Process Description For Reactor Area CCR Regeneration Section

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Page	Revision								Page	Revision								Page	Revision							
	00	01	02	03	04	05	06	07		00	01	02	03	04	05	06	07		00	01	02	03	04	05	06	07
1	✓	✓	✓						37									73								
2	✓	✓	✓						38									74								
3	✓	✓		✓	✓				39									75								
4	✓	✓							40									76								
5	✓	✓		✓	✓				41									77								
6	✓	✓	✓	✓	✓				42									78								
7	✓	✓							43									79								
8	✓	✓		✓	✓				44									80								
9									45									81								
10									46									82								
11									47									83								
12									48									84								
13									49									85								
14									50									86								
15									51									87								
16									52									88								
17									53									89								
18									54									90								
19									55									91								
20									56									92								
21									57									93								
22									58									94								
23									59									95								
24									60									96								
25									61									97								
26									62									98								
27									63									99								
28									64									100								
29									65									101								
30									66									102								
31									67									103								
32									68									104								
33									69									105								
34									70									106								
35									71									107								
36									72									108								

TABLE OF CONTENTS

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 Reactor Area CCR Regeneration Section process of the Plant.

2. Description 3981300-110-01 Process Flow Diagram-CCR Regeneration Section Auxiliary Equipment

The function of the reactor regeneration unit is mainly to realize the circulation of catalyst between reactors. The control of this circulation is realized through CRCS system.

PSA hydrogen gas from outside the boundary, except for a portion sent to the separation unit, the rest enters the Purge Gas Heater (81-E-301) for heating, and then divided into three streams: one stream is sent to four reactors as the purge gas of center cylinder, the other stream is sent to the Lock Hopper No.2 (81-V-416) and Lift Engager No.5 (81-V-417)of CCR regeneration unit as the purge gas and lift gas, and the other stream is sent to

the Reduction Gas Heater (81-EH-301), the Reactor Surge Pot Heater No 2~4 (81-EH-302-303-304), and the Sulfur Strip Heater (81-EH-305). Reduction Gas Heater (81-EH-301) provides reduction hydrogen for the reduction buffer zone of the reactor and reduces the oxidized catalyst to the reduced state. Reactor Surge Pot Heater No 2 ~ 4 (81 - EH - 302-304) provide for the buffer zone preheating hydrogen, preheat catalyst, to prevent the low-temperature catalyst from entering the reactor and causing radial stress to damage the catalyst screen mesh, Sulfur Strip Heater (81-EH-305) is used to provide purge gas for the desulfurization zone and remove excessive hydrogen sulfide in the catalyst.

After the net gas from the separation system is heated by CCR Gas Heater (81-E-302), there are two destinations: one is the carrier gas enters the hot combined feed exchangers(This dry gas, as the carrier gas, was injected together with DMDS into the outlet of the first reactor(81-R-101) and the inlet and outlet of the heat combined exchanger(81-E-101A/B/C/D), thereby achieving a sulfur content of 50-60 ppm mol% in the reaction effluent.); The other is to enter the collectors No. 1 ~ 4 (81-V-301, 303, 305, 307) and lift engagers No. 1 ~ 3 (81-V302, 304, 306) separately as blowing gas and lift gas. There is a bypass between Reduction Gas Heater (81-EH-301) and CCR Gas Heater (81-E-302). At the initial stage of start-up, dry gas fails to meet the feed requirements of PSA system, so qualified PSA hydrogen can not be produced for the system to use. This bypass can be opened before the PSA system produces qualified hydrogen to temporarily replace PSA hydrogen with dry gas before CCR Gas Heater (81-E-302) for use.

2.2 3981300-110-02 Process Flow Diagram- CCR Regeneration Section Inter-Reactor Catalyst Transport

The regenerated catalyst is lifted to the reduction section of the Reactor No.1(81-R-101) by the Lift Engager No.5 (81-V-417) of CCR regeneration unit, and reversely contacts with the high-temperature hydrogen from the Reduction Gas Heater (81-EH-301), so that the catalyst changes from oxidation state to active reduction state, and preheating is realized. The preheated catalyst enters the annular space formed by the inner and outer nets of the

reactor under its own gravity, and contacts with the materials to realize the catalytic dehydrogenation reaction.

The reacted, partially coked catalyst flows by gravity from the bottom of each reactor to its respective catalyst collector (Catalyst Collector No.1 (81-V-301) is below Reactor No.1 (81-R-101), Catalyst Collector No.2 (81-V-303) is below Reactor No.2 (81-R-102), Catalyst Collector No.3 (81-V-305) is below Reactor No.3 (81-R-103), and Catalyst Collector No.4 (81-V-307) is below Reactor No.4 (81-R-104)).Here, the catalyst is cooled to avoid damage to the various valves in the catalyst delivery line and the hydrocarbons are swept away with a purge of net gas from the separation system and heated in the CCR Gas Heater(81-E-302). The catalyst is then transported by gravity through a valved catalyst delivery line from Reactors No.1 to No.3(81-R-101~103) to the lift engager (Lift Engager No.1 (81-V-302) is below Reactor No.1(81-R-101), Lift Engager No.2 (81-V-304) is below Reactor No.2(81-R-102), and Lift Engager No.3 (81-V-306) is below Reactor No.3(81-R-103)). The catalyst is pneumatically lifted from each lifter to the top of the next reactor with net gas from the Separation System(81-W-104). The catalyst is lifted when the catalyst level at the top of the next reactor drops.

At the top of each reactor, the catalyst enters the upper part of the reactor, called the buffer tank. In the buffer tank, the catalyst is heated to minimize temperature cycling at the top of the reactor internals, which occurs when the catalyst is removed. The high purity hydrogen from the Hydrogen Purification System(81-W-106) is first heated in the Purge Gas Heater (81-E-301) and then heated in the electric heaters in each reactor (Reactor No.2 Surge Pot Heater (81-EH-302), Reactor No.3 Surge Pot Heater (81-EH-303), and Reactor No.4 Surge Pot Heater (81-EH-304)) for the purpose of heating the catalyst. The high temperature hydrogen stream from the Sulfur Strip Heater (81-EH-305) also enters the upper section of the Catalyst Collector No.4(81-V-307) to remove sulfur of the catalyst.

Catalyst from Catalyst Collector No.4 (81-V-307) below Reactor No.4 (81-R-104) flows into Lock Hopper No.1 (81-V-308) rather than directly into the lift engager. This is done so that the catalyst is purged with nitrogen in a lock hopper to remove hydrogen and hydrocarbons before being transported to the regeneration section. After blowdown, the

catalyst in the Lock Hopper No.1 (81-V-308) flows in batches into the Lift Engager No.4 (81-V-309), which is controlled by controlling the level at the top of the downstream Intermediate Disengaging Hopper (81-V-312).

The transfer of catalyst from the reactor section to the regeneration section and back again is the main feature of the equipment within the reactor section of a continuous catalyst regeneration (CCR) unit. A network of interconnected vessels can safely and fully control the transfer of catalysts from the reactor section in a hydrogen and hydrocarbon-rich environment to the regeneration section in an oxygen-containing environment.

2.3 3981300-110-03 Process Flow Diagram-CCR Regeneration Section Intermediate Disengaging Hopper

Catalyst from Reactor No.4 (81-R-104) is pneumatically lifted from Lift Engager No.4 (81-V-309) through an Intermediate Disengaging Hopper (81-V-312) to a Disengaging Hopper (81-V-413) at the top of the Regeneration Tower(81-R-401), and the lift gas comes from a Lift Gas Blowers (81-F-405A/B).

A.hoseingoo:(8/30/2025)
Should be revised to 81.

From the Intermediate Disengaging Hopper (81-V-312), the catalyst is sent to the Disengaging Hopper (85-V-413) of CCR regeneration unit from the bottom, and the gas phase with powder at the top enters the Dust Collector (81-W-403) of CCR regeneration unit.

The lift air for the lower section “L” lift of the Disengaging Hopper(81-V-413) also comes from the Lift Gas Blowers (81-F-405A/B).

Primary air flow control: put into use first in the manual state, adjust to the appropriate position, put automatic, after smooth put the string level.

Secondary air flow control: The measured OP value of the disengaging hopper level controller LIC is compared to the OP value of the CRCS system climbing material level for lower selection to adjust the secondary air flow.