

SUPERFRAC® and NYE TRAYS® Help Increase FCCU Capacity

Customer: Lindsey Oil Refinery
Location: United Kingdom
Tower Names: FCCU Depropanizer, Propylene Splitter

Tower Diameters:
 Depropanizer: 1 700mm/2200mm
 Propylene Splitter: 2204mm

Number & Type of Trays:
 Depropanizer: 40 sieve trays
 Propylene Splitter: 150 sieve trays

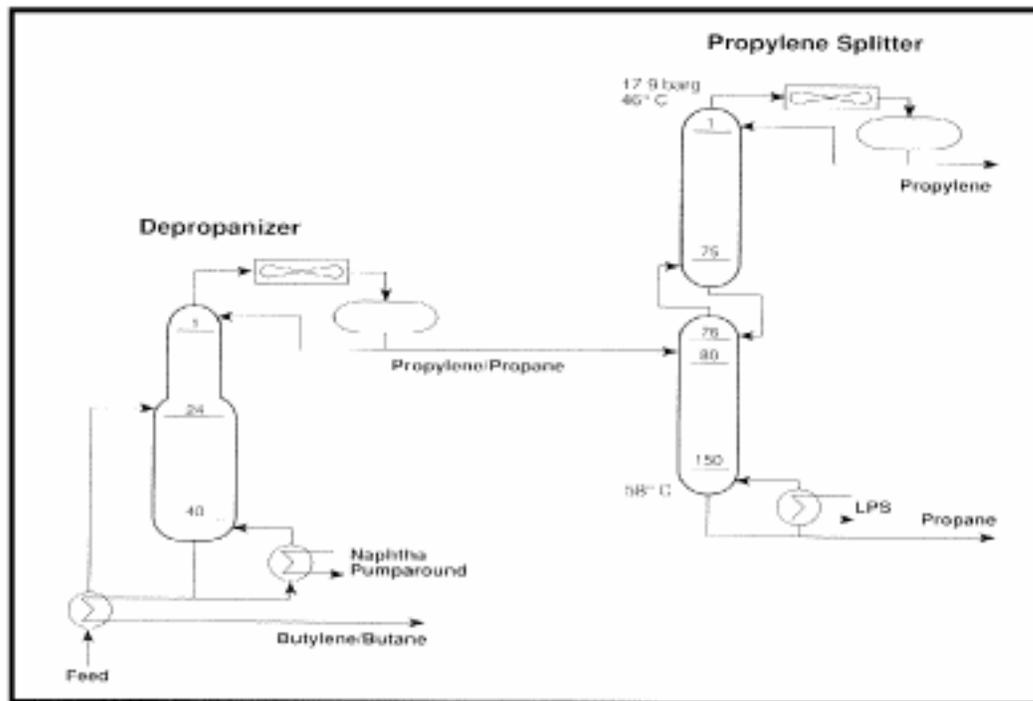
Problem: Due to a capacity-increasing revamp of the Fluidized Catalytic Cracking Unit (FCCU), Lindsey Oil's depropanizer column was unable to handle increased feed rates while maintaining required Reid

vapor pressure (RVP). The propylene splitter capacity was limited by the required product purity specifications.

History: Both columns were installed when the FCCU was constructed in 1981. The depropanizer column takes a feed of mixed LPG from a Merox treating unit. The overhead propylene / propane product, typically 75-80% propylene, is routed via molecular sieve dryers to the propylene splitter for production of 95% pure propylene for sale.

The depropanizer was built with 40 two-pass sieve trays with a liquid feed to tray 24. The top section has 23 trays and a diameter of 1700mm. The bottom section has 17 trays and a diameter of 2200mm.

The propylene splitter consists of one main splitter column built in two sections, followed by treating and drying sections. The 2204mm diameter column was originally constructed with 150 conventional two-pass sieve trays.



The FCCU was originally designed for a feed rate of 25,000 BPSD, but had undergone several revamps, increasing capacity to about 50,000 BPSD. The depropanizer was retrayed in 1985 with improved two pass sieve trays for a design rate of 70 m³/hr, but increasing FCCU feed rates required the column to handle LPG rates of up to 85 m³/hr. The propylene splitter was revamped in 1988 when product specifications were tightened, allowing increased product purity but limiting the column throughput.

Solution: To handle the increased loads and maintain product quality, both columns were retrayed, the depropanizer column with Koch-Glitsch SUPERFRAC trays and the propylene splitter with Koch-Glitsch NYE TRAYS. The NYE TRAYS allowed a one-to-one replacement of existing sieve trays using existing support rings and were considered the most economical choice where a straightforward capacity increase with no sacrifice of purity was the goal. Where both in creased capacity and improved product purity were required, SUPERFRAC trays were used.

	1983	1985	1992
Feed Rate, m ³ /hr	57.8	74.4	77.0
Propylene product, m ³ /hr	25.3	30.0	28.3
Butylene product, m ³ /hr	32.5	44.4	48.7
Reflux rate, m ³ /hr	86.6	91.3	102.6
Reflux ratio	3.4	3.0	3.63
C ₄ + in propylene, mol %	0.4	0.5	0.1
C ₃ - in butylene, mol %	0.3	0.5	0.2

Results: In the depropanizer, the product splits at the new feed rates are even better than design. Tray efficiencies have been calculated to be greater than 90%. The new trays will also allow for future increases in LPG production.

The propylene splitter has been operating at or above design tray loadings while maintaining design specifications. Product purities and recoveries achieved indicate that actual tray efficiencies are comparable with design.

The increase in column capacities and improvements in fractionation have allowed a significant increase in FCCU throughput. Column capacities have been effectively doubled since original construction while achieving better-than-design fractionation.

On Stream: Spring, 1992.

	1983	1990	1993
Feed Rate, m ³ /hr	12.07	17.3	24.0
Propylene product, m ³ /hr	8.05	13.2	19.6
Propane product, m ³ /hr	4.02	4.1	4.4
Reflux rate, m ³ /hr	160.0	141.6	220.4
Reflux ratio	19.9	10.7	11.2
Feed purity, wt %	73.0	76.0	78.0
Propylene purity, wt %	98.8	96.3	94.2
Propylene recovery, wt %	90.2	95.0	98.1