Pall Corporation

Case Study

Pall Ultipleat® High Flow (UHF) Filter Protects a Naphtha Hydrotreater Reactor

Application

A Middle East petrochemical company operates a naphtha hydrotreater. Naphtha is supplied to the plant via a 40 km pipeline to the customer's storage tanks. From the storage tanks, it's pumped across a Pall Rigimesh® basket filter (45 µm), then passes through a heat exchanger and furnace, and finally to a naphtha hydrotreater (Figure 1).

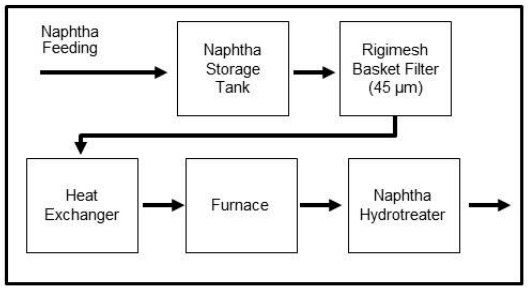


Figure 1: Simplified schematic of the original Naphtha Hydrotreating process

Process data

- Feed filter to remove solids from Naphtha feed to hydrotreater
- Fluid: Naphtha (with up to 1% vol. benzene, cyclohexane & aromatics)
- Design pressure: 15 bar max. g
- Operating pressure: 3.3 bar max. g
- Design temp: 232°C (for the vessel)
- Operating temp: 37-55°C
- Design flow rate: 211 m^3/h
- Viscosity at 45°C: 0.3 cp
- Specific gravity: 0.683 at 46°C

Solid particles size

Customer data: 160 mg/l of settled solids in the naphtha storage tank bottoms.

But in samples taken at the pump suction after the naphtha storage tank, repartition was:

- 3 mg/l >20 µm
- 10 µm < 1 to 2 mg/l < 20 µm
- 1 mg/l <10

Problem

After a few years of operation, the reactor bed ΔP rose quickly. The plant had a planned shutdown in December 2002/January 2003, during which time the reactor bed catalyst was changed or skimmed. There was concern that the plant would have to shut down before planned due to reactor bed ΔP. An early shutdown would generate high costs in the loss of production – unplanned shutdown catalyst handling costs of $100k; lost margin for seven day shutdown of $242k.

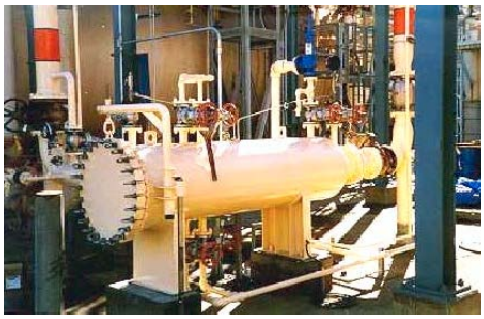
Discussion

Pall was contacted in mid June 2002. A decision was made to install an Ultipleat High Flow filter system based on:

- Damage limitation
- Reduction and limitation of any further bed ΔP rise until the reactor could be skimmed or changed during the next planned shutdown

Pall Solution

A redundant 36 inch diameter horizontal heat exchanger, available on site, was modified and used as an Ultipleat High Flow filter housing.



Pall proposed to fit a trapped tubesheet to accept (12) HFU660GF elements in place of the heat exchanger tubesheet bundle. The customer first tested Pall's GF200 cartridges, then the GF100 grade filter cartridges. The transformed heat exchanger vessel was positioned downstream of the Rigimesh basket. Pall advised the customer to go finer and install a Rigimesh Grade K basket (18 µm) against the Rigimesh basket (45µm) that was originally supplied.

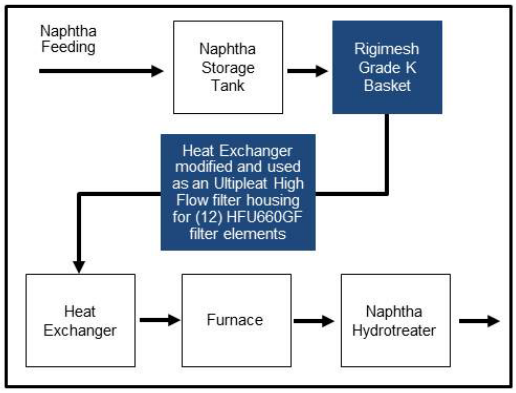


Figure 2: Simplified schematic after Pall solution

Operating Feedback

No appreciable ΔP increase was seen across the Pall filter installed (only 50 mBar).

The bed ΔP continued to rise, but the rate was very much reduced and slowed. This was attributed to the dirty system downstream of the Pall filter (pipework, and heat exchanger/furnace).

After start up, the customer settled on the finer Ultipleat High Flow GF020 grade filter cartridges.

The reactor was back on stream in early January 2003 after the planned shutdown. To date, the ΔP across the bed has been flat.

The life of the elements is 5-6 months under normal operating conditions. Shorter life is noticed twice a year during Naphtha supply lines pigging operation.

Conclusion

As of January 2005, the filter continues to perform very well. According to our contacts at the plant, the filter has given outstanding performance.

This case study demonstrates the creativity of our team. By using a redundant heat exchanger as a filter housing, we provided our customer with highly effective protection for their reactor – all within just three weeks from our initial discussion. The installation of a Pall filter enabled the reactor to keep running until a planned shutdown was scheduled.

Another big advantage seen by the customer is that our solution protects the heat exchanger, furnace, and reactor even when slugs of solids are produced during pigging operations.