

Case Study

High Temperature Ultipor® HT Filters Protect Catalytic Distillation Unit and Improve Energy Efficiency

The Challenge

Two duplexed Naphtha filters were specified for a refinery in Greece to protect the Naphtha Desulphurization Unit pre-heat exchangers and Catalytic Distillation Column from fouling due to corrosion products and possible FCC catalyst fines in the FCC Naphtha feed. A Reflux filter was also provided to protect the spray nozzles on the Reflux pump. The Naphtha Hydroprocessing Unit is licensed by CD Tech. Refer to Figure 1 process flow diagram for the locations of both the Feed filter and the Reflux filter.

The Naphtha was coming directly from the FCC Fractionator and the operating temperature was relatively high (up to 210°C / 410°F). Specifying high temperature filters was necessary for maintaining energy efficiency and to avoid the need to cool the feed, filter

it, and then reheat the feed prior to the Catalytic Distillation Unit. To cool the feed prior to filtration would likely require significant additional capital expenditures for a cooler, possibly an intermediate storage tank, and associated engineering, pipework, and instrumentation and space.

The project specifications called for disposable filters, but due to the elevated operating temperature, the options for suitable disposable filter elements were somewhat limited.

The AE&C and refinery were considering conventional, generic nominal-rated wound glass cartridges with steel hardware. Pall's challenge was to offer a good technical solution that provided added value to the process.

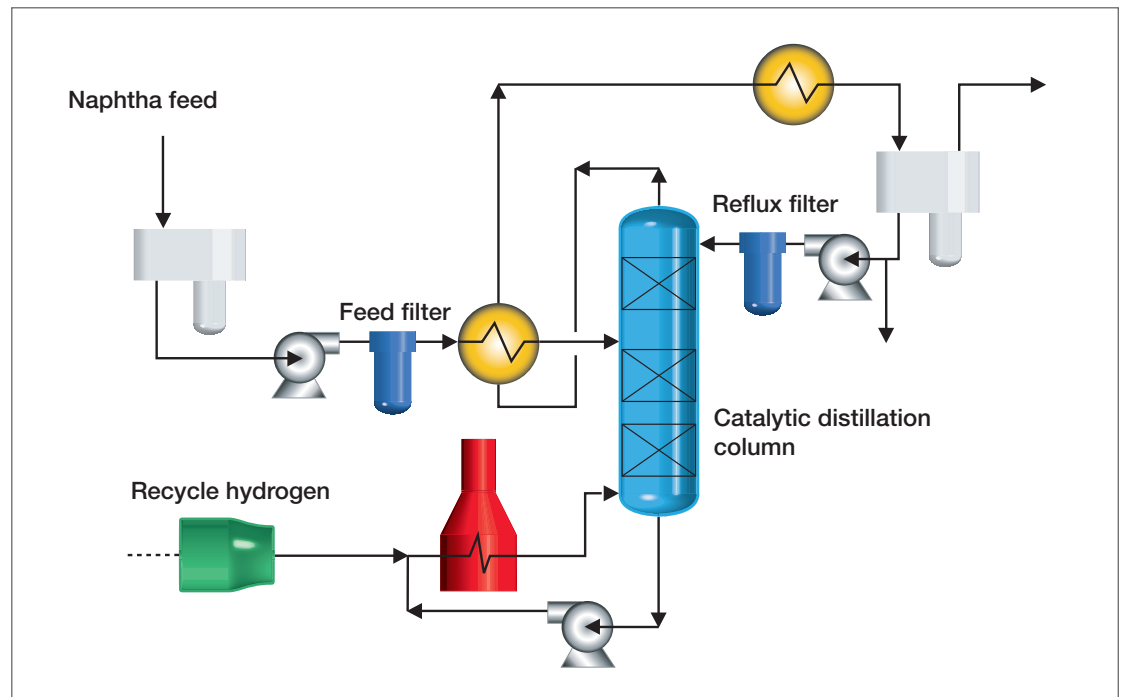


Figure 1: Simplified CD Tech Process Flow Diagram

The Solution

The AE&C and the refinery selected Pall's innovative Ultipor HT "High Temperature" filter cartridge which, in addition to being able to withstand operating temperatures as high as 215°C (419°F), was designed in a "high flow" arrangement with a 152 mm (6 in) OD x 1118 mm (44 in) length. With this highly effective surface area filter format, the solution offered was very compact, comprising of 4-around and 3-around Ultipor HT filter elements respectively.

The conventional filtration alternative for the same applications required 50 and 36 wound filter elements respectively, using larger diameter filter housings than Pall had offered. See Table 1 for details.

In addition to the discussions carried out by Pall's local distributor, a detailed presentation was made at the AE&C's office. Process and mechanical engineers were very interested in learning all of the technical factors that enabled Pall to develop such a compact, competitive design. They were equally interested in discussing the many operating benefits derived from the use of Pall's Ultipor HT filter cartridges.



Installed Duplexed Filter Housings



Used Ultipor HT Cartridges



Inside of an Ultipor HT Cartridge Showing the Support Core

Table 1: Comparison of Pall's Proposed Technology vs. Conventional Filtration

Application	Naphtha Feed Filter	Naphtha Reflux Filter
Flow m ³ /hr (gpm)	183 (805)	143 (629)
Viscosity cP	0.21	0.12
Temperature °C (°F)	133 (271)	210 (410)
No. of Pall's Ultipor HT elements	4	3
Pall's vessel diameter	500 mm (20 in) NB vessel	450 mm (18 in) NB vessel
Conventional filtration no. of elements	50	36
Conventional filtration vessel diameter	Est. 650 mm (26 in) NB vessel	Est. 550 mm (22 in) NB vessel

The Benefits

Both the AE&C and the refinery were impressed with Pall's proposal and the significant economical and operating benefits offered to the refinery, especially when compared to generic, nominal-rated "commodity-type" filter elements:

- Smaller housings, smaller footprint, lower capital cost
- Superior filter media yielding an absolute filter efficiency for far better protection of the heat exchanger and Catalytic Distillation Column
- Much longer life compared to the nominal-rated glass wound cartridges
- Quicker, less expensive cartridge replacement and disposal – a difference of replacing 4 and 3 cartridges each time compared to 50 and 36 cartridges
- Secure cartridge sealing via individually sealed filter elements

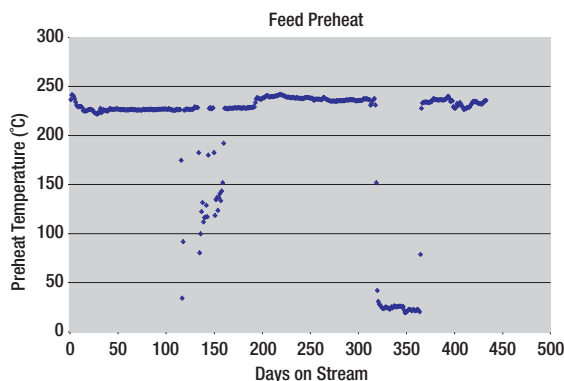


Figure 2: Feed Pre-heat Exchanger Pre-heat Temperature Since Start-up

The Results

Since start-up in 2008, the feed pre-heat temperature has remained very stable. See Figure 2 below.

The Naphtha Feed filter life is 2.5 to 3 months per set and the Naphtha Reflux filter life is approximately 4 months. The refiner is very pleased with the performance.

With the success of this project, Pall has demonstrated that high efficiency separations technology delivers outstanding economical and operating benefits to the refiner and provides added benefits to the AE&C contractor as well.

Conclusion

Refiners are constantly striving to meet increasingly tighter 'clean fuels' specifications, decrease greenhouse gas emissions, increase energy efficiency, reduce maintenance, and increase refinery productivity. One way to accomplish these goals is to better protect their heat exchangers and process equipment. The use of Pall's Ultipor HT high temperature filters provides refiners with cost effective solutions.



Pall Corporation

Fuels and Chemicals

25 Harbor Park Drive
Port Washington, NY 11050
+1 516 484 3600 telephone
+1 888 873 7255 toll free

Portsmouth - UK
+ 44 (0) 23 9230 3303 telephone
+ 44 (0) 23 9230 2507 fax
processuk@pall.com

Visit us on the Web at www.pall.com

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