Ref.-No.: ProOil-273

LOHRMANN
INTERNATIONAL

54,000 bpd OIL REFINERY

FOR SALE AND RELOCATION

Presented by: Lohrmann International Germany

1. Project Introduction and Brief Description

1.1 General Capacity

The Capacity of the refinery is equivalent to 2x 27,000 bpd. (in total 54,000 bpd) crude oil feed.

It is designed for Russian Export Blend Crude Oil (REBCO).

1.2 Facts and History

The US-based refinery was dismantled and is now getting completely overhauled and packed untill the end of 2007.

Due to the overhaul, the plant will get offered with 1 year warranty, which is subject to more detailled information.

2. Price

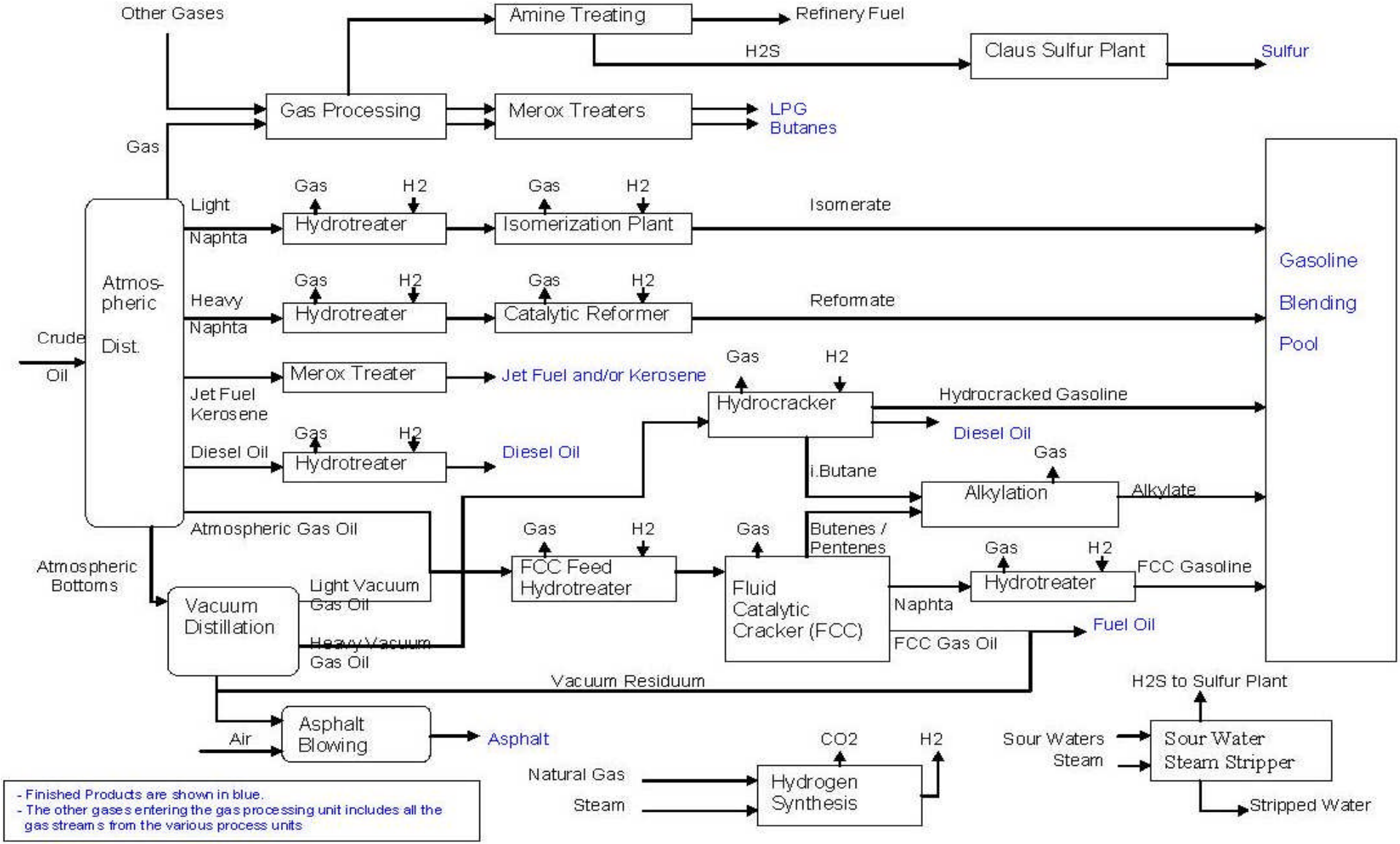
The Price for the refinery is on request after presentation of an official LOI and proof of funds.

Inclusions:

- Process Units as described in the Unit List
- General Refurbishment
- 1 Year Warranty
- Packing and Labeling, Transportation FOB

Exclusions:

- OSBL
- Utilities
- Tank Farm
- Power Plant
- Civil Work and Piping


Other Gases
Amine Treating
Refinery Fuel
H2S
Claus Sulfur Plant
Sulfur
Gas Processing
Merox Treaters
LPG
Butanes
Gas
Light
Naphta
Gas
H2
Hydrotreater
Gas
H2
Isomerization Plant
Isomerate
Atmos-
pheric
Dist.
Crude
Oil
Heavy
Naphta
Hydrotreater
Catalytic Reformer
Reformate
Gasoline
Blending
Pool
Merox Treater
Jet Fuel and/or Kerosene
Jet Fuel
Kerosene
Diesel Oil
Hydrotreater
Diesel Oil
Hydrocracker
Hydrocracked Gasoline
Diesel Oil
i.Butane
Alkylation
Alkylate
Atmospheric Gas Oil
Atmospheric
Bottoms
Vacuum
Distillation
Light Vacuum
Gas Oil
Heavy Vacuum
Gas Oil
FCC Feed
Hydrotreater
Fluid
Catalytic
Cracker (FCC)
Butenes /
Pentenes
Hydrotreater
FCC Gasoline
Naphta
FCC Gas Oil
Fuel Oil
Vacuum Residuum
Air
Asphalt
Blowing
Asphalt
Natural Gas
Steam
CO2
H2
Hydrogen
Synthesis
H2S to Sulfur Plant
Sour Waters
Steam
Sour Water
Steam Stripper
Stripped Water
- Finished Products are shown in blue.
- The other gases entering the gas processing unit includes all the gas streams from the various process units

Summary

The equipment at the location was inspected. The diesel desulfurizer from was not available for inspection.

All the equipment seen appeared to be in reasonable-to-good condition.

The refurbishment facilities inspected appeared to be competent operations. All are certified by the American Society of Mechanical Engineers (ASME).

Using cost estimation curves that are widely used in the industry, an estimate of the new replacement cost of all the equipment which belongs to the scope of supply, or is considering buying, was calculated and adjusted for installation to the end of 2007.

Due to the currently huge refining margins, it is not unreasonable to expect this refinery to generate a cash flow of EUR 1 mill. per day, depending upon timing, location, and crude availabilities.

It is not anticipated that current refining margins will last indefinitely. They reflect a shortage of refining capacity worldwide. Many projects have been announced to increase refining capacity in the US and elsewhere in the world.
Once sufficient capacity is available, it is anticipated that refining margins will subside back closer to historic levels.

The scope of supply include the following major process units:

- 2 Crude Units
- Vacuum Distillation Unit
- Fluid Cat Cracker Unit (FCCU)
- FCCU Feed Desulfurization Unit
- Gas Concentration Unit
- Platformer
- Unifiner
- Merox Units
- Amine Unit
- Sulfur Recovery Units
- Sour Water Stripper
- Tail Gas Unit
- Associated Spare Parts
- Platformer
- C4 Isomerization Unit
- HF Alkylation Unit
- Hydrogen Production Unit

History of the Oil Refinery

Initial construction of the refinery started in the early 1930s, when the founder erected a 3,000 barrels per day crude topping unit to process the crude from the recently discovered in the location area.

In 1959, the refining and marketing operations were transferred to another associated company. The refinery went through many episodes or expansion and improvement, the last being in 1982, when the capacity increased to 46 thousand barrels per day (mbpd), yielding 90% of clean products; typically gasolines, jetfuels, and diesel fuels.

In 1984 the company declared bankruptcy and the refinery was shut down.

The refinery was bought 1986 and operated until 1995.

Since then, the refinery has changed ownership several times, the last being in 1998.

The last reference to the refinery in the Oil and Gas Journal was for 1995 when it showed the refinery to comprise the following process capacities in barrels per calendar day:

- Crude Distillation 46,500
- Vacuum Distillation 25,000
- Delayed Coking 9,600
- Catalytic Cracking 11,700
- Catalytic Reforming 9,400
- Catalytic Hydrocracking 7,500
- Middle Distillate Hydrorefining 5,800
- Reformer Feed Desulfurization 9,400
- Cat Cracker Feed Desulfurization 11,700
- Other Distillate Hydrotreating 9,500
- HF Alkylation 2,200 b/d of alkylate
- C_4 Isomerization 1,400
- Hydrogen Generation 18.0 mill. standard cu ft/day
- Coke Production 545 tons/day

The Oil and Gas Journal did not report sulfur units at that time.

Before our sales approach started, the following process units were sold out of the refinery, and have been removed:

- Delayed Coking
- Catalytic Hydrocracking
- Middle Distillate Hydrorefining
- Distillate Dydrotreating

Remaining units at the site, which are not part of the scope of supply, but may be available for sale:

- Cat Cracker Depentanizer Column
- One distillation column from the Catalytic Hydrocracker
- Varous treting units
- Utilities:
  - Process Air Supply & Distribution
  - Boilers & Steam Distribution
  - Cooling Water Treatment & Distribution
  - Firewater System
  - Waste Water Treatment & Disposal
  - Electrical Distribution & Switchgear
- Maintenance Equipment
- Laboratory & Testing Equipment
- Flares & Relief Systems
- Tank Farm
- Loading Facilities

Progress of Dismantling and Refurbishing the Relinery (stand August 2007)

The dismantling and refurbishing company has commenced dismantling the process units and is shipping them to their site for refurbishment:

- Crude Unit 2 has been removed. Some heat exchangers are completely refurbished
- The Vacuum Distillation Unit is partly removed
- The Unifiner (Catalytic Reformer Feed Desulfurizer) is in the process of being dismantled
- Most heat exchangers for all units of the scope of supply have been removed

Much of the refurbishment work is subcontracted out to specialized companies. These will be selected for the refurbishment of:

- Control Valves
- Relief Valves
- Pumps
- Electric Motors
- Process Heaters

Refurbishment of vessels, columns and heat exchangers will include sandblasting to remove corrosion, scale, thickness testing, weld filling, remachining flange faces, retubing heat exchangers, pressure testing, painting and readying for shipment.

Only six items, all heat exchangers, have been refurbished and are ready for shipment.

However, the inspection of the facilities and work in progress showed the quality of work to be good.
The refurbished equipment will not be in as-new condition, but it will be close.

Metal thicknesses can be expected to be less than new, but will be adequate for operation, and are expected to meet all relevant operating standards.

Documents, testing procedures, and physical ratings of the equipmenl for temperature and pressure, etc., are being performed to meet ASME (American Society of Mechanical Engineers) and European standards.

It is our undastanding that the tests will be witnessed and approved by TÜV (German Product Testing and Certification Organisation) after refurbishmenl, and that this will qualify the equipment for new status for European construction.

The dual qualification of the equipment will give any buyer increased flexibility in relocation.

This would imply an expected service life of at least 10 years, but this is not part of the guarantee.

The refurbishing and dismantling company is guaranteeing the operation of the refinery for one year after start-up.
No representations are made for longer term service

Suitability of refinery for use with other crude oils

The refinely was configured to process heavy crude oils, typically 20 degrees API gravity, 4 wt % sulfur.

The equipment has the metallurgy to process most domestic and international crude oils.

However, to process crude oils of different composition and characteristics may result in a change in the processing capacity of the process units, or may require modifications to achieve optimum performance

Note also that the refinery was originally configured with a delayed coker and a hydrocracker.

The delayed coker took heavy vacuum residue and thermally cracked it to yield heavy coker gas oil which was fed to the PCCU and its feed Desulfurizer, light coker gas oil which was also hydtotreeted to saturate olefins and remove sulfur, and coker naphtha, which also required desulfurization before either blending into the gasoline pool or muting to the catalytic reformers.

The hydrocracker was a major consumer of hydrogen, and processed light VGO, heavy VGO and coker gas oils into lighter products boiling in the gasoline to diesel range. Some of the hydrocracker gasoline stream was processed in the reformer units. The hydrocracker also produced a significant volume of H_2S which was routed to the amine unit and ultimately the sulfur units.

Condition of Process Units

Crude Unit A

It is the older of the two crude units, originally constructed in the late 1950s, but is still in reasonable condition for refurbishment.

In this unit, crude oil is washed to remove salts and sediments, heated to approximately 680 degrees F and distilled under approximately 50 psig pressure.

It includes a desalter, preflash separator, two fractionation columns and a naphtha stabilizer. The nominal capacity for local crude oil (20 deg API) is reported in various documents at the refinery as 18 to 19 mb/d.

It is reported that the unit can process up to 25 mb/d of 29 deg API crude.

The refinery sales literature shows a capacity of 25 mb/d. It is not known what materials of construction were used, but one would expect to be robust to process heavy crude oils.

Crude Unit B

Three heat exchangers and four air coolers have been scrapped.

It is the newer of the two crude units, constructed in 1974.
This unit operates in a similar manner to crude unit A.

It does not have a preflash separator and associated fractionator. It does include a desalter, main fractionation column and naphtha stabilizer.

The nominal capacity of the unit is 32 to 35 mb/d when running local heavy crude oils. The major vessels and columns were identified in the refurbisher's facilies. The main crude oil distillation column had been modified in 1993, with the top 40 feet of the column being replaced with alloy steel. Refurbishment had not been completed on these components, but they appeared to be in remarkably good condition for equipment that had not been operated for twelve years.

The desalter shows some external pitting. However, this vessel was originally an LPG storage vessel and as such was designed and constructed to a higher pressure rating than is necessary for a desalter. It is reported that the remaining metal thickness is more than adequate for its present service.

The majority of the heat exchangers were in the facilities of the refurbishing companies, undergoing rehabilitation.

Vacuum Distillation Unit

The unit was constructed in 1966 and is rated at 25 mb/d.

It is designed to distill the heavy residue from crode unit A and B under vacuum to extract heavy gas oils which are further processed in the Fluid Catalytic Cracking Unit (FCCU)

Unifiner

The unit was constructed in 1966, using UOP tecnnology. It is currently rated at 11 mb/d m the sales literature, but at 9,400 b/d in the OGJ.

The Unifiner pretreats the naphtha feed for the two catalytic reformer units (Platformers 2 and 3).

The unit removes sulfur and other contaminants from the reformer feedstock. Reformer catalysts are very expensive and are very sensitive to contamination.

Platformer # 2

It is the older of the two catalytic reforming unils, constructed in 1955, but is still in reasonable condition for refurbishment.

Platforming is the name given by Universal Oil Products (UOP) for their licensed reforming process. Feedstock is mixed with hydrogen, heated to 960 degrees and passed over a catalyst containing platinum and other rare metals. The major reaction taking place in the unit is the conversion of naphthenes into hydrogen and refomate, a high octane gasoline blendstock.

The unit is a semi regenerative design, utilizing three heaters and reactors. The unit has to be takn offline at regular intervals to regenerate or replace the catalyst. The unit is designed to operate at a product separator pressure of approximately 350 psig. This would be regarded as an obsolete design for construction today. Modern units operate at lower pessures, and give a higher yield qf liquid product, and yield purer hydrogen.

The unit is rated at 3,000 b/d in the sales literature.

Platformer # 3

It is the newer of the tyo catalytic reforming units, constructed in 1961, and is it1 reasonable condition for refurbishment.
The unit is similar in design and operation to Platformer # 2, giving similar yields.

The unit is rated at 7,000 b/d in the sales literature.

The two reformers are thus rated at 10,000 b/d combined, vs. 9,400 in the OGJ

Platformer # 1 was converted into a butane isomerization unit utilizing UOP technology, in 1981.

Butane Isomerization Unit (see previous page)

This unit converts normal butane into iso-butane which is a feedstock for the alkylation unit.

It is rated at 1,400 b/d capacity.

Diesel Desulfurization Unit

This unit has a nomial capacity of 8,750 b/d and operates at a pressure of 740 psig.

This unit is intended to desulfurize the feedstock to today's on-road diesel fuel ultra low sulfur specifications.

The capability of this unit is being checked by the refurbishing company.

Cat Cracker Feed Desulfurization Unit

The unit was constructed in 1982, utilizing Union Oil technology. It is designed to remove most of the sulfur, and some other contaminants from the feed to the Fluid Catalytic Cracking Unit (FCCU).

The sales literature rates the capacity of the unit at 13,000 b/d, while the OGJ reports 11,700.
Capacity would be somewhat dependent on feed characteristics.

The FCCU feed is mixed with hydrogen, heated to 670 degrees F and passed over a catalyst at a pressure of 980 psig. Sulfur from the feed is removed as H_2S, nitrogen is partly removed as ammonia, NH_3, and metal contaminants are deposited on the catalyst.

The lower sulfur of the FCCU feed produced results in lower SO_X emissions from the FCCU regenerator, and a lower sulfur content of the cat cracked gasoline product; the yield of gasoline from the FCCU reactor is increased, and the catalyst makeup rate is decreased due to the reduction in metals content of the FCCU reactor feed.

Fluid Catalytic Cracking Unit (FCCU)

It was originally built in 1967, utilizing UOP technology. It was revamped in 1972 to include riser cracking.

The sales litetaturn rates the capacity of the unit at 13,000 b/d, while the OGJ reports 11,700.
Capacity would be somewhat dependent on feed characteristics.

The FCC unit is ihe most complex in the refinery. It involves a circulating powdered catalyst, separation of reactor products from catalyst, fractionation of the reactor products, continuous regeneratian of fhe catalyst, and waste heat recovery from the regenerator combustion gases.

Heavy gas oil from the vacuum distillation unit (HVGO) is contacted with hot powdered catalyst. The HYGO breaks down into smaller molecules that boil in the gasoline and diesel fuel range. During this process carbon is deposited on the calalyst. The catalyst and the reaction products are separated in a separation vessel (usually called the reactor).

The hydrocarbon products are separated into gasoline and diesel blendstocks in the fractionation section, while the carbonized catalyst is routed to the regenerator, where the carbon is burned off with injected air.

The regeneration reaction takes place at 1,300 degrees F, and generates the heat necessary for the cracking reaction, and waste heat for steam generation.

HF Alkylation Unit

The unit was built in 1967, utilizing UOP technology.

The process uses concentrated hydrofluoric acid as a calalyst to combine low molecular weight olefins (typically C_3 – C_4's) from the FCCU with low molecular weight isoparaffins (typically isobutane) from the LPG recovery and butane isomerization units, to produce a stream of heavier isoparaffins, (typically iso-octane) of 92 - 94 octane number. The alkylate product is essentially free of sulfur, aromatics and olefins, all components whose concentrations are regulated in some grades of gasoline.

Amine Unit

The unit was built in 1982.

Lean amine solulion is supplied to all the H_2S removal scrubbers throughout the refinery; the FCCU feed desulfurization unit, the unifiner, the diesel desulfurization unit and fuel gas scrubbers. H_2S dissolves in the amine solution and is removed from the process environment in the rich amine solution. Ih the amine regeneration section the H_2S is boiled out of the rich amine solution and sent to the sulfur recovery plant as a concentrated gas.
The resultant lean mine solution is recirculated to the H_2S scrubbers.

Sulfur Plant

The sulfur recovery units were built in 1982.

The plaht comprises two parallel units of 22 -24 long tons per day of sulfur production capacity. The capacities can be increased by the enriching the combustion air with oxygen.
Essentially the H_2S rich gas from the amine regenerator is partially combusted to yield H_20 and elemental sulfur. The sulfur is condensed as a liquid. Waste heat is used to generate 350 psig and 60 psig steam.

The remaining exhaust gases are routed to the Tail Gas Unit for further cleaning.

Tail Gas Unit

This unit was conshucted in 1982 using UOP technology. The unit is designed to convert the residual sulfur compounds present in the sulfur recovery unit tail gas to molten elemental sulfur. This unit will reduce the H_2S level in the treated gas to less than 10 ppm, and the total sulfur level to less than 250 ppm.

Sour Water Stripper

The unit was designed to process 80 gallons per minute (gpm) of sour waler, but was reported to be processing 125 gpm when the refinery was shut down.

Sour waler conlaining H_2S and ammonia from various process units is steam stripped to produce an overhead gas rich in H_2S and ammonia, which is routed to the sulfur recovery plant, and a clean water product, which is used as desalter wash water.

Hydrogen Production Unit

The unit first started operation in 1982. It was designed to produce 18.5 million standard cubic feet per day (MMSCFD) of 96 mol percent hydrogen at 245 psig. The hydrogen supplements the hydrogen produced by the catalytic reformer units, and is used in the unifiner, the diesel desulfurizer and the FCCU feed Desulfurizer.
The plant also produces 23,350 lb/hr of byproduct carbon dioxide, and 22.000 lb/hr of 640 psig steam.

The unit uses Foster Wheeler technology for the stem reformer furnace, and Union Carbide technology for the carbon dioxide removal process.
The essential process is that refinery fuel gas and purchased nalural gas are reacted with steam at 900 degrees F in the presence of reforming catalyst to yield hydrogen and carbon monoxide.
The carbon monoxide is further reacted with steam to produce hydrogen and carbon dioxide. The carbon dioxide is removed, and the hydrogen is routed to the desulfurization units.
No work has been performed on this unit pending purchase negotiations. We left the option of supplying either this unit or any other unit to the future buyer. Other hydrogen units are under consideration for acquisition.

Merox Units

Merox (mercaptan oxidation) is a proprietary process licensed by UOP, designed ta remove corrosive and foul smelling mercaptans from gasoline components and jet fuel.

Liquid hydrocarbon streams at low temperature and pressure are mixed with a small volume of injected air and passed over a charcoal bed that is impregnated with Merox catalyst. Mercaptans are oxidized to disulfides, which are non corrosive and have no obnoxious odor. The disulfides can be removed from the lighter gasoline streams, thus reducing the sulfur content of the gasoline product.

The disulfides are typically left in the jet fuel which typically does not have a stringent sulfur specification.

Gas Concentration Unit

This unit takes the light products from the FCCU and separates into fuel gas, propane/propylene, butane/butylene and stabilized gasoline streams.

Pictures of units before refurbishment Page 1

FCC Unit Unifiner

Crude A Isomerisation

Pictures of units before refurbishment Page 2

Amine FHT

Alkyl Unit

Pictures of refurbished units Page 1

Thank you for your attention !

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