

PROJECT REPORT (PR-020)

GAS PLANT FRACTIONATION UNIT REVAMP WITH AMT'S ADV PINNACLE PERFORMANCE TRAYS WITH DOWNCOMER DISTRIBUTOR

Customer: Major Oil and Gas Company in Asia

Project: Gas Plant Revamp

Date of Revamp: June, 2008

BACKGROUND

AMT designed and installed ADV Pinnacle Performance Trays with the innovative Downcomer Distributor (Please see *Technical Bulletin: Downcomer Distributor with ADV Pinnacle Performance Trays*) in both the LPG and Depropanizer (DeC3) Columns of a Gas Plant. A Performance Test Run (PTR) was conducted over a period of 4 full days in July of 2008 (After Revamp). The results from a prior PTR by the plant (Before Revamp) were used to benchmark quantitative performance improvements.

REVAMP OBJECTIVES

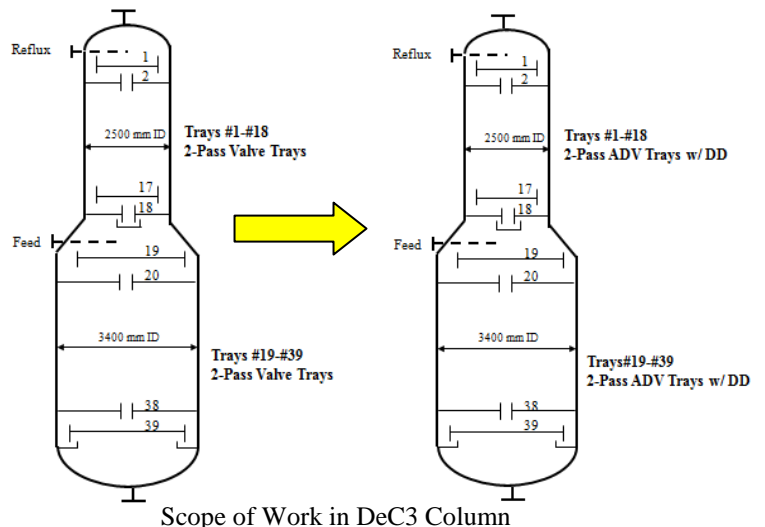
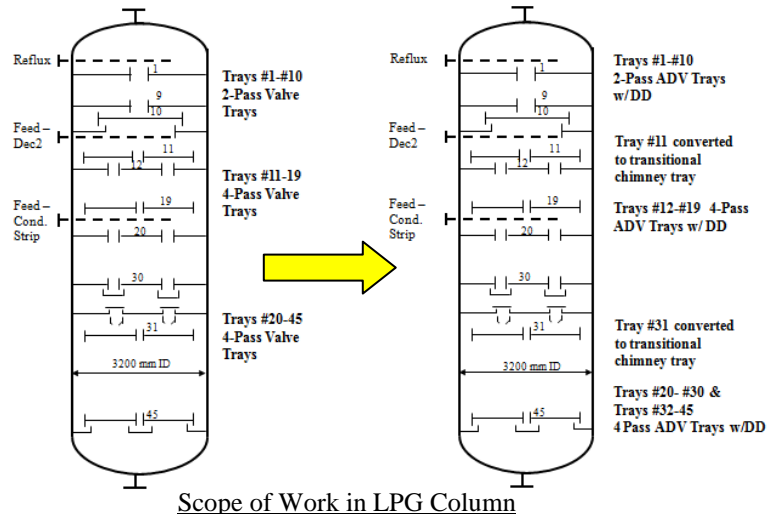
The general project objectives were to:

1. Increase the liquid handling and rich gas processing capabilities;
2. Improve the production quality and recovery of on-spec propane (C3), butane (C4), and condensate products (C5+), while meeting the product specifications; and
3. Derive value creation based on targeted incremental propane and butane production rates.

COLUMN PERFORMANCE

C3 and C4 Production Rates:

The performance of the LPG and DeC3 Columns is significantly improved with increased and richer feed gas and feed liquid loading. A summary of the C3 and C4 production rates before and after revamp is shown in the Table 1. The targeted incremental on-spec product tonnages of 1.5 MTon/hr C3 and 2.0 MTon/hr C4 were exceeded and the overall plant recovery of C3 and C4 products was increased.



Description	Units	Before Revamp	After Revamp
Incremental C3 Product Increase	MTon/hr	Base	+2.3
Incremental C4 Product Increase	MTon/hr	Base	+4.2
Overall C3 Plant Recovery	%	89.1	93.5
Overall C4 Plant Recovery	%	81.1	89.4

Table 1. Gas Plant Production Rates



Column/Tray Performance:

Table 2 summarizes specific performance improvements in each column. After revamp, the energy consumption (based on same charge rate) in the LPG Column and DeC3 Columns have been reduced to approximately 77% and 86%, respectively, of that before revamp. This is true even though the product purities are significantly improved after revamp.

One indication of improved tray efficiency is the notable trend of decreased C4 in the bottom Condensate Product during the PTR, which ultimately contributes to a lower Condensate RVP and results in greater C4 product recovery. The average daily Condensate Product RVP is markedly decreased during the PTR and well below the Design Product Specification of 12.04 psia maximum.

The C3 and C4 product specifications were also substantially improved as indicated by the purity of the propane product. C4 was recovered from the propane product to effectively increase the incremental yield of butane product as compared to the prior performance of the column before revamp.

Description	Units	Before Revamp	After Revamp
LPG Column Performance Indicators			
Energy Consumption	%	100	77
Condensate RVP	psia	12.3	10.90
C4 in Condensate	mol %	4.94	2.50
DeC3 Column Performance Indicators			
Energy Consumption	%	100	86
C3 Product:			
C3	mol%	98.29	99.20
C4	mol%	1.4	0.18
C4 Product			
C3	mol%	0.58	0.79
i-C4	mol%	53.2	56.62
n-C4 mol %	mol%	45.3	42.11
C5 mol %	mol%	0.91	0.48

Table 2. Summary of LPG and DeC3 Column Performance Indicators

Tray Efficiency:

After revamp, the tray efficiency of the LPG Column has been increased by approximately 24%, while the tray efficiency in the DeC3 Column is increased by approximately 29%. It is evident that the increase in tray efficiency is a result of the optimal design combination of the Pinnacle Performance ADV Trays with Downcomer Distributor, which achieves uniform plug-flow liquid distribution and optimized/enhanced vapor-liquid contact.

Description	Units	Before Revamp	After Revamp	Efficiency Ratio (After/Before) Revamp
LPG Tray Efficiency	%	63	77	1.24
DeC3 Tray Efficiency	%	77	97	1.29

Table 3. Summary of LPG and DeC3 Column Tray Efficiency

Tray Hydraulic Capacity:

The detailed hydraulic calculations of the PTR cases confirm that the tray operation during the PTR was not hydraulically loaded and well within the broad operating envelope of the new ADV Trays installed in the LPG and DeC3 for the revamp. Additionally, it was calculated that the new ADV Trays with Downcomer Distributor in the LPG and DeC3 columns could handle an additional 25+% increase in feed throughput from that the average feed during the PTR period, contingent on the ability of the existing plant equipment outside of the scope to perform at the increased rate.

CONCLUSIONS

The revamp of the fractionation unit in a large scale Gas Plant with ADV Trays coupled with the Downcomer Distributor technology was very successful. The performance of the LPG Column and Depropanizer Column is significantly improved with increased and richer feed gas and feed liquid loading after the revamp. Improved product specifications signify notable increases in separation efficiency and product recovery in the overall plant, which can all be attributed to the superior separation performance of the ADV Trays with innovative Downcomer Distributor design.