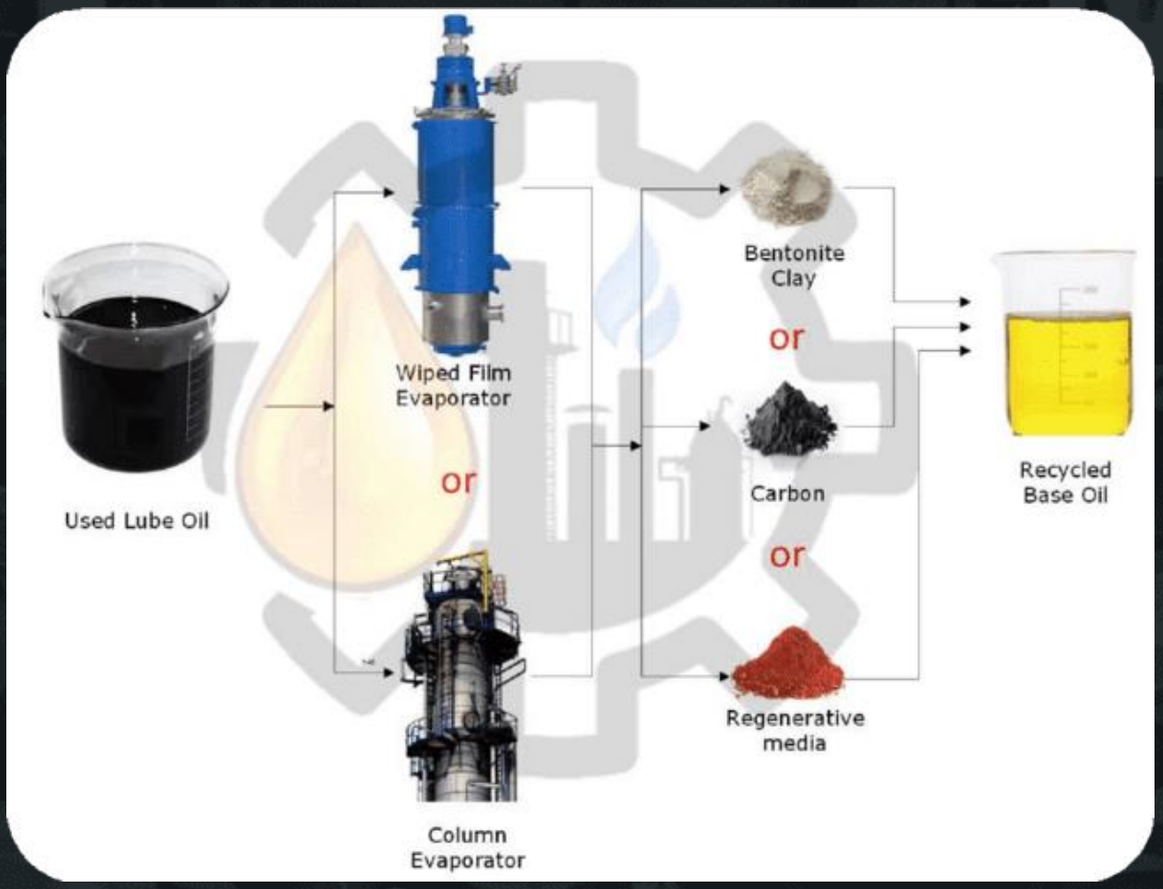
Recycling process of Used Oil is carried out in 4 stages:

1. **Pretreatment:** In this stage used oil goes through screening process and chemical treatment
2. **Dehydration:** In this stage water and fuel is separated from Used Oil
3. **Distillation:** In this stage base oil is distilled from Used Oil under ultra-high vacuum
4. **Polishing:** In this stage received base oil from distillation process is treated to enhance its color and properties to make it ultra fine, as good as virgin oil.



Used Oil Composition

Process Flow Diagram for Used Oil Recycling Process



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Available Technologies for Distillation

WFE (Wiped Film Evaporator)

- ✓ WFE works with short path distillation technology, as result the Used Oil spends minimum time on hot surface which decrease the risk of thermal cracking and degradation, preserving the quality of the base oil.
- ✓ Due to indirect heating system WFE provides longer lifespan.
- ✓ Fully Automated (SCADA + PLC) & Continuous Process.

Available Capacities: 25 TPD, 50 TPD, 100 TPD, 200 TPD.

Column Evaporator

- ✓ Column-type evaporators are more preferable when the production capacity is less than 30 TPD due to their low initial cost.
- ✓ Multiple cuts can be separated by one evaporator.
- ✓ Batchwise process & Semicontinuous process using PLC.

Available Capacities: 10 TPD, 14 TPD, 20 TPD, 30 TPD.

Available Technologies for Polishing

Regenerative Media

- ✓ Continuous process
- ✓ Same filtration media can be used up to 200 times
- ✓ No hazardous waste is generated, easy disposal.
- ✓ up to 1.0 ASTM D1500 color can be achieved.

Activated Carbon

- ✓ Batchwise process
- ✓ Zero Disposal – After use it will be disposed in firebox and converted into fly ash.
- ✓ up to 1.5 ASTM D1500 color can be achieved.

Clay Treatment

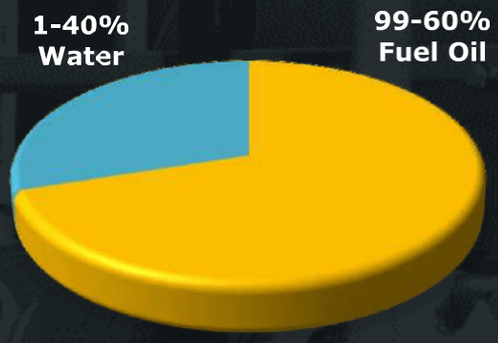
- ✓ Batchwise process
- ✓ Disposal is Complicated though preferred in many countries due to low production cost.
- ✓ up to 1.7 ASTM D1500 color can be achieved.

Waste Oil Recycling Plant

Waste oil is fuel or furnace oil contaminated with water and slop oil is fuel oil / other hydrocarbon oil contaminated with water in large shipping vessels or large storage tanks. Typically, this water cannot be separated using a centrifugal separator as it is highly emulsified. It can only be separated using molecular distillation, a process known as the dehydration of waste oil.

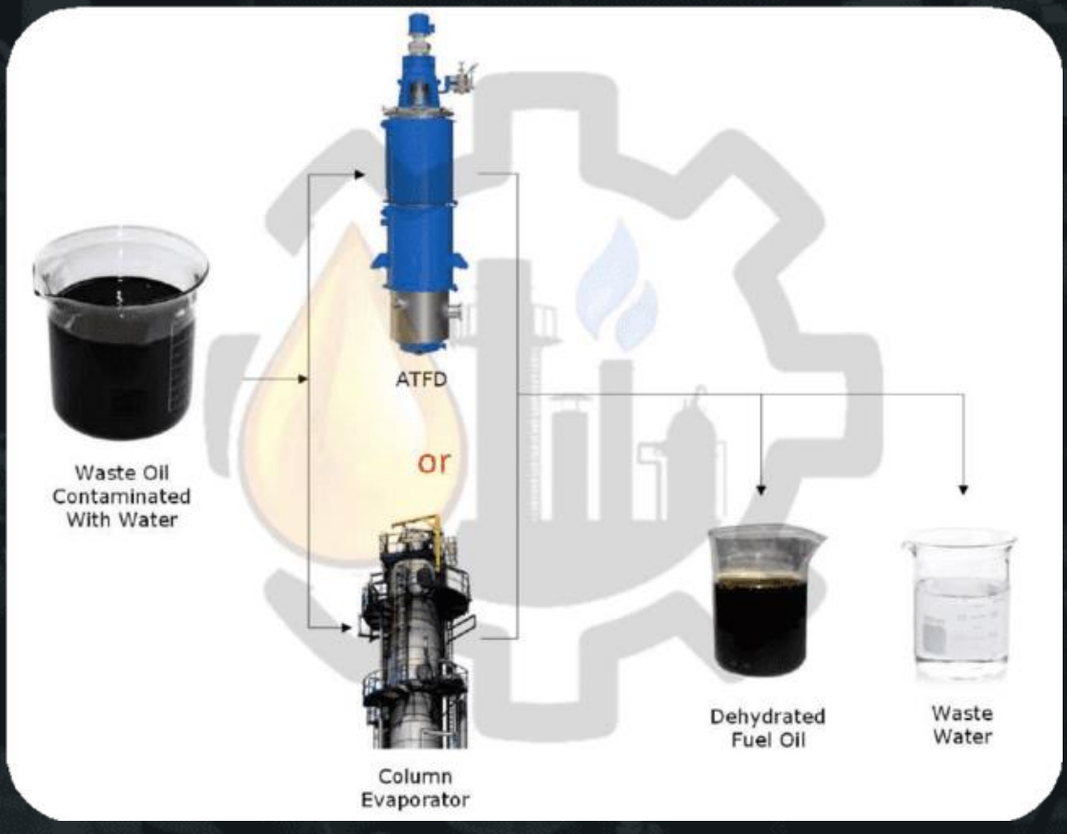
Recycling the waste oil is done by following procedure:

1. **Pretreatment:** screening process is conducted to remove particles and free water is separated from waste Oil.
2. **Dehydration:** moisture content is removed by using evaporator under high vacuum and controlled temperature.



Waste Oil / Slop Oil Composition

Process Flow Diagram for Waste Oil / Slop Oil Recycling



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Available Technologies for Dehydration

ATFD (Agitated Thin Film Dryer)

- ✓ ATFD works by spreading the material as a thin film on a heated surface while being agitated by a rotor with blades, which enhances heat transfer and ensures uniform drying. ATFDs are compact and energy-efficient.
- ✓ Fully Automated (SCADA + PLC) & Continuous Process.

Available Capacities: 50 TPD, 100 TPD, 200 TPD.

Column Evaporator

- ✓ Column-type evaporators are more preferable when the production capacity is less than 50 TPD due to their low initial cost.
- ✓ Multiple cuts can be separated by one evaporator.
- ✓ Batchwise process & Semi Continuous Process using PLC.

Available Capacities: 10 TPD, 20 TPD, 50 TPD.

Transformer Oil Recycling Plant

Used transformer oil is insulating oil that has been used in electrical transformers and other electrical equipment and has degraded over time. This used transformer oil can be recycled, with up to 90% converted back to its original or near-original condition, allowing it to be reused in electrical equipment.

Recycling process of Transformer Oil is carried out in 5 stages:

1. **Pretreatment:** In this stage, the oil is screened to remove large contaminants after then it is chemically neutralized.
2. **Degassing and Dehydration:** In this stage, the oil is heated under vacuum to remove dissolved gases, water, and light hydrocarbons. This process helps in improving the insulating properties of the oil.
3. **Distillation:** In this stage, the oil is distilled at under vacuum to remove more volatile contaminants that can degrade the oil's performance. For distillation, we provide 2 options:
   - ✓ Distillation by WFE (Continuous Process).
   - ✓ Distillation by Column Evaporator (Batchwise Process).
4. **Polishing:** In this stage received oil from distillation process is treated to enhance its color and properties to make it ultra fine, as good as virgin transformer oil.
5. **Additive Restoration:** After Polishing, certain additives might be reintroduced to enhance the oil's performance characteristics, such as improving its resistance to oxidation and enhancing its dielectric strength.

Oil Polishing System

The ERE OPS (Oil Polishing System) is a state-of-the-art solution engineered to rejuvenate contaminated oils to superior quality. Its standout feature is the ability to regenerate the adsorbent media up to 200 times, efficiently absorbing impurities and enabling their repeated use. This innovative approach not only enhances sustainability but also significantly reduces costs compared to traditional oil polishing techniques.

ERE OPS refines the color, odor, sulfur and chemical properties of the oils using advanced active absorbent technology, eliminating the need for bleaching clay. It seamlessly integrates into existing refineries as a post-processing unit for vacuum-distilled oils.

Application

- ✓ Transformer Oil Recycling
- ✓ Diesel Sulphur Removal
- ✓ MHO Sulfur Removal
- ✓ Transformer Oil Drying
- ✓ Sulfur removal & Color improvement for any Petroleum Products

Advantages

- ✓ Reduction of Colour Index, Sulphur, Acidity, and smell of distilled oil.
- ✓ Possibility to produce **API Group I, API Group II** base oil.
- ✓ Continuous operation, 4~6 hours per day polishing, and 8~12 hours per day reactivation period.
- ✓ **UP to 200 times media reactivation.**
- ✓ No Re-turbidity. 98% efficiency, maximum up to 2% losses.
- ✓ Different sizes from 1 to 200 columns, Long Columns.
- ✓ Different feed capacities from 250 kg/day to 80 tons/day.

Distillation Plants

With extensive experience and expertise in thermodynamics, solid mechanics, chemistry, and process designing, we specialize in developing customized distillation plants tailored to our customers' specific feed products such as **Diesel, MHO (Mixed Hydrocarbon Oil), Glycols, Solvents, and more...** Our fully-equipped laboratory allows us to provide product demonstrations,

ensuring our customers' complete satisfaction before we scale up to full-scale distillation plant development.

Available Distillation Technologies:

- ✓ Distillation Columns
- ✓ ATFD (Agitated Thin Film Dryer)
- ✓ WFE (Wiped Film Evaporator)
- ✓ Batch Vessel Evaporator
- ✓ Flash Column Evaporator

Air Pollution Control System

ERE's cutting-edge Air Pollution Control System (APCS) eliminates VOCs, SOx, and H2S, purifying air and improving environmental quality around refineries. Versatile and effective, it's ideal for crude oil distillation, engine oil recycling, waste furnace oil recycling, catalytic cracking, and other petroleum processing industries, there are two types of (APCS).

FLARE

WET Scrubber

Lube Oil Blending Plant (ABB)

Lube Oil Blending Plant (ILB)

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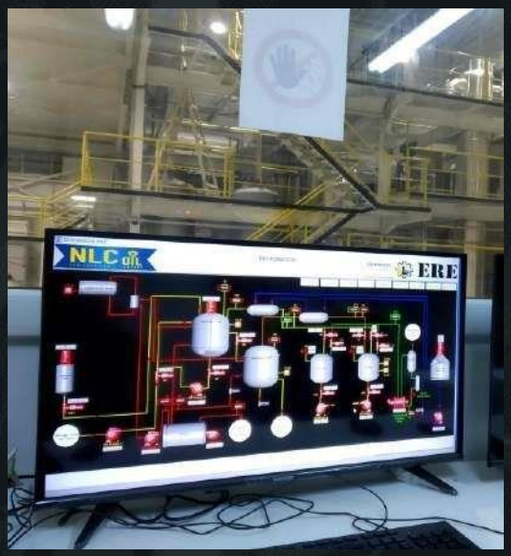
Used Oil Recycling Plant (Column)

Used Oil Recycling Plant (WFE)



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Waste Oil / Slop Oil Recycling Plant

Our Global Presence

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