



MODULAR USED LUBE OIL RE-REFINING



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Modular Used Lube Oil Re-refining



GENERAL

Modular Used Lube Oil Re-refining proposed by STP is a skid mounted facility ready for immediate installation.

Modular realization is particularly advisable in low range of re-refining capacity and consists in prefabricated and pre-assembled skid mounted systems including equipments, instruments, electrical and structural material, defined according to the basic sequence of the re-refining process.

Capacity of Modular Re-refining Unit is ranging from 8,000 to 15,000 MTPY.

Modules are assembled in the workshop complete of equipment, piping, instruments and electrical component and are delivered as package system shipped in standard 40' containers. Modules are then easily erected and interconnected at site.

Modules include Distillation columns, vessel, heat exchangers, vacuum sets, pumps and motors, film evaporators, Thermal oil system, filters, DCS, instrumentation, piping and structures

Modular Unit is designed and fabricated in accordance with International codes and Standards (ASTM, ANSI, API) as well as International environment specifications for wastes and emissions.

Modular Unit offer the following advantages:

- Easy assembly in areas with limited technical support
- Quick assembly and disassembly without dedicated specialists
- Transportation and handling by common equipment
- Full construction and production tests in factory, before shipping
- Short implementation schedule



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Other advantages are:

❖ **Factory-Built:**

- ✓ No delay or risks due to climate
- ✓ Labour savings on the construction site

❖ **Commissioning:**

- ✓ Factory tested and verified
- ✓ On-site start up time schedule reduced

❖ **Cost Saving:**

- ✓ Quick erection and lower field labour costs
- ✓ Easy Start up and reduced specialists assistance due to pre-factory tests and modular design

Modular Re-refining Units are designed to obtain high quality oil products, high recovery rate and no environment impact.



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MODULAR UNIT DESCRIPTION

Used Lube Oil Re-refining is a challenging and attractive method of oil conservation and environment protection.

The Modular Re-refining Unit proposed by STP includes Dehydration, Gasoil removal, Vacuum Distillation by Thin Film Evaporator, Finishing and Final Fractionation.

Oil recovery by evaporation is more effective than by other chemical or physical methods proposed by other technologies.

Product yield is definitively higher and operation is less expensive because of lower utility consumption.

The Unit includes the following sections to selectively remove all contaminants and recover a high quality lube oil product:

- ✓ **Dehydration**, including preheating, additive injection and flash vaporization to remove water, gasoline and light contaminants (solvents, glycols, lighter organic).
- ✓ **Gasoil removal**, to separate gasoil from the base oil by stripping and recover a valuable gasoil fraction.
- ✓ **Vacuum Distillation by Thin Film Evaporator**, to separate lube oil distillate from “heavier than” contaminants by high vacuum distillation and thin film technology.
- ✓ **Finishing and Final Fractionation** of vacuum distillate by alkaline treatment and fractionation tower, to improve base oil quality and produce SN-150 and SN-400/500 Base Oils.
- ✓ **Thermal Oil System**, to provide high temperature heat duty for process operation. Thermal Oil is a synthetic fluid.

Vacuum distillation for lube oil recovery achieves high selectivity and oil purification from metals, heavy polymers, carbon, dust, and involves only heating/cooling operation.

Due to the high temperature required and the thermally unstable nature of the contaminants this operation is carried out by thin film evaporator under high vacuum conditions.



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Base oil products after finishing are fully equivalent to virgin lube oil quality and specification.

The operation of the Modular Re-refining Unit is fully automatic and controlled by DCS (Distributed Control System).

Modules are skid mounted shop assembled and include equipment, piping, instrumentation and electrical material as necessary for the proper operation .

Piping inside the skid terminates at the skid edge with companion flanges.

Instrument/electrical cables terminate at the skid edge with junction boxes and terminals.

All connections are provided at convenient point to allow easy interconnecting among the skid or to the external systems.

The modules include instrumentation and control valves and skids layout is arranged to allow easy access for maintenance.

The modules are assembled and tested at shop and are delivered as package system.

Equipment not installed on modules (off skid equipment) because of process and mechanical requirement, are erected at site.

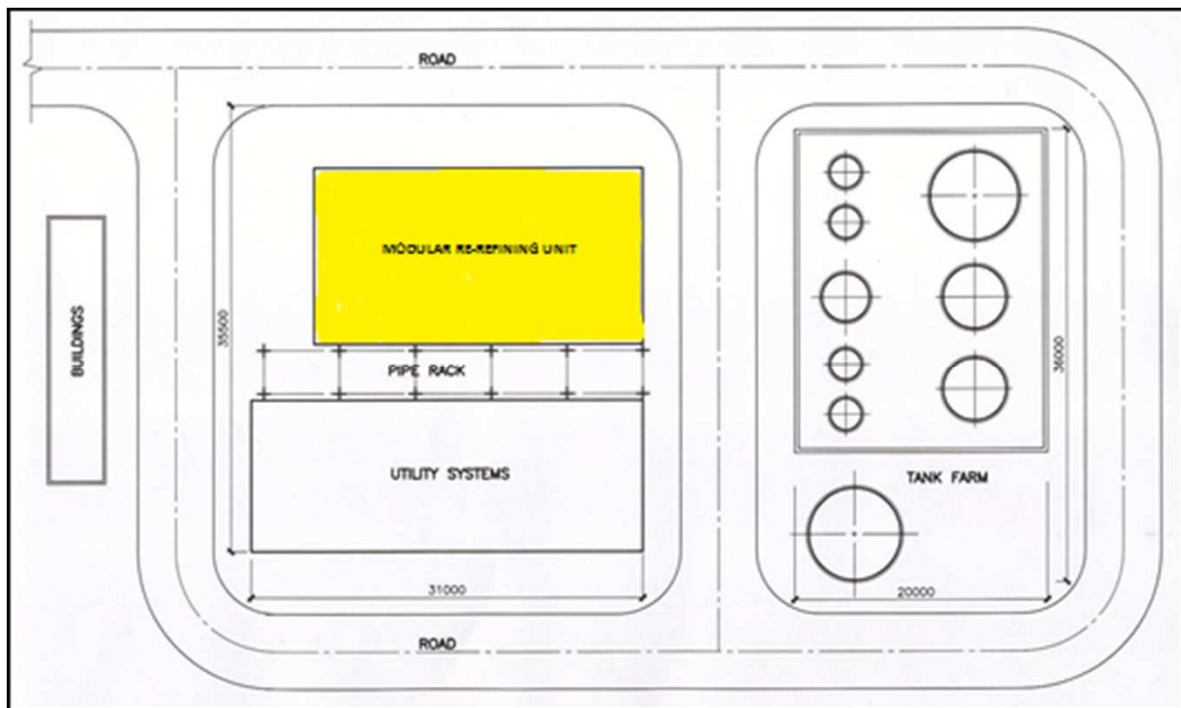
Piping interconnecting among modules and off skid equipment as well as electrical connections for electric motors and instruments from module's terminals/junction box to electrical substation and control room are realized at site.



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Modular Unit is a very compact facility and area required for installation is about 1,000 sqmt.

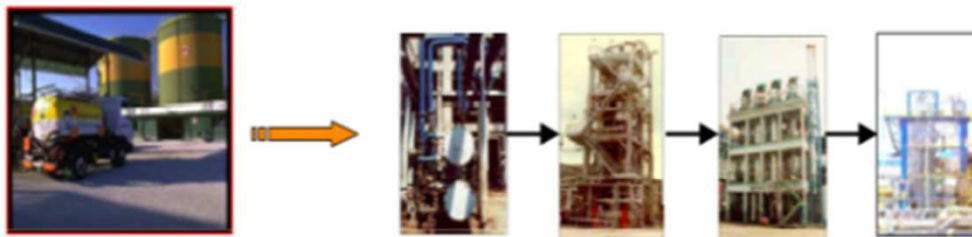
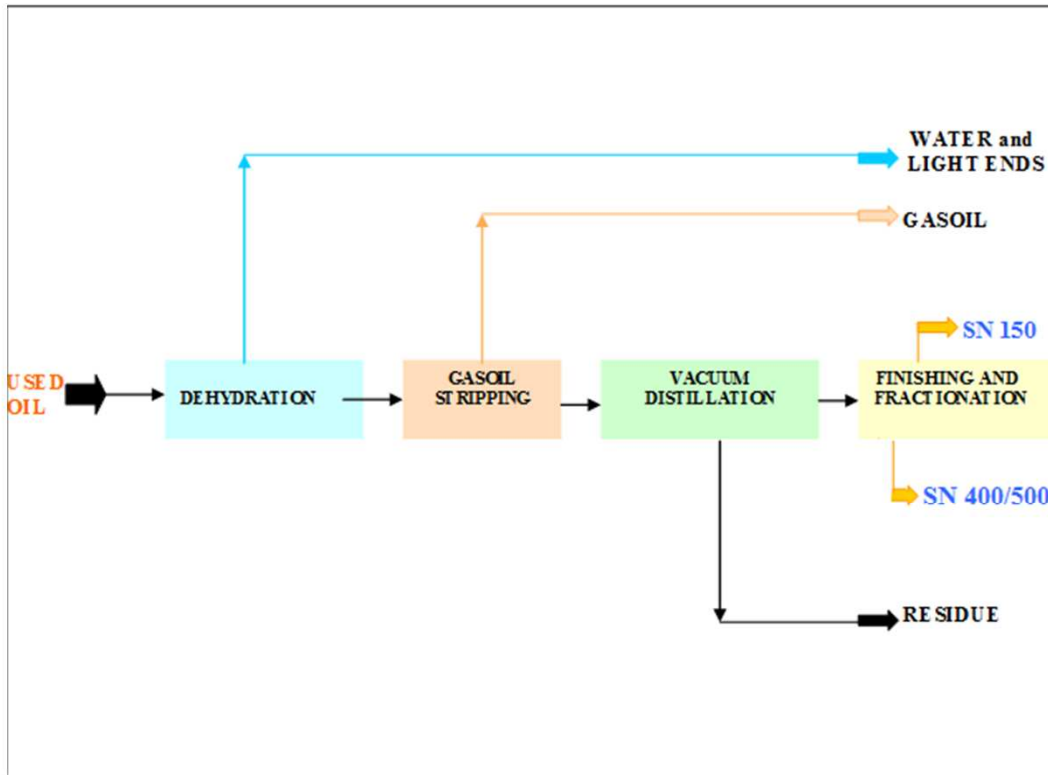




Modular Used Lube Oil Re-refining

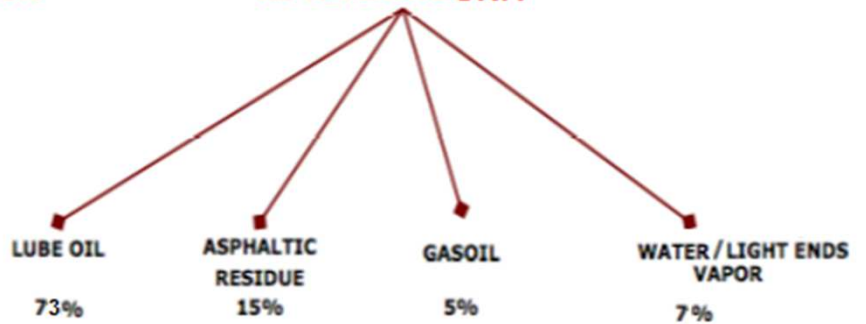


PROCESS BLOCK SCHEME



USED LUBE OIL COLLECTION

RE-REFINING UNIT





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**SKIDS
TRANSPORTATION**



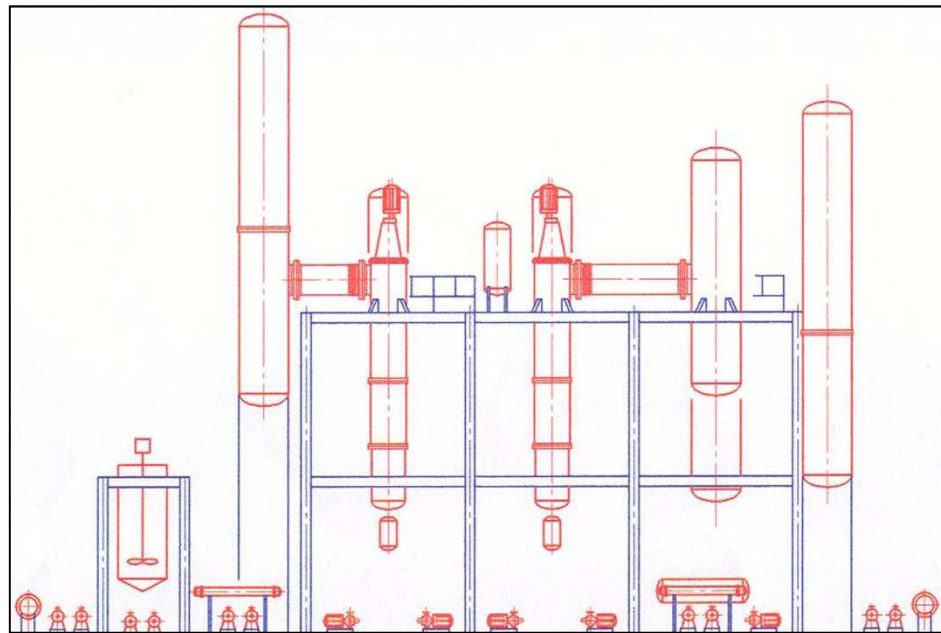
**SKIDS
ERECTION**



**SKIDS
OPERATION**



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RE-REFINING UNIT ASSEMBLY



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FEEDSTOCK AND PRODUCTS CHARACTERISTICS

The STP Re-refining Unit is designed to obtain high quality base oil products, high recovery yield and no environmental impact.

Typical composition of used lube oil feedstock is reported below:

Component	%wt
Water and Light Ends	5 - 10
Gasoil	5 - 7
Lube Oil Fraction	70 - 75
Residue	15-17

Characteristics of Re-refined Base Oil products are shown below.

Characteristics	Light Base Oil (SN-150)	Heavy Base Oil (SN-400/500)
Specific gravity @ 15°C	0.870	0.885
Viscosity, cst at 40°C	25-35	80-95
Colour	2.0	2.5
TAN, mg KOH/g	0.03	0.05
Viscosity index	98	95
CCR, %wt	0.05	0.05
Flash point COC, °C	210 min	240 min
Metals content, ppm	5 max	5 max



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By products are Gasoil and Residue. Their typical characteristics are reported herebelow:

Gas oil Characteristics	Value
Specific gravity @ 15°C	0.86
Viscosity, cst at 40°C	3 – 5
Flash point COC, °C	70
LHV, Kcal/Kg	10,000

The Gasoil may be used as diesel oil or fuel oil.

Residue Characteristics	Value
Specific gravity @ 15°C	0.95 – 1.05
Viscosity, cst at 40°C	10,000
cst at 100°C	80
Ash content, % wt	10 – 12
Softening point, °C	15 - 20

Residue may be used as follows :

- as heavy fuel in cement factories or in blast furnaces after flushing with fuel oil or gas oil
- as component for the formulation of bitumen and asphalt extender. For example 80/100 bitumen may be obtained by mixing 20% of residue with 80% of 40/50 bitumen
- for recovery of lead and zinc and for ink manufacturing



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MATERIAL BALANCE

Typical material balance of 12,000 MTPY Modular Re-refining Unit based on typical used lube oil composition (8% water and light ends, 6% gasoil content) is shown herebelow.

<u>Feedstock</u>	<u>Ton/year</u>
Used lube oil	12,000
<u>Products</u>	
Off gases (water, light ends and losses)	1,000
Gas oil	700
Base Oil (SN 150 and SN 400/500)	8,500
Residue	1,800
	<hr/>
	12,000

UTILITIES AND CHEMICALS

The expected Utilities and chemicals consumption of 12,000 MTPY Modular Re-refining Unit is as follows:

➤ Fuel, Kcal/hr	1,000,000
➤ Electric power, Kwh	110
➤ Cooling water, m3/hr (DT = 10 C)	100
➤ MP Steam, Kg/hr	1,200
➤ 30% Alkaline solution, Kg/hr	30%



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EFFLUENTS

Liquid effluents of the Unit consist of process water from Dehydration, condensate from ejector sets and oily drains/ oily water from equipment and surface area cleaning.

Process water and oily water are sent to water treatment to meet with effluents specifications.

Gaseous effluents issued from ejector sets are burnt in the Thermal Oil heater and flue gases from stack are discharged according to the limit values allowed by local standard for air pollution and environment protection.



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