KEEPING ENGINES CLEAN THROUGH AFRICA

OPTIMIZING FILTRATION IN A HUMID AND DUSTY DESERT ENVIRONMENT

Pulse filtration has traditionally been used for dry and desert locations where large amounts of dust are present. But desert and dry are not necessarily synonymous. High humidity and fog are also often present, and combined with a high dust load they can cause high pressure spikes and particle re-entrainement. New high efficiency media technologies are now tackling these issues very successfully without compromising filtration life, even in high dust load areas.

A major North African pipeline is a typical case of a pulse installation facing seasonal high humidity and high concentrations of coarse dust. The pipeline has a total of twenty 30 MW engines, half of which are inland and equipped with pulse filtration systems.

These turbines were originally equipped with M6/MERV 16 pulse filters and they faced average relative humidity of over 50%. Dust is typical of the area and contains mainly sand, both in calcium and silicon form, combustion particles and some salts. After a major audit done by a third party inspection, the operator found dust in the gas turbines and decided to upgrade the inlet filtration efficiency.

Single stage systems have typically offered lower filtration efficiency, and combined with moisture, they are more likely to suffer from particle re-entrainment, with the particles dissolving in ambient humidity and passing through the media to the clean side.

Changing to a higher efficiency filter, minimally F9 per EN779:2012*, and choosing media with hydrophobic properties can solve these issues. Most operators understand the added value of higher efficiency filtration but many fear that raising efficiency might negatively impact the filter life and increase maintenance needs for filter replacement.

THE SOLUTION

Camfil proposed the installation of the CamPulse HemiPleat™ GTC as an upgrade. The GTC, an F9/Merv 16 cartridge with depth loading properties has proven itself to be a product of choice when both large quantities of dust and humidity are present.

The filters were installed in the spring of 2012 and, two years later, they now have over 3,500 hours of operation. The gas turbine suffered no apparent power degradation and filter pressure drop curve showed impressive stability. Averaging at 181 Pa (0.73 inch w.g.), the filter is still performing like new, promising many more years of service (see Figure 1).

To confirm the engine performance data, one filter was sent for testing in

*F9 EN779:2012 classification: Minimal efficiency rating at 70% and 95% average efficiency at 0.4 um.

an EN779:2012 test rig. The results confirmed the filters were performing above expectation concerning the efficiency; reaching 92.5% on 0.4 microns, a very strong F9 (minimal efficiency needs to be 70% to qualify as an F9), providing excellent engine protection.

IMPACT

Pressure drop (DP) and efficiency have an impact on the turbine power output. Pressure drop is directly linked to filter life, but high DP also negatively affects power output - generally, 1" of DP (250 Pa) reduces turbine power output by 0.375% and increases heat rate by 0.125% - but most of all, pressure drop spikes can have a negative impact by tripping the turbine and forcing an outage for filter replacement.

When filtration **efficiency** is inadequate, the turbine is subject to fouling and corrosion. There is also a risk of plugging the cooling holes which can cause an increase in temperature and shorten a turbine blades life.

Low pressure drop should never be achieved at the expense of high efficiency filtration, but rather, with good filter construction and the right media. Combining both **low DP and high efficiency** will provide operators with:

- **Less unplanned outages**
- **Lower maintenance cost**
- **More engine availability**
- **Higher power output**

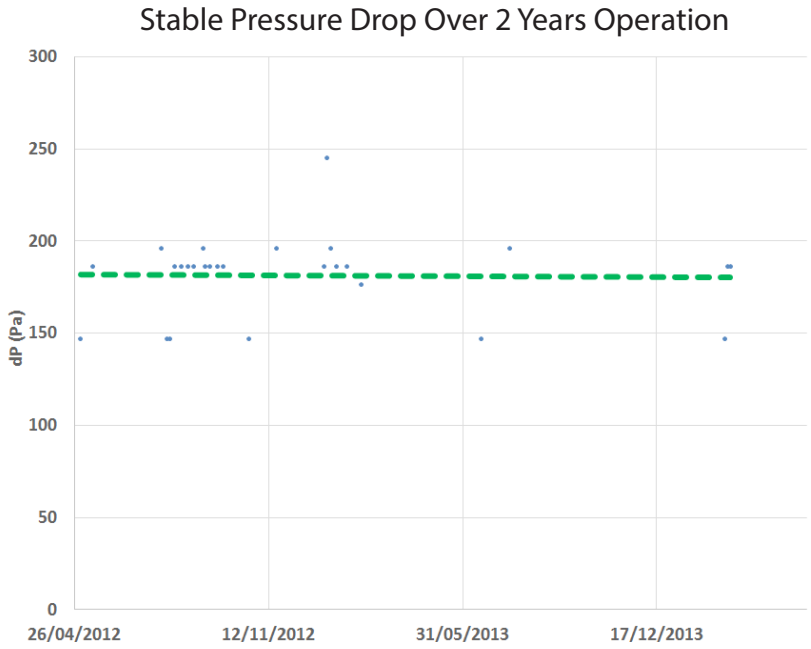
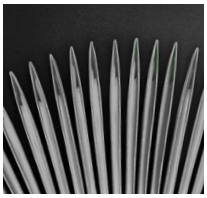
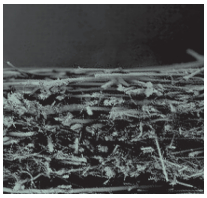


Figure 1: After over 3500 hours of operation, pressure drop remained stable, averaging at 181 Pa.





Key Technical Differentiation Points

The GTC media is a 3-dimensional media with fine fibers in the central layer. This allows the smaller particles such as salt to be distributed throughout the media instead of staying in the dust cake. If this was allowed to occur in high humidity, salt would swell and create high pressure drop, which is avoided here. The smooth synthetic fibers also offer low impedance to airflow, resulting in lower pressure drop through the filter life.

In addition to the media performance, the **HemiPleat™** open pleating technology in Camfil cartridges also offers wider spacing, exposing more surface media to the air stream and resulting in:

- Lower overall pressure drop and more importantly, minimal pressure drop increases in high humidity
- Improved dust release during pulse cleaning
- Longer filter element life

Synthetic HemiPleat™ GTC	
Initial dP	0.6"wg
Average dP	0.6"wg
Efficiency on 0.4 µm	92.5% / F9
DP after 2 years	0.7"wg
Typical change out dP	4"wg