



Magnetic Separators for Refinery Applications

A review of a refinery's approach to testing and adopting magnetic separators as a solution for improving facility up-time, reducing filter consumption, and minimizing rotating equipment repair costs.



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MAGNETIC SEPARATOR SYSTEMS



Black Powder Solutions' patented magnetic separator systems utilize proprietary magnetic technology to remove black powder contamination or rouge (ferrous and non-ferrous particulates) from hydrocarbon liquids and gasses, as well as amine, glycol and water.

*No membrane filters employed.



Trial

Black powder or “rouge” contamination issues exist in multiple refinery processes and fuel systems. The client, a 200,000 bpd+ refinery, decided to test a Black Powder Solutions (BPS) magnetic separator system to evaluate its effectiveness capturing sub-10 micron contaminants.

Trial success would be determined by improved operations, reduced disposable filter costs and extended equipment life in the following applications:

- (1) Hydrodesulfurization (HDS) unit amine system;
- (2) Vacuum gasoil feed into the HDS unit;
- (3) 2 separate furnace fuel gas systems; and
- (4) Turbo compressor lube system in the fuel complex.

BPS provided a test magnetic separator to the refinery along with flexible steel hoses for plug-and-play testing purposes.



BPS magnetic separator installed in the fuel gas system of the hydrocracker complex.

Testing

The testing process continued through most of calendar 2019, with the unit being moved between systems. BPS provided flow, volume and temperature parameters to the refiner for purposes of understanding maximum testing values – particularly flow rates.

Recommendations

1. The installation of a flow meter and valves on test magnetic separator systems so that maximum flow rates are not exceeded, and accurate test results are achieved.
2. Contamination samples be collected to determine the mass, composition and sizing of particulate contamination and the efficiency of magnetic separation in each application.



BPS magnetic separator installed in the HDS amine system during testing, as well as contamination captured after 2 weeks of testing.

Results

The test results were very positive according to the refinery staff.

The refiner is proceeding with the permanent installation of multiple magnetic separators in different systems:

1. 3 separate crude feed streams
(120 kbopd, 85 bopd & 17.5 kbopd);
2. VGO feed stream;
3. Combined VGO/LGO/MGO/HGO feed stream;
4. Amine system in the HDS unit; and
5. Fuel gas system in the hydrocracker and other fuel gas streams.



BPS magnetic separator removed for cleaning from VGO feed to the HDS unit.

Questions to ask.

While magnetic separators offer substantial benefits in a refinery, there are a few questions to ask when initiating the process.

1. How much is campaign life reduced by sub-10 micron particulate fouling of catalyst beds and exchangers?
2. How much would you save if disposable filter changeouts & costs were reduced by over 70%?
3. What is the financial impact of extending pump, compressor and seal life by a factor of at least 2X?
4. What are savings from a 50-80% reduction in lube-related maintenance frequency on rotating equipment.
5. What is the value of a > 50% reduction in worker hazard exposure due to reduction in planned and unplanned maintenance and repair events?
6. What is the value of a substantial reduced environmental footprint as a result of reduced filter, chemical and wastewater disposal?

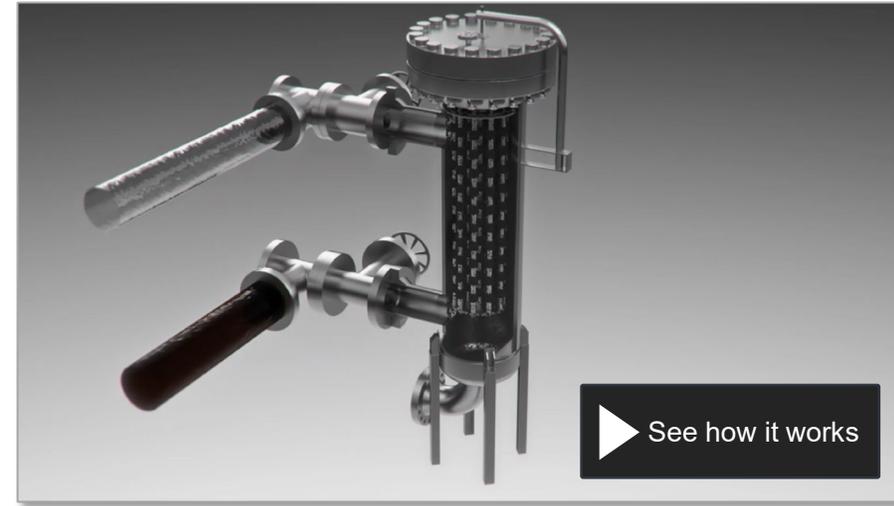


Contamination captured after 18 hours in a desalter water test.

MAGNETIC SEPARATOR SYSTEMS



- Established products - patented magnetic technology **originally developed over 18 years ago** by sister company, One Eye Industries, who manufactures industrial magnetic filtration products for rotating equipment.
- High efficiency (95%+) removal of black powder **above 500 microns down below 0.1 microns** – no absolute or nominal filter ratings.
- Systems only require cleaning via wiping of the magnetic elements. Only the contamination is disposed – **no disposable filter elements**.
- Typically **well below 5 psi differential pressure** in fully contaminated systems, vs. typical pressure alarms at +/- 25 psi.
- Standalone system – **no power or fuel requirements** due to permanent rare earth magnetics.
- Permanent solution – **longest system in use is 17 years** (and running) with original equipment - no reported performance degradation.
- Typical magnetic separator system **holding capacity is measured in hundreds of pounds** and cleaning intervals are measured in months.





Black Powder Solutions

MAGNETIC SEPARATOR SYSTEMS

Effective removal of contamination in upstream, midstream,
and downstream operations.