

Lube oil blending plant

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Above image represents Lube Oil Blending Plant (LOBP) supplied by engineering department of ERE, India to one of reputed Lube Oil Manufacturing Company.

Specification of above lube oil blending plant

Plant includes - 3 lube oil blenders, 5 additive tanks, 3 base oil tanks, 5 manufactured lube oil storage tanks, Thermic Fluid Heater, automatic filling & packing lines, blow molding machine & advanced laboratory setup. Plant is capable of producing **13.1 Million Liters** per year.

Plant has been automated by using automation system from **Schneider Electric, France**. So it requires minimum manpower, hence minimum production cost and matchless accuracy. ERE also provided the bulk material loading and unloading solution to customer as well.

Service & Support

ERE took full responsibility for the engineering studies for customer's requirement, procurement, installation, commissioning, training, after-sales services as well as automation system for automated management of operations, for that computers of technical staff of ERE are connected to the automation system of plant so that technical staff can provide instant support whenever needed.

Advanced features of above plant

- ✓ Process equipments made from Stainless Steel
- ✓ High performance transfer pumps are used from **KSB, Germany**
- ✓ IE3 Premium efficiency motors from **ABB, France** are used
- ✓ Onsite and mobile operation options availed by using automation system from **Schneider Electric, France**.

1. INTRODUCTION TO LUBE OIL MANUFACTURING PROCESS

1.1 - ABOUT LUBE OIL

A lube oil is type of oil introduced to reduce friction between surfaces in contact, which ultimately reduces the heat generated when the surfaces move, reduces the corrosion, improves efficiency of mechanisms where it is applied or used. As new machines are being developed every day, demand of high performance lube oil is also increasing.

API (American Petroleum Institute), JASO (Japanese Automotive Standards Organization), SAE (Society of Automotive Engineers) & other organizations are serving very well to categorize lube oil.



Lube oils may be categorized by:

Type of application

- ✓ Engine oil
- ✓ Gear oil
- ✓ Hydraulic oil
- ✓ Transmission oil
- ✓ Brake fluid

Base oil type

- ✓ Mineral base
- ✓ Semi-synthetic base
- ✓ Synthetic base

SAE viscosity grade

- ✓ SAE 30, SAE 50, SAE 70 etc.
- ✓ SAE 5W-30, SAE 15W-40, SAE 20W-40 etc.

Service categories

- ✓ API SJ, SL, SM, SN etc. for petrol engines
- ✓ API CH-4, CI-4, CJ-4, CK-4 for diesel engines

1.2 - ABOUT LUBE OIL MANUFACTURING

Various additives are blended into base oil to enhance its properties and formulate lube oil. Selection of additives is done according to desired lube oil specifications. For making any lube oil basically 3 raw materials are used:

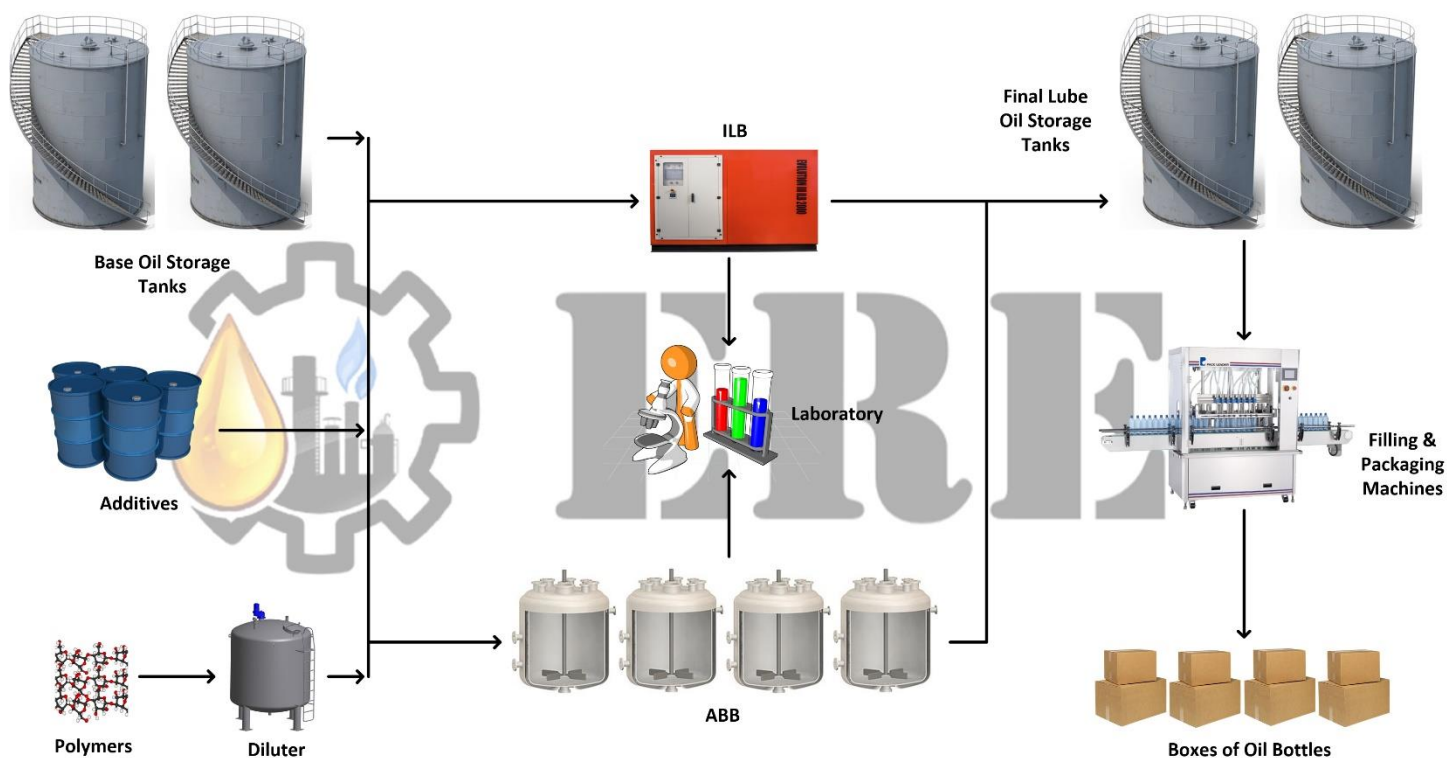
- Base oil
- Additives
- Viscosity Index Improver (Viscosity Modifier)

Lube oil manufacturing process:

- ➡ Different type of base oils & additives are stored into their respective storage tanks
- ➡ According to recipe for any particular lube oil which is to be manufactured, raw material is transferred to lube oil blenders, then blending process is done under particular temperature as needed
- ➡ While manufacturing process is going on, lube oil is tested in laboratory to make sure that it meets all desired specifications
- ➡ Once lube oil is manufactured as per the specifications & has passed from all laboratory tests then it is passed through very fine filters to make sure that no foreign particles are present in it and then it is transferred to storage tanks
- ➡ It is then packed into bottles by automatic filling and packaging systems and distributed in market

This whole manufacturing and packaging process is done by automatic systems.

LUBE OIL MANUFACTURING PROCESS DIAGRAM



Different types of base oil are available in market like - SN 150, SN 500, Mineral base, Synthetic base, etc. Also two types of additives are available as - Mono grade additives & Multi grade additives. Our customer (Lube oil blending plant owner/director) may choose type of base oil and additives according to suggested by chemist or lube oil recipe consultant. Viscosity Index Improver is also a type of additive only.

2. ERE's SCOPE OF WORK



2.1 - DESIGNING

Understanding customer's requirement of raw material storage tank capacities & quantity, production & working shift timings, automation requirement, skills and availability and allocation of manpower etc. are very necessary to design Lube oil blending plant. Engineers of ERE discuss with customer in detail and gather data to design Lube oil blending plant which can fulfill requirement of customer well. After designing of plant is done and explained to customer, designing team prepares production requirement data which is then submitted to manufacturing team of ERE. Once manufacturing team receives data from designing team, it starts manufacturing the equipments.

After designing the plant, below mentioned data are shared with customer:

- ✓ Equipment allocation diagram
- ✓ Piping and instrumentation diagram (P & ID)
- ✓ Electrical diagram

- ✓ 3D diagram
- ✓ Civil diagram for foundation requirements

2.2 - MANUFACTURING

Once designing phase is completed successfully, ERE's manufacturing team takes charge to manufacture all equipments with highest accuracy and selected raw material. For manufacturing of plant ERE has modern facilities, overhead crane, latest tools & machinery, qualified and experienced engineers, trained fabrication team and automation team. All equipments are manufactured according to plan.



2.3 - PLANT INSTALLATION & TRAINING

We provide 2 types of installation & training services:

- 1. Pre-installed plant & training at India**
(For small plants - fast installation)
- 2. Installation & training at customer's place**
(For large plants - time taking installation)

After all equipments of Lube Oil Blending Plant are manufactured, then if the plant is small then full installation is done in India at ERE's installation facility in India for fast installation. Once installation is completed, customer's team is invited for trial. If the plant is large in size, then full plant is shipped to customer's place directly and then it is installed there under supervision of ERE's team.



ERE handovers Lube oil blending plant to customer only after complete installation and training to operate. As plant is connected with cloud system, ERE provides 12-month online support to customer if needed.

3. EQUIPMENTS OF LUBE OIL BLENDING PLANT

3.1 - LUBE OIL MANUFACTURING PROCESS EQUIPMENTS

For making Lube oil below mentioned equipments are involved in blending (manufacturing process)

1. Base oil storage tanks
2. Additive storage tanks
3. Polymer diluter (for VII making)
4. Lubricant blenders
5. Filters
6. Pumps
7. Thermic fluid heater
8. Sensors
9. Control panel

1. Base oil storage tanks



For storing various base oils like - SN 150, SN 500 from mineral base or synthetic base, base oil storage tanks are needed. Size of these storage tank varies depending upon availability of base oil, available area, available initial investment, available working capital etc. ERE manufactures storage tank up to 50000 Liters (13200 US gallons) capacity with Mild Steel or Stainless Steel.

ERE manufactures Base oil storage tanks equipped with:

- ✓ Inlet line, outlet valve, drain valve
- ✓ Ultra sonic or pressure based level sensor
- ✓ Man hole
- ✓ Safety railings
- ✓ Both side ladders

Mostly used sizes:

Between 10000 Liters - 200000 Liters **OR** Between 3000 US gallons - 55000 US gallons

2. Additive storage tank

Most Lubricant blending plant use up to 15 different type of different additives. Storage tanks are needed to store these additives. For multi-grade additives storage tanks don't required mixing arrangement, for mono-grade additives mixing arrangement may be needed depending upon process. ERE manufactures additive tank up to 10000 Liters (2642 US gallons) capacity with Mild Steel or Stainless Steel.



ERE manufactures Additive storage tanks equipped with:

- ✓ Mixing and heating arrangements (optional)
- ✓ 4 Load cells
- ✓ cleaning hole/man hole
- ✓ sample valve, outlet valve
- ✓ Inside ladder

Mostly used sizes:

Between 1000 Liters - 10000 Liters **OR** Between 300 US gallons - 3000 US gallons

3. Polymer diluter (for VII making)

For modifying viscosity of Lube oil, Viscosity Index Improver (VII) concentration is used which is made up by diluting special polymers into base oil. For diluting polymers, Polymer diluter is needed.



ERE manufactures Polymer diluter equipped with:

- ✓ 4 load cells
- ✓ Powerful agitation assembly made by using **Bonfiglioli** or **Premium** or **Elmech** make gearbox with IE2 or IE3 motors from **ABB** or **Crompton Greaves**
- ✓ Fast-heating arrangement by thermic fluid circulation coil or jacket
- ✓ Heat prevention by Rock wool insulation cladded with Aluminum sheet

Size of Polymer diluter depends upon Lube oil blending plant capacity.

4. Lubricant blenders



Lubricant blender is used for mixing additives with base oil to formulate Lube oil, thus it can be called main equipment of plant. It has automation for feeding raw materials by load cell & HMI-PLC, mixing and heating arrangements.

ERE manufactures **Polymer diluter** equipped with:

- ✓ 4 load cells for raw material input observing
- ✓ Powerful agitation assembly made by using **Bonfiglioli** or **Premium** or **Elmech** make gearbox with IE2 or IE3 motors from **ABB** or **Crompton Greaves**
- ✓ Fast-heating arrangement by thermic fluid circulation coil or jacket
- ✓ Heat prevention by Rock wool insulation cladded with Aluminum sheet

5. Filters

Fine filters are required to eliminate solid impurities from manufactured Lube oils.



ERE's manufactured filters have:

- ✓ Stainless Steel mesh screen filters (Cleanable & Re-usable)
- ✓ Robust body
- ✓ Spare Stainless Steel mesh screen filter

6. Pumps

Different pumps are needed in Lube oil blending plant for transferring raw materials, re-circulation in Lube oil blenders, circulating thermic fluid etc.

ERE provides

- ✓ Centrifugal pumps from **Kriloskar** or **Crompton Greaves**
- ✓ Gear pumps from **Rotodel** or **Rotofluid**
- ✓ High temperature centrifugal pumps from **KSB**

7. Thermic Fluid Heater



For obtaining heating in process, ERE provides Thermic Fluid Heater (TFH) with following specifications:

- **Efficiency:** 88 ± 2 % as per BS 845:1984 Part-I
- **Design Temperature:** Up to 300 °C
- **Capacity:** 200,000 to 2 Million Kcal
- **Starts:** 3 start in radiant heat-exchanger, 3 start in convective heat-exchanger
- **Fuel:** LDO, Diesel or Natural Gas
- Most electronic components & sensors from **Baumer, Siemens & Schneider Electric**
- Automatic operation with auto ignite - cut off system

8. Sensors

For bringing automation in plant, various sensors like - Load cells, flow meters, float switches, level & temperature sensors are required.

9. Control panel

ERE provides control panel for automatic operation with **Schneider Electric** make HMI & PLC. Most of the electronic components used in panels are from global series of Schneider Electric which is available worldwide easily. Control panel is pre-loaded with ERE's state of art developed **Smartblend Program**, which is very easy for operation.

Advantages of ERE's control panel:

- ✓ Centralized operation
- ✓ Up to 99 different combinations of raw material for Lube oil can be stored
- ✓ Password protected
- ✓ Can be also operated remotely by iPad or smart device
- ✓ Connected on Ethernet for availing online access & support by ERE's automation team





3.2 - LUBRICANT OIL PACKING PROCESS EQUIPMENTS

For packing Lube oil in different packages, below mentioned equipments are used.

1. Automatic filling machine



The Electronic PLC Based Filling Machine is compact and highly efficient machine with elegant look. This multi-functional multi featured machine meets the GMP requirements of filling for glass, plastic or Aluminum bottles. The flow of liquid is measured and converted in to electronic signals being controlled by microcomputer base circuitry. Minimum adjustment required to set different capacities from 1L to 5L with varying containers. The entire range can be set on the same machine without any change parts with help of flow meter pulses. This filling machine is available from single filling head to 8 filling heads depending upon customer's requirement.

2. Automatic screw capping machine



This automatic inline capper is a high speed capper applicable for round, rectangular and most irregular bottles. Machine has a noiseless cap elevator to unscramble and feed caps for capping system. Unique design of machine requires no changeover parts and no tools when changing caps size. Customization available to meet specific requirement by customers.

3. Online Induction Sealing machine



Induction sealing is a non-contact process, which is used to bond a foil disk or to seal the opening of a container. The technique provides the user with a tamper evident seal. The seal assures product integrity and prevent any chances of leakage. It increases the products shelf life, reduce pilferage, and ensures maximum customer satisfaction. The method can also be used for different types of containers and also used for foods, drugs, chemicals and petroleum products.

4. Sticker Labeling machine



This fully automatic working machine is capable of labeling up to 300 containers per minutes depending on products and label size. The machine process very smoothly with high speed operation which make it different from other similar machines.

5. Carton sealing & strapping machine



The above carton stripping machine has convenient operating modes with panel and foot pedal switch. User or operator can easily adjust the tension of straps up to 70 kg with the help of mechanical tension knob. The machine has safety design to ensures the safe operation and prevents operators from electrical shock. The components installed in the machine are heavy duty and long lasting, resulting in trouble free operations.

6. Automatic batch coder



Lube oil bottles and bottle boxes may have varying data to be printed on it like - batch no, manufacturing date, item no etc. To print this data, automatic batch coder is needed. We recommend Videojet automatic ink jet printing machine for this application. Videojet had outlets and service centers in many countries around the world.

7. Automatic blow molding machine



Automatic blow molding machines are needed for making Lube oil bottles, these machine comes with various mechanical customizations according to requirement of production speed. For lube oil industry, 2 machines are recommended - first machine for making Lube oil bottles up to 1 Liter - second machine for making Lube oil bottles up to 5 Liter.

3.3 - LABORATORY EQUIPMENTS

ASTM (American Society for Testing and Materials) is working hard on setting & updating test methods so industries can control quality of their products.



Here is the list of usually performed tests (with ASTM testing method) for testing Lube oil:

1. Viscosity @ 40°C, cSt (ASTM D445)
2. Viscosity @ 100°C, cSt (ASTM D445)
3. Viscosity Index (ASTM D2270)
4. Pour Point, °C (ASTM D97)
5. Flash Point, °C (ASTM D92)
6. Density @ 15C, Relative (ASTM D4052)
7. TBN (ASTM D 974,4739)
8. Carbon Residue (ASTM D 189)

Equipments required for analyzing Lube oil

1. Kinematic Viscometer Bath



2.TBN Testing kit

3. Cloud & pour point apparatus



4. Color comparator



5. Muffle furnace



6. Foaming test apparatus



8. Magnetic stirrer with hot plate



7. Laboratory Weighing Scale



9. Miscellaneous items

- ✓ Borosilicate glass beakers
- ✓ Borosilicate glass flasks
- ✓ Borosilicate glass measuring cylinders
- ✓ Test tubes
- ✓ Stands for laboratory
- ✓ pH paper set
- ✓ Thermometers of various ranges
- ✓ Infrared thermometers
- ✓ Digital temperature gauges
- ✓ Digital stop watch

Above mentioned equipments are most widely used for analyzing Lube oils, we recommend to buy laboratory equipments according to customer's lube oil recipe consultant or lube oil chemist.