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| Unused 6000BPD Refinery |
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**1**. With reference to the above mentioned subject, we are pleased to submit our proposal for the supply of a crude oil topping refinery, 2 x trains of 3000 barrels each (total 6000 BPD or 832 tons MT/day or 304,000 MT/year). It was basically designed to make fuel for power stations, but the output can be used for a variety Of purposes. It was built in the USA for a European client in year 2000 but is unused and preserved in boxes.

**2. General Information**

Manufacturer: PETROFAC, LLC (USA) Number: 2 trains

Year of manufacture: 2000

Year of purchase: 2013

Total capacity: 300 thousand tons/year

**3. Technical Description**

The design capacity of each oil-distilling aggregate is 150 thousand tons per year (416 tons/day) of oil, wherefrom about 37.5 thousand tons per year (104 tons/day) of directly

distilled gasoline, 37.5 thousand tons per year (tons/day) of diesel fuel and 72 thousand tons per year (199 tons/ day) of furnace fuel oil. The aggregate produces oil fractionation by boiling temperature into three fractions (directly distilled gasoline, diesel fuel and furnace fuel oil) which are directed for storing in LPG storage.

**3.1 Characteristics of Initial and Final Product**

**Raw mixture**

Flow rate 416 tons/day (taking into account losses 2%) Density 820 kg/m3

Fr. Up to 180°С 2 5%

Fr. Up to 350°С 50%

Salt percentage Max. 40 mg/kg

**Directly distilled naptha**

Flow rate 104 tons/day

Density 700 kg/m3

**Diesel fuel**

Turbine fuel output 104 tons/day

Density 815 kg/m3

Flash temperature Min. 40°C

**Furnace fuel oil**

Flow rate 199 tons/day

Density 890 kg/m3

Flash temperature Min. 130°C

**3.2 Standard Operation Conditions**

Max. Ambient temperature 40°C, Min. Ambient temperature 36°C Calculated wind

Speed 4.6 m/s Operation intensity 8,000 h/hour.

**3.3 Process description**

Below is the description of the technological process in oil-distilling aggregates, with

Capacity 508 nm3 of oil (820 kg/m3) per day, where from 124 nm3 of diesel oil per day is produced. This description should be read while taking into account of the process diagram shown in Section E.

Oil is directed to the aggregate via oil supply pump P-101 А/B. Also, water is pumped into

The aggregate in amount of 2 per cent of the amount of oil for prevention of formation of salty depositions when oil is heated. Pre-heating of oil is performed in the heat-exchanger “oil/cold

Residue” E-101 and heat-exchanger “oil/diesel fuel” E-102. At this stage, water is added into oil in amount of 4 per cent of the amount of oil. Water passes via the ball valve wherein it is well mixed prior to be supplied to the desalter V-102, where salt is electrostatically removed from oil down to the level not exceeding 5 ptb.Thereafter oil is further heated up in the heat exchanger “oil/partial residue” E-106 and heat- exchanger “oil / hot residue” E-103.

Pre-heated oil is supplied to the heater H-101 wherein it is heated until evaporating of light fractions (naphtha and diesel fuel). The mixture of liquid oil/vapours goes out from the heater and is supplied to the tower T-101. Heater H-101 is equipped with burners allowing burning both residual oil and fuel gas.

There are 22 fractioning plates in tower T-101. Light fractions (vapours) go up via the plates and are condensed as they are cooled down. The cooling rate is regulated by the reflux

condenser installed atop the tower.

Naphtha and water vapours go out via the tower top and are supplied into the overhead condenser АC-101, after which, being in a partially condensed state, they occur in the distillate collector V-101 where water is separated from naphtha. Water flows down into the collecting tank attached to the distillate collector. From there, using the level gauge, it is discharged into industrial sewage. Naphtha is pumped back on the top of the tower by

means of reflux pumps 104 А/B and is used for temperature control atop the tower. The excess naphtha is delivered for storage.

Note: the above technological process supposes availability of a desalter. When salt percentage in the oil is 40 mg/kg (40 per/mille) or under the desalter is not mandatory. However, in this case mounting of an additional corrosion inhibitor atop the tower will be required, as well as thorough acidity control in order to prevent corrosion.

Diesel fuel as a liquid is collected into plates with a pipe duct for passing of gas under

Plates 11 and is delivered into the 2nd stripper T-102 which is a vertical tank with inner diameter 30 inches x 19’-6” S/FF with six trays. Vapours from the stripper are returned into the tower between plates 8 and 9. The stripper is heated up by a separate section of oil heater H-101. Diesel oil is pumped out from the stripper bottom by means of diesel oil pump P-103

А/B via diesel pump re-boiler of diesel fuel where it is heated and then returned on the stripper bottom. The boil-off temperature of diesel fuel is regulated by reflux ratio, while the flash temperature is regulated by boiling of diesel fuel and the stripping process of the stripper. The diesel fuel level is regulated from the stripper by means of diesel fuel pump, heat- exchanger “oil/diesel fuel” E-102, diesel fuel cooler АC-102. Some portion of diesel fuel is returned onto tray 10 for flow rate control. The cooled diesel fuel is delivered for storage.

Residues are pumped out from the tower bottom via heat-exchanger “oil /hot residue” E-

103, via pumps of residue supply P-102 А/B, heat-exchanger “oil / cold residue” E-101 and

E-106.

A small amount of vapours is collected from the distillate collector and is supplied to the heater.

Residues are pumped out from the tower bottom via heat-exchanger “oil /hot residue” E-

103, via pumps of residue supply P-102 А/B, heat exchanger “oil / cold residue” E-106 and heat-exchanger “oil/partial residue” E-101 until battery limit.

Air preparing installation will provide technical air and air for spraying residual oil for oil

heater 11-101.

**3.4 Required Electric Power, Fuel and Water**

**3.4.1 Electric Installations**

А. Electric power 160 kVA, 380 V, 3 phase, 50 Hz

B. Installed load 127 kW

C. Maximum basis load 75 kW

**3.4.2 Fuel Consumption**

Diesel fuel 3,3 nm3/day\*\* Based on burning of two types of fuel at heater 11-101: 50% from gas from the distillate collector and 50%from burning of residues (oil).

**3.4.3 TECHNICAL WATER FLOW RATE**

Desalted water 10-30 nm3/day\*\*

\*\* based on salt percentage in oil

**3.5 Equipment Data**

**TANKS/HEATERS**

**№ DESCRIPTION**

T-101 **Oil tower**

Dimensions: 1219 mm OD. x 18288 mm

S/S w/2:1 S.E. Top and 2438 mm bottom section, Rated pressure: 5.3 bar int. pressure at 371°C Material: SA-516-70

Number of plates: 22 + plate with pipe duct for gas passing 2 - 18" (457 mm)

T-102 **Diesel fuel stripper**

Dimensions: 762 mm OD. x 5944 mm S/FF and 1829 mm bottom section

Rated pressure: 5.3 bar int. pressure at 316°C Material: SA-516-70

Number of plates: 61 - 18" (457 mm)

V-101 **Distillate collector**

Dimensions: 1219 mm OD. x 2438 mm S/S

w/324 mm OD. x 762 mm Boot

Rated pressure: 5.3 bar int. pressure at 121°C Material: SA-516-70

1 - 18" (457 mm)

V-102 **Electric desalting unit**

Dimensions: 1981 mm OD. x 2438 mm S/S Rated pressure: 16.2 bar int. pressure at 149°CMaterial: SA-516-70

1 - 18" (457 mm)

II-101 **Oil heater**

Power: 2.329 mm kcal/h (2,7 MW)

Type: Vertical cylinder with radiant and convective parts

Fuel: Natural gas (combustion control system is on) or residual oil

**JACKET AND TUBULAR HEAT-EXCHANGERS**

E-101 **Cold residues /oil**

Type: BEU

Power: 0.257 mm kcal/h (298.4 kW) Dimensions: 330 mm OD x 6096 mm

Area: 53.1 M2

E-102 А/B **Diesel fuel + reflux /oil**

Type: BEU

Power: 0.469 mm kcal/h (545 kW) Dimensions: 330 mm OD x 6096 mm

Area: 106.1 m2

E-103 **Hot residues /oil**

Type: BEU

Power: 0.215 mm kcal/h (250 kW) Dimensions: 330 mm OD x 6096 mm

Area: 53.1 m2

E-104 **Exchanger of desalted water**

Type:

Power: 0.04 mm kcal/h (46.4 kW) Dimensions: 60 mm OD x 4877 mm

Area: 2.4 m²

E-106 **Partial residues/oil**

Type: BEU

Power: 0.215 mm kcal/h (250 kW) Dimensions: 330 mm OD x 6096 mm

Area: 53.1 m2

**AIR COOLERS**

АC-101\* **Partial condenser**

Power: 1.821 mm kcal/h (2.1MW) Air rated temperature: 35°C, Output temperature: 49°C

АC-102\* **Diesel fuel cooler**

Power: 0.11 mm kcal/h (127.7MW) Air rated temperature: 35°C, Output temperature: 49°C

\* Combined into one unit.

**PUMPS AND COMPRESSORS**

P-101 A/B **Oil and booster pump**

Type: Vertical in-built centrifuge.

Power: 27,0m3/h at 11.0 bar AP

Motor: 14.9 kW

P-102 A/B **Oil residue pump**

Type: Vertical in-built centrifuge

Power: 12.3 m3/h at 12.0 bar

Motor: 14.9 kW

P-103 A/B **Diesel fuel pumps**

Type: Vertical in-built centrifuge

Power: 15.0 m3/h at 6.0 bar AP

Motor: 7.5 kW

P-104 A/B **Reflux pumps**

Type: Vertical in-built centrifuge

Power: 46.5 m3/h at 13.0 bar AP

Motor: 18.6kW

P-105, P-106 **Inhibitor pump**

Type: Diaphragm

Power: 1.6 l/h at 20.6 bar AP

Motor: 0.25 kW

P-107 **De-emulsion pump**

Type: Diaphragm

Power: 1.6 l/h at 20.6 bar AP

Motor: 0.25 kW

P-108 A/B **Desalted water pump**

Type: Centrifuge

Power: 2.1 m3/h at 11.1 bar AP

Motor: 2.2 kW