Pall Corporation

Case Study

Pall's Coreless Filter Solves Fouling of Cold Box Downstream of Molecular Sieve Driers

Application

A Middle East gas production company operates a major gas processing plant which produces sales gas and Natural Gas Liquids (NGL). The plant is comprised of three trains, with a current total capacity of more than 1400 MMSCFD (1,650 x10^3 Sm^3/hr).

After the gas has been dried using molecular sieve driers, it enters the cold section for the recovery of NGL. The cold section is comprised of a plate-fin aluminum brazed heat exchanger or "cold box" followed by a turbo expander.

On each train the cold box was protected from fine particles released from the driers with a particulate filter equipped with 21 non-Pall cartridges (on two trains) and 36 non-Pall cartridges (on one train with higher capacity). The removal rating of the filters is 1 micron according to the filter supplier. Each train has a duplex filter system (one duty / one standby), vessels are horizontally configured.

Plate-fin heat exchangers require an efficient protection as they are more sensitive compared to shell and tube heat exchangers. Although fabricators claim that the flow path between the fins is in the range of several hundred microns, fine solid particles can deposit due to collision in the turns and progressively foul the heat exchanger.

Problem

The plant reported fouling issues of the cold box. The pressure drop (DP) across the cold box was increasing steadily until the maximum allowable DP was reached, above which the heat exchanger would be damaged. Consequences of the fouling of the cold box were numerous:

- Progressive drop in the NGL recovery yield due to less heat transfer and less pressure available before the turbo expander
- Loss of revenue due to drop in NGL production - possibly tens of thousands of dollars daily
- Loss of revenue due to the shutdown of the train when cleaning of the cold box is required

The fouling of the cold box was due to the ingression of solid particles, as a dark black cloud was coming out of the equipment during cleaning operations (blowing with nitrogen).

The plant made several attempts to solve the problem. The filter supplier recommended the use of another type of filter cartridge but the situation did not improve. The filter supplier also advised the operators to tighten the cartridges more to prevent bypass at the end caps of the cartridge due to sagging in the horizontal configuration, but this had no effect.

Solution

Pall first worked on a retrofit proposal using Pall's Coreless filter cartridges. Objectives were to solve fouling problems on the cold box and to increase the filter's flowrate capacity by 10%.

Pall proposed new filter plates (tubesheets) to be fitted with 19 and 22 cartridges depending on the size of the existing vessels. Pall's Coreless filters were recommended as a replacement of the existing 1 micron cartridges.

The new tubesheets, the inner cores, and the stand-pipes were fabricated and assembled by Pall, then internals were delivered to a local subcontractor close to the plant. During the shutdown of the plant, the six existing filter vessels were disconnected and delivered to the subcontractor, where the existing internals were removed and the new internals were welded. The modification of the six filter vessels was made within two weeks, so that it had no impact on the production schedule of the plant.

Cut out and removal of existing internals

Installation of Pall's internals within the same vessel

Operating feedback

The efficiency of Pall's Coreless filter was demonstrated quickly after the start-up of the modified filters. The pressure drop across the filter was increasing steadily, indicating that solid particles were being efficiently trapped and retained within the filter media. This was not the case with the previous 1 micron filter for which the pressure drop was hardly increasing over time. No increase of the pressure drop was seen across the cold box. The plant was extremely satisfied with this retrofit job. The service life of the filters was approximately three months.

As the plant had planned to increase the capacity by an additional 10%, larger filters using Pall's same Coreless filter technology were later supplied, as replacements of the modified filters.

Benefits

This retrofit using Pall's Coreless filter featuring a more efficient filter technology has enabled a permanent protection of the cold box, resulting in:

- Increase in productivity due to maximized NGL recovery and no more plant shutdowns
- Reduction in maintenance costs

Conclusion

Plate-fin aluminum brazed heat exchangers are commonly used for NGL recovery from natural gas. The cold box is a critical piece of equipment as its heat transfer performance has a direct impact on the condensate production. Condensate is more profitable.

Particles released from the upstream molecular sieve driers or mercury removal unit are very fine in size, typically in the micron range. Although they are fine, they are detrimental to the cold box and they must be removed effectively. Filters with a poor construction, a poor sealing, or with a nominal rating can't protect cold boxes efficiently.

Pall's Coreless filters are perfectly suited for gas filtration. Due to their depth and graded pore construction they can remove very fine particles while providing a long service life.

Pall has engineering capabilities to evaluate the possibility of a retrofit of existing filter systems. Contact your local Pall representative for more information.

Pall Corporation

Fuels and Chemicals

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

Pall Middle East
+971 4 3406204 telephone
info-MiddleEast@pall.com

Pall bureau de liaison Alger
+213 21 35 5866 telephone
NorthAfrica@pall.com

Pall France
+33 1 3061 3800 telephone
industrialFR@pall.com

Filtration. Separation. Solution.SM

Visit us on the Web at www.pall.com

Pall Corporation has offices and plants throughout the world. For Pall representatives in your area, please go to www.pall.com/contact

Because of technological developments related to the products, systems, and/or services described herein, the data and procedures are subject to change without notice. Please consult your Pall representative or visit www.pall.com to verify that this information remains valid.

FCCSCOLDBEN Printed in the USA December 2009