INFO

DAHLMAN

CASE STUDY

IMPROVING HCGO FILTRATION

Introduction This is a case study on a diesel oriented EU refinery, which operated a backwashing filter for the filtration of Heavy Coker Gas Oil (HCGO) as product of a Delayed Coker Unit (DCU), required for protection of the downstream Hydrocracker Unit (HCU) catalyst beds. This refiner faced short cycle times of the filtration unit and subsequent high costs due to downtime and high losses of product, which are washed out at each backwash cycle. DAHLMAN has analyzed the operation problems (which also results from the penetration of cokes and asphaltenes into the filter elements) and performed field trials with a mobile industrial test unit. Based on these field results DAHLMAN has designed and supplied a new, full scale automatic backflush filtration package making use of more effective gas pressure for cleaning. This case study focuses on the conventional approach (back*washing*) and DAHLMAN's approach in HCGO filtration and automatic cleaning (gas-assisted back*flushing*).

Application Overview Upgrading of residual feedstock is typically limited by the poor conversion of present asphaltenes, which leads to high coke and sediment formation. In this respect, the HCGO from the DCU carries a high concentration of cokes and asphaltenes which can cause fouling issues in the HCU and can thus significantly affect its performance. The expensive catalyst beds of the HCU therefore require protection in the form of high efficient filtration down to a low micronage. This will keep ingress of cokes and other solid contaminants down to an acceptable level.

The Refiner's Problem Some technologies separate coke particles from HCGO by filtration and perform automatic *in-situ* cleaning. Conventional backwashing filters (filter banks) tend to plug quickly as a result of poor cleaning and are unable to effectively remove cokes and asphaltenes penetrated and clogged into the filter media. The lack of powerful cleaning will cause this problem to arise more quickly and frequently. This results in significant product loss each time in-effective cleaning occurs.

The subject refiner using a conventional backwash type filter, needed to perform drastic *ex-situ* and expensive cleaning (temporarily shutting down of filtration unit, 3rd party cleaning) every two weeks in order to return to the clean pressure drop the unit was initially designed for. Only then the backwash filter unit was able to achieve cycle times of 6 hours, however, cycle times quickly decreased over the two-week period. Besides very frequent shutdowns and cleaning costs, the refiner experienced high loss of product due to very frequent backwashing, which could have otherwise contributed to the hydrocracker yield.

Dahlman's Solution DAHLMAN was consulted and requested to analyze the process data and filtration performance. In order to fully assess the present problems and to find the possible root cause for plugging, the failing elements were examined on coke deposits and other sediments. Cleaning was performed by pyrolysis and chemical cleaning.

Field Results The full scale filter package, which was delivered in 2010 to the refiner, has demonstrated that DAHLMAN's backflush filtration technology performs excellently in this application. This has reduced the loss of product greatly and contributes significantly to a high return on investment for the refiner.

The figures in below table provide a comparison of the total utility costs involved for the initially installed conventional filter system and the improved, DAHLMAN system.

Conclusion The formation of cokes and asphaltenes are unavoidable in the process of delayed coking. When HCGO is processed as feed to a HCU, it is of top priority to filter out these particles down to the maximum acceptable specification of the HCU, as they are detrimental to its catalyst beds.

The outdated filtration and cleaning principles of conventional filter banks are not sufficient to clean filter media effectively, and as such, do not efficiently protect HCU catalyst beds. This can contributes to high operational costs, because of their inability of dealing with fine cokes and asphaltenes in combination with their unavoidable poor backwash cleaning results.

DAHLMAN's HCGO backflush filtration technology has provided a sound and satisfactory solution to the refiner. The technology has proven to greatly surpass the conventional type, by combining highly efficient filtration with excellent *in-situ* cleaning. The system continuously reflects the performance as it was originally designed for, without deteriorating cleaning results and without decreasing cycle times.

Design figure	**Conventional Backwash System**	**Dahlman Backflush System**
Filtration area	154,8 m^2	154,8 m^2
Backflush liquid volume	11,7 m^3	7,3 m^3
Assisting Gas Volume	-	55,04 Nm^3
Cost of Disposal/Utilities		
Price of sludge disposal/feed	Euro 10/m^3	Euro 10/m^3
Price of gas per m^3	Euro 0,11/kg	Euro 0,11/kg
Cleaning Characteristics & Comsumption		
Frequency of cleaning	Every 1 hour	Every 6 houres
Gas consumption (per cleaning cycle)	-	55 Nm^3
Total cost per cleaning cycle	Euro 117	Euro 116,80
Total costs per YEAR	**Euro 911.690**	**Euro 524.483**

In the above mentioned no costs for external cleaning, downtime and operator costs for maintenance have been taken into consideration

Supportive Tools

Dahlman can provide mobile industrial test equipment and field test engineers, who can be mobilized to any plant to assist in problem solving and optimizing the operation of their critical assets.