Chemistry and Technology of Fuels and Oils, Vol. 46, No.6, 2011

EXPERIENCE IN MODERNIZING A PROPANE-PROPYLENE FRACTION SEPARATION PLANT

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Two process streams in a propane–propylene fraction separation plant were modernized at Neftekhimiya Co. As a result of replacing the internal contacts in the towers by valve and centrifugal trays, the output of the towers increased, the quality of separation with production of propylene of 95-98% purity improved, the residual content of propylene in the propane fraction decreased to 7-10%, and the pressure drop in the towers decreased.

Key words: *Petrochemistry, propylene modernization, fractionation, tower equipment, internals.*

Neftekhimiya Co., part of Renova Orgsintez Holding Co., has modernized the existing propane-propylene fraction (PPF) separation plant to expand production of propylene.

Problems of modernization:

• to increase the unit's output to the maximum possible in replacing tower internals;

• to improve the quality of separation with production of 95- and 97%-pure propylene and reduce the residual propylene content in the propane fraction to 10%.

A comprehensive approach was used to solve these problems, consisting of optimization of the process scheme, selection of optimum process parameters (pressure, temperature, load on boilers), use of highly efficient equipment and modern control systems.

A special feature of modernization consisted of replacing only the internals of existing towers with maximum utilization of existing equipment (boilers, condensers, etc.). As a result of a detailed comparative analysis of the internals of different modern domestic and foreign suppliers, high-yield tray equipment developed by Kedr-89 was selected.

Two PPF separation process streams were modernized: in the first stream, the K-110.115 slotted tower, in the second, the K-14 tower. The characteristics of these towers and the process parameters of their operation are reported in Table 1.

A feature of the modernization was the maximum utilization of existing connections and supporting elements of the "old" internals. Process and hydraulic calculations were first performed and engineering designs for replacing the tower internals were developed at Kedr-89 to ensure the required tower operating indexes. As a result, it was proposed that 90 valve trans be installed in tower K-110, 115, and 106 high-efficiency centrifugal

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Neftekhimiya Co. Kedr-89 Co. Translated from *Khimiya i Tekhnologiya Topliv i Masel*, No. 6, pp. 9 – 10, 2010.

0009-3092/11/4606–0375

Table 1

Indexes	PPF separation tower	
	K-110, 115	K-14
Output in feedstock, tons/h	3.07	3.95
Dimensions, m		
height	32.56	64.21
diameter	1.6	1.4
Number of trays	2×45	106
Pressure at top, MPa	1.63–1.9	1.61–1.9
Temperature, °C		
at top	39–45	39–45
at bottom	49–55	48–55

Table 2

Indexes	PPF separation plant after modernization of tower			
	K-110,115		K-14	
	projected	real	projected	real
Propylene content, wt. %				
in propylene fraction	95	96	97	97.5–98
in propane fraction	10	9	10	7–9.55
Reflux flow rate, m^3/h	76–87	85	99–114	84.5–91
Pressure at top of tower, MPa	1.33–1.79	1.58	1.33–1.76	1.51–1.55
Temperature, °C				
at top of tower	32–45	40.3	31–46	38.9–39.7
in condenser	31–44	38.8	31–43	38–38.5
at bottom of tower	44–57	49.9	43–59	47.5–48.5

trays be installed in tower K-14. Most of the existing support elements were used, which reduced the times and laboriousness of assembly work.

Due to the requirement of significantly increasing the amount of feedstock processed with improvement of product quality in modernization of tower K-110, 115, of all the auxiliary equipment, only the boilers could be saved. Reflux condensers, pumping equipment reflux tanks, and an evaporator were replaced in modernizing tower K-14.

The start-up work on bringing the PPF separation plant on line was performed in short times with parallel adjustment of the new system of control and measuring instruments and automatic equipment. The basic results of the process tests performed after startup are reported in Table 2. The basic process parameters and quality of the products of PPF separation correspond to or are better than the rated indexes: the output of the towers increased; the purity of the propylene obtained was 95-98%, and the residual propylene content in the propane fraction dropped to 7-10%; the pressure drop in the towers decreased to 0.08 MPa.

Modernization of the PPF separation plant thus increased productivity and yielded an additional amount of propylene while reducing specific power consumption. The calculated pay-back time for replacing catalytic devices is a maximum of 6 months.