Process Description For Regeneration Area CCR Regeneration Section

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1. Introduction

Pars Petrochemical Company intends to build a propane Dehydrogenation (PDH) plant to produce 600 KTY propylene polymer grade based on UOP Oleflex technology in Pars south Special economic energy zone (PSEEZ), Asalouyeh , Bushehr Province, Iran.

EPCC contractor for PDH plant: Panah Sanat Part Co., and BINA Co. Consortium.

The plant consists of several main process units, including Feed Treatment, Dehydrogenation reactor CCR, Distillation, Hydrogenation reactor, refrigeration, Merox, utility, tankage, …

1.1. Terms and Definitions

PROJECT:	Propane Dehydrogenation Plant (PDH)
Contract Number:	39-402/685
OWNER:	Pars Petrochemical Company
MC:	Aria Pishro Gharn
CONTRACTOR:	Panah Sanat Part Co. and BINA Co. Consortium
PDP	
BASIC DESIGNER:	Sinowey Engineering Technology Co., Ltd
Third Party Inspection	-
SITE:	Pars south Special economic energy zone (PSEEZ), Asalouyeh Bushehr Province, Iran.
SUBCONTRACTOR:	Organization/Party that CONTRACTOR hires to do a part of the WORK
GOODS:	Any and all equipment machinery, apparatus, material, and other PROJECT commodity described in the contractor's contract.
VENDOR:	Any manufacture/supplier selected by OWNER/CONTRACTOR to supply the GOODS

MANUFACTURER: Any Company selected by OWNER/CONTRACTOR to fabricates GOODS according to the purchase order placed with the CONTRACTOR.

Shall: Indicates mandatory requirements to be strictly followed.

Should: Indicates that through several possibilities, one is recommended as practically suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required. Other possibilities may be applied subject to OWNER approval.

May: It is used where a provision is completely discretionary

1.2 Scope of Document

The document is to describe the Regeneration Area CCR Regeneration Section process of the Plant.

2. Description

2.1 3981400-110-01 Process Flow Diagram- Regeneration Tower

The main function of catalyst regeneration unit is regeneration and circulation of catalyst. The deactivated catalyst is lifted from the Intermediate Disengaging Hopper (81-V-312) of the regeneration unit in the reaction unit to the Disengaging Hopper (81-V-413) of the catalyst regeneration unit, and the elutriated gas in the disengaging hopper carries the catalyst dust to the Dust Collector (81-W-403). The dust collector filters the catalyst dust through the filter bag, and the filtered catalyst dust is discharged into the Fines Collection

Pot (81-V-420) and finally into the drum for catalyst fines, and the dust and debris are collected to recover the precious metal platinum of the catalyst. Part of the filtered elutriation gas is sent to the hopper through the Fines Removal Blower (81-F-404) for use as elutriation gas. The other part of elutriation gas is pressurized by the Lift Gas Blowers (81-F-405A/B) and sent to Lift Engager No.4 (81-V-309) in the regeneration section of the reaction area for use as lift gas. The outlet of the Lift Gas Blowers (81-F-405A/B) adjusts the pressure through the pipeline where the Lift Gas Blower Spillback Cooler (81-E-403) is located.

The undamaged catalyst enters the Regeneration Tower (81-R-401) under the action of gravity flow. In the upper combustion zone of the Regenerator Tower(81-R-401), the catalyst is sent to the air of the regenerator tower through the Upper Regeneration Blower (81-F-401) for combustion, removing carbon, hydrogen, sulfur and other components from the catalyst surface. The burned regeneration gas is cooled by the Upper Regeneration Cooler (81-AE-402) and enters the inlet of the Upper Regeneration Blower(81-F-401). The outlet gas of the upper regeneration blower is heated by the Upper Regeneration Heater (81-EH-402) before entering the regeneration tower to complete the regeneration gas cycle. In the lower combustion zone of the regeneration tower, the catalyst is sent to the air of the regeneration tower for combustion through the Lower Regeneration Blower (81-F-402), further removing carbon, hydrogen, sulfur and other components from the catalyst surface. The burned regeneration gas is cooled by the Lower Regeneration Cooler (81-AE-403) and enters the inlet of the lower regeneration fan. The outlet gas of the lower regeneration blower is heated by the Lower Regeneration Heater (81-EH-403) before entering the regeneration tower to complete the regeneration gas cycle. The catalyst after combustion flows to the lower part of the regeneration tower by gravity flow. The regenerated gas cooled by the Cooling Zone Cooler (81-AE-401) is injected into the lower part of the regenerator tower to cool the catalyst.

The chlorine provided by the Chlorination System (81-W-301) is injected into the outlet of the Air Heater (81-EH-401) and the outlet pipeline of the Upper Regeneration Blower(81-F-401) through the Chlorination Zone Chlorine Eductor (81-J-401) and the Burn Zone

Chlorine Eductor (81-J-402), respectively. Chlorine containing gas is injected into the regenerator tower to redistribute platinum in the catalyst to prevent platinum agglomeration and remove water generated by coke burning. Chlorine is injected into the chlorination zone at a required chlorine injection rate between 0.6 and 0.8 wt% of the catalyst cycle.

The air further dehydrated by the Air Drier (81-W-404) is injected into the inlet pipelines of the upper and lower regeneration blowers, as well as the inlet of the air heater, to supplement the oxygen in the Regeneration Tower(81-R-401). After being pressurized by the CoolerBlower (81-F-403), the air is injected into the Cooling Zone Cooler(81-AE-401), upper regeneration cooler, and lower regeneration cooler as the cooling medium. The air filtered by the regenerator air filter is injected into the regeneratin tower to remove excess chlorine from the catalyst, and the enters the Vent Gas Treating System (81-W-402) for treatment. The Regenerant Heater(81-EH-403) is only used when start-up. In normal operation, the regeneration gas is circulated through the Regenerant Cooler(81-AE-403) to remove the heat of combustion. The regeneration Cooler Blower (81-F-403) is used to circulate air through the Regenerant Cooler(81-AE-403) to remove heat. The concentration of oxygen in the Regeneration Tower(81-R-401) is controlled by venting the Regeneration Tower(81-R-401)discharge gas to avoid high temperatures, which can damage the catalyst. The more regeneration gas is emitted, the more air (oxygen) should be drawn from the dry zone.

Chlorine is involved in the catalyst regeneration process. And it will generate toxic, harmful, and highly corrosive media such as hydrogen chloride. Therefore, the regenerated vent gas discharged from the system needs to be treated to meet the standards before it can be discharged into the atmosphere. The Vent Gas Treatment System (81-W-402) removes HCl, Cl2 and SO2 from the regenerator exhausted vent gas by circulating sodium hydroxide solution and sodium sulfite solution.The gas is then washed and treated, and the qualified gas after treatment is discharged into the atmosphere.

The regenerator starts with "black burning" and "white burning" is the normal operating mode.

As the instrument air valves are opened and the Regeneration Tower(81-R-401) is transitioned from Black Burn to White Burn, the temperatures in the Chlorination Zone should be monitored closely. The Regeneration Tower(81-R-401) will go to a cold shutdown if the temperature differential between the Air Heater outlet and any of these seven thermocouples exceeds a preset value, initially set at + 10° C.

Once all nitrogen flow to the Chlorination Zone is stopped and only instrument air is flowing to the Chlorination Zone, the Regeneration Tower(81-R-401) is in White Burn Mode of operations. The nitrogen push button can be depressed to close nitrogen valve. The upper air push button can also be depressed to close the upper air valve.

2.2 3981400-110-02 Process Flow Diagram- Regenerated Catalyst Transport

Once the carbon on the catalyst is burned off in the Regeneration Tower(81-R-401), the catalyst enters the Flow Control Hopper (81-V-414) by gravity. The overall catalyst circulation rate is controlled by the frequency of loading and unloading of the flow control hopper. This rate is achieved by a timer by controlling the opening and closing of valves above and below the flow control hopper. The catalyst exits from the Flow Control Hopper (81-V-414) and flows into the Surge Hopper (81-V-415), which allows for buffering and irregularities in the catalyst flow through the loop. Surging occurs as the reactor lifters circulate and deliver their respective catalysts.

In addition, surge hoppers containing inert nitrogen environments are monitored for testing possible hydrogen or hydrocarbon contaminants. A water cooling coil is provided inside the surge hopper to cool the regenerated high temperature catalyst to avoid damaging the various valves in the catalyst delivery line. The catalyst flows from the surge hopper into the Lock Hopper No.2 (81-V-416), where the nitrogen and oxygen environment from the Regeneration Tower(81-R-401) is removed from the catalyst, and the environment (of the catalyst) changes to a hydrogen environment. The catalyst then flows by gravity to Lift Engager No. 5 (81-V-417), where it is lifted back to the top of reactor No.1 using high purity hydrogen from the Hydrogen Purification System(81-W-106)) while controlling the catalyst level at the top of Reactor No.1(81-R-101) .

At the top of Reactor No.1(81-R-101), the catalyst enters the upper part of the reactor, also known as the reduction zone. In the reduction zone, the platinum on the catalyst changes from an oxidized state to a reduced state by reacting with high-temperature hydrogen (due to the combustion of carbon in the regeneration column). The platinum on the catalyst must be in the reduction state for optimal dehydrogenation performance. In addition, the catalyst is heated to minimize temperature cycling at the top of the reactor internals, which occurs when the catalyst is removed. High purity hydrogen from the Hydrogen Purification System (81-W-106) is heated with a Reduction Gas Heater (81-EH-301) to change the catalyst from an oxidized state to an active reduced state and is used to heat the catalyst.

The fresh catalyst is replenished to the buffer hopper through the Catalyst Addition Hopper (81-V-418) and the Catalyst Addition Lock Hopper (81-V-419).

The Catalyst Addition Hopper System is used to add catalyst to the process.

Catalyst Addition Load and Unload Field Switch Positions The operator adds catalyst using the Catalyst Addition Hopper Load and Unload positions on the field switch located in the Field Control Station Moving the field switch to the Load position loads the Catalyst Addition Hopper with catalyst. Moving the field switch to the Unload position unloads the catalyst from Catalyst Addition Hopper to the Surge Hopper.