Brief Study About

DUKAN REFINERY

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Dukan refinery (first stage) was designed to Refine 20,000$PSD of the Taq taq crude oil construction started end of 2013.

The unit and utilities designed and executed by (PROKOP ENG AND TECHNOEXPORT)

The unit is compact and easy operable, designed with up to date technology and according to ASME, API and ASTM standards.

The refinery has one of the best economical design efficiency by pre-heating the crude oil through series of heat exchangers (10) before main heater which absorbed all produced heat from products and the temperature of the crude will reach to 237 C so that effect on the size of the main heater and reduction of fuel consumption although the products will be cooled by series of air coolers and that leads to reduction of water consumption.

The (DCS) control system designed according to most modern technology, unit and utilities will be controlled automatically through the control room.

The refinery consists of the following units:

1. Atmospheric distillation crude unit (20000) B/D
2. Electrical power generation station of total capacity of 6 MW
3. Nitrogen planet and instrument air
4. Waste water treatment in unit accordance with (EPA) requirement
5. River intake unit
6. Raw water filtration unit
7. Cooling tower

8. Water treatment unit
9. Boiler feed water treatment unit (softener)

10. Steam generation unit consist of two boiler 10 Tons/H capacity each at 10 Bar

11. Chemical treatment unit

12. Firefighting center:

-Firefighting truck (water and foam)

- (31) Hydrants

-Two main pumps

13. Unloading terminal

Capable of unloading 20000 B/D of crude oil in 10 hours, consist of seven truck bays that can be utilized at same time.

The terminal is supplied with a computerized weighting balance.

14. Loading terminal

Capable of loading seven trucks at the same time by different products from a central computer room controlling quantities to be loaded

15. Three tanks fixed roof each of 3000,000 liters with total capacity of 9000,000 liters

16. Eight fixed roof tanks for the final products (Naphtha, Kerosene, Light gasoil, Heavy gasoil and fuel oil) Tanks capacity ranges from 1000 cubic meter to 2000 cubic meter.

17. Central control with up to date computerized (DCS) system

18. Laboratory: Consist all necessary instruments for different products testing.

19. Warehouse

The produced products specifications are in accordance with Iraqi requirement and International standards.

PROCESS DESCRIPTION

GENERAL

The Unit is compact and easy operable with high efficient one route heat exchanging system equipped with the following major equipment: heater, atmospheric and side products stripping column, naphtha stabilizer column, heat exchangers, air coolers, pumps, etc. This technical solution enables, under dry conditions, the production of required products and high flexibility of the Unit. The obtained products are as follows: LPG, Stabilized Naphtha, Kerosene, Light Gas Oil (LGO), Heavy Gas Oil (HGO) and Reduced Crude. The total naphtha cut is drawn-off from top of atm. column. After the stabilization (LPG production) is sent with other products to PU 12 – Products Tank Farm. Heater is two passes vertical bottom fired type consisting of the convection and radiation section provided with oil/gas natural draught burners. Likewise, the steam super heater and soot blowers are parts of a heater. Decoking system is provided for heater steam-air decoking.

Columns contain the following GTC internals type: C01 - GT-mFIX TM Valve type trays C02 - GT-mFIX TM Valve type trays C03 - GT-PAK TM Structured Packing C04 - GT-mFIX TM Valve type trays

UNIT CAPACITY, OPERATING FACTOR, FLEXIBILITY

The Crude Distillation Unit is designed for processing of 20 000 BSPD of Iraq Taq Taq crude oil. The Unit Operating Factor is 8000 hr/year and the Unit flexibility is 60 – 100 % for Taq Taq crude oil of design capacity.

PROCESS FLOW DESCRIPTION

Crude oil is taken by gravitation flow from PU 11 – Crude Tank Farm, by means of pump 02-P01 is fed to the one route heat exchanging system, where it is preheated in the train of exchangers 02-E01, 02, 03, 04, 05, 06, 07, 08 and 09 to temperature 237°C. With this temperature, it is entering the heater H01, where is further heated, vaporized and fed with temperature 334°C to the Atmospheric Column 02-C01, where fractionation of crude takes place. Naphtha leaves column via the column top, Kerosene, Light Gas Oil and Heavy Gas Oil as side products and Reduced Crude is drawn off from tower bottom.

Liquid from flash zone flows through five stripping trays in the bottom section of the atmospheric column. Stripping steam is injected to increase vaporization and reduce volatile content of liquid and in this way to remove lighter constituents. The system operates with pressure 1.3 – 1.65 kg/cm2 g and total condensation. Naphtha, after condensation in air and water cooler 02-A01, 02-W01 is accumulated in vessel 02-D01, from where it is fed by means of pump 02-P02 to the heat exchanger 02E10 and through the control valve of the vessel 02-D01 level control to Stabilizer 02-C04. Side products of the atmospheric column: Kerosene, LGO and HGO are at first stripped by steam in columns 02-C02/1, C02/2 and 02-C03 under level control where they are individually steam striped to remove dissolved lighter components which are returned to the column. By means of pumps 02-P05, 02-P06 and 02-P07, they are then fed to the heat exchanging system, where they are used for crude preheating and after cooling – down in the appropriate air and water coolers, they are sent to PU 12 – Products Tank Farm. Reduced crude, after stripping by steam in the tower 02-C01 bottom section area, is at first fed, by means of pump 02-P08, to the heat exchanging system and after cooling in air cooler 02-A06 it is sent to the PU 12. Heat balance of atmospheric column and economy of process is secured by side and top pump around (pumps 02-P03 and 02-P04) used to heat re boilers of stabilizer and to preheat crude in the one route heat exchanging system. The Stabilizer column 02-C04 operates with a pressure 8.8 – 9.1 kg/cm2 g. Stabilized Naphtha is drawn off from the column bottom and after heating of stabilization feed, in exchanger 02-E10, is fed to the air cooler 02-A02 and water cooler 02-W03 under a level control to the PU 12. The

Stabilizer re boiler 02-E11 is heated by Side P. A. of atmospheric column 02-C01. LPG vapors are leaving the Stabilizer 02-C04 via its top. After condensation in the condenser 02-W02, they are accumulated in the reflux drum 02-D02 and the part is pumped by means of pumps 02-P09 back to the column top and the other part is pumped through water cooler 02-W07 under level control to PU 13 – LPG Tank Farm.

The atmospheric heater 02-H01 is fuel oil/fuel gas up–fired with natural draught burners. Fuel oil is fed to the burners directly from a designed PU 21 – Fuel Oil System. Fuel gas is fed to the burners through the Fuel Gas K.O. Drum 22-D01 as a fuel gas from designed PU 22 – Fuel Gas System and as an off gas from the stabilizer reflux drum 02D02. The decoking drum 02-D04 is installed for intermittent decoking operation of Heater 02-H01. The Heater H01 preheats finally crude oil in convection and radiation section. The convection section is used also for preheating striping steam.

PROCESS VARIABLES

General

Both, satisfactory operation of the plant and the preserving of the equipment full performance depend to a great extent upon the care the Operators will show to the entire system. There are, however, certain rules which are to be applied with particular frequency and care in order to ensure smooth operation as well as a production in line with the foreseen quantities and characteristics. The basic process variables for the distillation unit are as follows:

- column pressure - column feed temperature - column reflux and pumparounds

- column stripping steam - column product withdrawal

When assessing the effects brought about by the modification of a process variable, it ought to be taken into account that each variable exerts some influence on the others and is, in run, affected by them. Needless to say, therefore, that every single move is to be planned carefully, after appreciating its possible effect on the overall balance of the system.

Column Pressure

Pressure is the prime distillation variable. Pressure affects condensation, vaporization, temperatures, composition of volatile components and almost any process that takes place in the column. An unsatisfactory pressure control often implies poor column control. Most of distillation columns, including all columns in this unit, are designed to operate at constant pressure. It means that maintenance of constant pressure is a question of column stability. Failures of pressure (pressure fluctuating) as well as feed temperature negatively influence column operation and balance of whole column. Constant pressure within the column is maintained by means of non-condensable gasses from reflux drum restriction in case of C01 and C04 columns. The columns C02 and C03 are actually part of the column C01. They have the same pressure as column C01. In case of column system C01 (and its auxiliary column C02 and C03), there is additionally introduce inert gas - nitrogen to the OVHD receiver drum D01 in order to maintain pressure above vapor pressure because sub-cooling is expected there. Concerning to relation of pressure level and distillation efficiency, the pressure within the columns can affects the column fractionation efficiency. Generally, lower pressure means a better condition for distillation. However, other column pressure then designed, can give rise to problem with off gasses (pressure must be sufficient bring the off gasses to distribution systems – flare, fuel gas), with discharge pressure product pumps (lower suction pressure means lower discharge pressure), etc. If some pressure change is required, must be performed carefully and slowly. Sudden pressure drop can induce the foaming of liquid holding on the trays, down-comer and column bottom.

Column Feed Temperature

The Atmospheric Tower C01 is un-reboiled type of column and only one source of duty delivered to the column is duty supplied by means of the feed temperature. This temperature, especially to the column C01, largely affects the internal liquid/vapor countercurrent flow above the feed inlet. Increasing of the feed temperature will increase column internal flow in general and it means increasing of the fractionation efficiency finally.

The higher feed temperature, of course, means the higher utilities consumption for heating of feed and cooling of column head. At temperatures about 360°C and higher can also means essential increasing of the light non-condensable hydrocarbons created by cracking. The lower feed temperature means decreasing of the internal flow and downgrade of product parameters. The low internal flow can be monitored on the color of column C01 side products, especially HGO. Column C04 is reboiled and is not so sensitive on the feed temperature but in case of lower temperature there must be sufficient over-design of the reboiler to recharge of the absent heat and over-design of column stripping part (bellow feed) because of presents of a higher quantity of lighter fractions in this part of column.

Column Reflux and Pump rounds

Vapor reaching the top of the column is cooled and condensed to liquid in the overhead condenser. Part of this liquid is returned to the column as the reflux to provide liquid overflow. This overall flow pattern in a distillation column provides countercurrent contacting of vapor and liquid streams on all the trays through the column. Increasing of reflux or pump around refluxes will tend to increase of fractionation efficiency under them (increasing of countercurrent vapor/liquid overall flow) and decrease of fractionation efficiency above them (decreasing of countercurrent vapor/liquid overall flow). For reflux increasing, in order to fractionation increasing, there must be safe sufficient heating-up of column feed or bottom by means of boiler or heater to avoid cooling-down the overall column and lightening of all products under the reflux. In the case of decreasing of reflux, in order to optimization of distillation process, the care must be taken to tray draying-up (temperature of draying trays are close – theoretically equal).

Column Stripping Steam

Superheated low pressure steam is used to recover the light components from the side and bottom products of Atmospheric Tower C01. The flash point and viscosity of the stripped products can be adjusted by varying the stripping steam rate. Increasing of stripping steam rate will tend to increase the flash point as well as viscosity and vice versa.

Column Product Withdrawal

The side column products withdrawal from the Atmospheric Tower C01 is regulated by the stripper's bottoms C02 and C03 level control loops and the final stripped products are sent to the storage under flow control. Attention shall be paid varying the products flow rates that means increasing or decreasing the fractionation efficiency between two nearby side products. This operation results in a different internal reflux (column internal flow) on the trays below the withdrawal nozzles and in different withdrawal products distillation curves and properties.