Minutes of Air Filtration Meeting

06 October 2017, Fondazione Ansaldo, Genoa, IT

ETN Attendees:

Scott Taylor	AAF
Andrea Galli	AAF
Hatem Rashad	ADGAS
Francesco Anzelini	ADGAS
Jan Kaukopaasi	Ahlstrom-Munksjo
Marco Tappani	Ansaldo Energia
Giorgio Marchetti	BHGE
Richard Ringström	Camfil
Mark George	Cullum Detuners
Andrew Thomson	EMW
Ugo Simeoni	ETN
Gianluca Arcangelis	Faist
Georg Hirsch	Freudenberg
Carlo Coltri	Mann+Hummel
Elisabet Syverud	Siemens
Martin Oestemar	Siemens
Olaf Brekke	Statoil
Dominique Orhon	Total
Wilson Poon	W.L. Gore & Associates

1. Introduction by ETN Officer

U. Simeoni opened the meeting and welcomed the participants. He presented the agenda and the objectives of the current meeting. He stated that the agenda has been slightly modified and the following topics will be presented:

- ISO TC 142 – WG9 objectives (S. Taylor)
- Report from the ISO/TC 142 Meeting in Paris (D. Orhon)
- Definition of the oil moisture and soot present in the filters (D. Orhon, O. Brekke)
- Test activities at Camfil's lab (R. Ringström)
- Test activities at W.L. Gore's lab (W. Poon)

2. ISO TC 142 – WG 9 objectives

S. Taylor presented the objective of the ISO TC142 – W9. He highlighted that currently the air filtration products are tested in accordance with the EN779, EN1822, ASHRE 52.1 and 52.2. However, these standards don't fully cover all the needs of both power generation and oil & gas sectors and they don't take in consideration appropriately the real environmental conditions.

S. Taylor stated that most of the comments from ETN were related to ISO 29461 Part 5. U. Simeoni highlighted that ETN has also submitted comments on Part 2 and Part 6. However, it was not clear if the comments have been included in the revisions. U. Simeoni will follow up with the convener of the ISO Committee.

S. Taylor explained that ETN proposed to draft a new test procedure focusing on real environmental conditions and cyclic operations, which was not appropriately tested in the ISO concept according to the ETN members. As a result, the ISO TC142 WG9 agreed to develop the Part 5 including the ETN proposal.
So far, within the ETN WG, the members have conducted a research on sea water composition and on what's in the air in offshore and coastal onshore applications. The following step has been the identification of the equipment available to replicate saline aerosol challenge. Currently Camfil and W.L Gore are carrying out tests according to what has been agreed in the WG.

3. Report from the ISO/TC 142 Meeting in Paris

D. Orhon joined the ISO/TC 142 Meeting in Paris on 25th of September 2017 as representative of ETN.
With regards to the ISO 29461 Part 5, he reported that good progresses were done in Part 5 and a new test configuration was done with Latkin generator. He stated that one of the experts was reluctant to consider oil and soot loading as agreed in the ETN working group.
He underlined that ETN would still support the ISO committee, nevertheless the ISO standard currently doesn't cover the needs of ETN members and therefore, if there is no willing from ISO to progress, ETN will draft an internal standard.

With regards to ISO 29461 - Part 2, D. Orhon stated that no progress was made and no inputs were received from ETN. A new title has been proposed for Part 2, which changed into Cleanable filter elements. He stated that there was a discussion between the experts on people carrying out research work instead of writing a standard. For this reason the working group remains in back position and experts are not very supportive. A discussion took place whether inviting Aramco to be part of the WG9 or not.

H. Rashad stated that ADGAS has recently encountered blade failures. The main findings show that failures are related to corrosion due to harsh environment. Therefore there is a need to define harsh environment.
H. Rashad highlighted the importance for this Working Group in drafting a procedure which would allow the GT users to understand how to avoid failures due to condensation and salt within air filtration systems.

R. Ringström highlighted the importance to continue the cooperation with ISO and to work together as few companies may not have the same capabilities.

4. Definition of the oil moisture and soot present in the filters

D. Orhon presented the research done within Total to define the components that contribute to the degradation of the filters. In an offshore environment particulates that could deteriorate the filters are mainly coming from the exhaust systems of the machines (e.g. gas turbines, diesel engines, boilers) from the flares and from the vent of the lube oil system.
Typically the engine exhaust is made by: solid residue (carbons), soluble fraction (unburnt hydrocarbons from fuel and lubricant), insoluble fraction (sulfates and derived products). It was shown that the soot and carbon black is composed by the following components:

- carbon/soot – PM2.5 (0.1 to 0.3 microns)
- microsoot (0.05 to 0.1 microns)
- carbon impregnated with hydrocarbons.

Other components other than soots are: lead, iron, copper, calcium oxide, metallic oxide, halide, lead bromide, lead chloride, polycyclic aromatic hydrocarbons, SO2 agglomerate with sulfate and merged with particles, SO2 and N2O.
With regards to the flare, D. Orhon stated that it was not possible to collect robust data, however fumes may cross gas turbine air inlet filters. He also specified the type of mineral and synthetic oil used by Total.

O. Brekke presented the analysis done by Statoil on the definition of the oil moisture and soot offshore. The typical sources of soot in air filters are coming from the exhaust of turbines and engines and the flares. Oil moisture instead comes from vents from lubricating oil tanks, sumps and seals of rotating machineries.
O. Brekke highlighted that the typical concentration of oil in the air is in the range of 800 to 1200 ppm by weight with a measured values that often exceed the 50mg/m3 and a droplet size between 0,1-15 micron. He asked

whether the oil type should be taken into consideration within the tests and if the concentration of oil in the air is critical to accelerate the tests.
It was stated that it should be studied the interaction of different oils with the soot.
E. Syverud stated that the composition of the soot could probably be derived from the data of the soot and emissions reported to the authorities. She will share some suggestions on how to collect data.

5. Test activities at Camfil's lab

R. Ringström gave an update of the tests done at CAMFIL's. He presented the test rig, which is modular and allow to test an air filtration system. He explained how the ultrafine dry NaCL was generated.
R. Ringström explained the test procedure, which has the following steps:

- Ultrafine dry NaCL (orKCl) is sprayed continuously throughout the entire test.
- Test starts with ultra fine fresh water spray in 48 minutes, 0.2 liter/minute (9.6 liter)
- Relative humidity is cycled Hi/Lo in approx. 1.5h cycles.

During the latest tests, further cycles have been evaluated and it was added the ISO-fine test dust. However it was not yet introduced the oil or soot.

J. Kaukopaasi highlighted that the addition of contaminants will change the results obtained. R. Rinigström agreed, however he underlined that the test should consider how to accelerate the aging effect without changing the failure mechanism. Failure mechanisms happen when water and salt pass through the filters. The test will compare when the failure mechanism works. It was clarified that normally dp is not the failure mechanism in the filters offshore. Camfil has tried to recreate the failure mechanism due to the aging effect, trying not to fall into other failure mechanisms. He showed the comparison of Camfil tests with the ISO fine A2.
R. Ringström reported that from the tests done it seems there is not much difference with or without test dust, while you have water spray.

6. Presentation tests done at W.L. Gore's lab

W. Poon reported on the tests carried out at W.L. Gore's lab. He stated that the following contaminants have been considered when developing the test procedure for offshore air filtration:

- Sea salt
- Dust
- Soot particles
- Bulk water: fog, mist, rain
- Lube oil vapor and mist

Each characteristic of the contaminants have been properly identified by W.L. Gore (additional details in the slides).
W. Poon gave an overview of the Salt Breach Test developed and the results obtained measuring the following parameters:

- Filter pressure drop in dry and wet cycles
- Dust loading capacity in aging cycle
- Amount of water and salt bypass

After the initial tests, the procedure was modified in order to in reproduce more accurately the real environment.
All the results of the tests may be found in the presentation on the ETN Air Filtration webpage.

It was agreed that R. Ringström and W. Poon should work together in order to harmonise the tests done.

It was agreed that a common draft of the procedure should be updated and circulated to the group for comments. In the draft, the stopping criteria for the tests should be clarified.

It was agreed that Camfil and W.L Gore will add to the tests also oil and will start to draft the outline.

It was agreed that the Users should define the soot.

It was stated that even though it doesn't exist an official test procedure in other sectors reproducing soot and hydrocarbons, Freuderberg and Donaldson could share the information regarding the tool used to reproduce these contaminants and how to measure them.

It was agreed that the minutes of the ISO Meeting, held on 25th September in Paris should be circulated to the group.

7. Next meeting

It was proposed to schedule the next meeting at the end of January 2018.

Annex I: Action list

Action Owner	Description	Deadline date
U. Simeoni	To follow up on Part 2 and Part 6 of the ISO 29461	20 November 2017
R. Ringström, W. Poon	To harmonise the two test procedures presented.	1 December 2017
Sub-Group	To agree on one common test and update the first draft	1 December 2017
All	To provide feedback on the test procedure.	12 January 2018
Users	To define the soot/hydrocarbon composition.	1 December 2018
U. Simeoni	To share the minutes of the ISO TC142 Minutes of the Meeting on 25 September 2017.	20 November
M. Garnett, W. van Gelder	To find information on existing tools for soot/hydrocarbons	1 December 2017
E. Syverud	To share suggestions on how to collect data of the soot and emissions reported to the authorities.	1 December 2017