ISO 29461 Draft: Air intake filter systems for rotary machinery - Part 5: Test methods for static filter systems in marine and offshore environments

Measurements

European Turbine Network

Air Filtration Working Group

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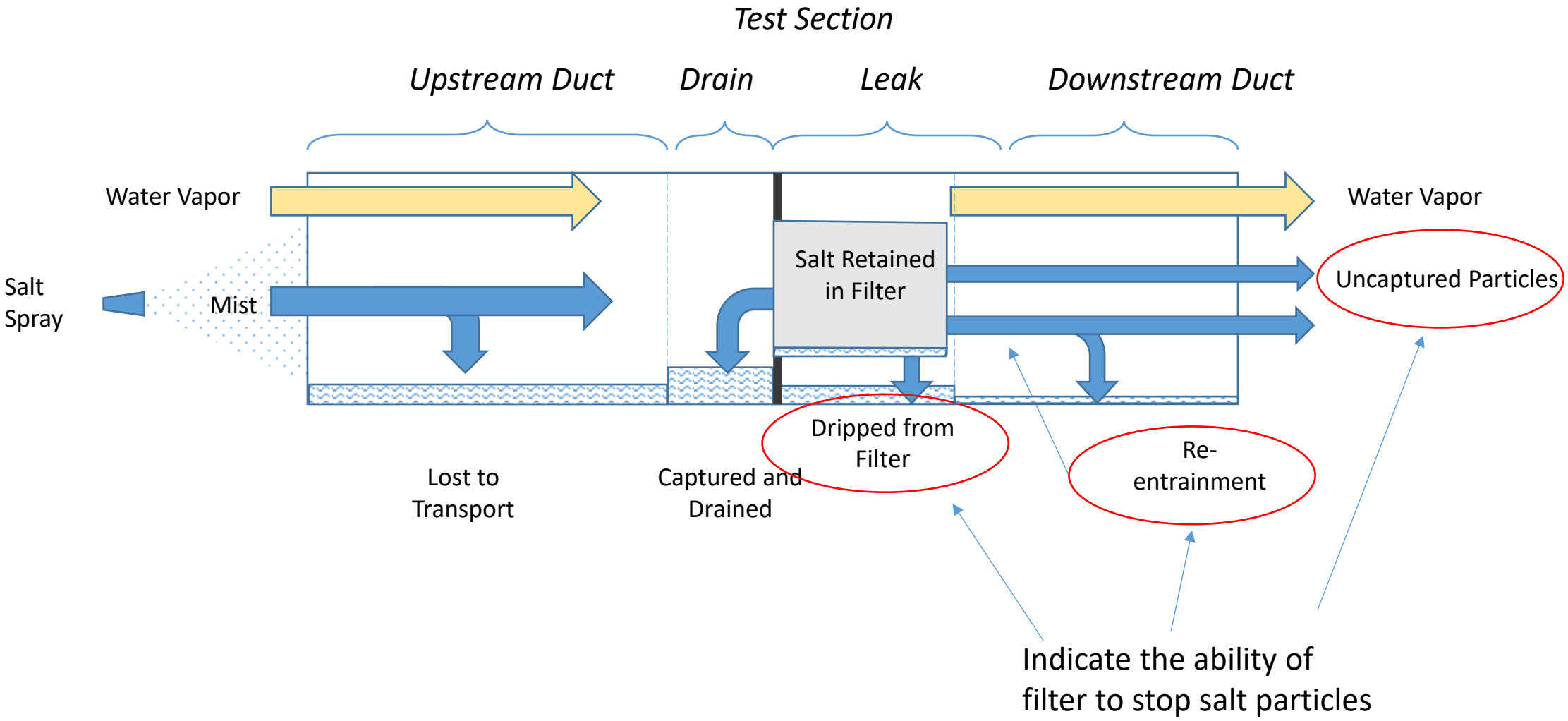
Deliverables & Timeline

Complete By

- **Phase I: survey available technology to measure salt**
  - **Water**
  - **Air**

  Web Meeting 2/13/2017
- Phase II: Present findings to stakeholders. Select technology to evaluate
- Phase III: Complete research and meet with core group during next ETN meeting on proposal

Salt Retention Test



Measurement of Captured Salt Water

Method	Principle	Pros/Cons
Silver Nitrate Titration	silver cation reacts quickly with chloride (or any halide) to form an insoluble silver chloride (AgCl) precipitate. ISO 9297:1989 Water quality -- Determination of chloride -- Silver nitrate titration with chromate indicator (Mohr's method). ISO 6227. Chemical products for industrial use - General method for the determination of chloride ions - Potentiometric method.	Pros: simple, relatively inexpensive Cons: limited to concentrations between 5 mg/l and 150 mg/l.
Flame Photometer	atomic emission method for the routine detection of metal salts, principally Na, K, Li, Ca, and Ba	Pros: simple, relatively inexpensive, high sample throughput Cons: interference and stability of the flame and aspiration conditions

Measurement of Captured Salt Water

Method	Principle	Pros/Cons
Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES)	employs the intensity of light from a plasma, flame, arc or spark at a definite wavelength to calculate the quantitative presence of an element in a particular sample	Pros: linear dynamic range and limit of detection, low chemical interference, reproducible Cons: high cost of infrastructure maintenance and operating expense
Ion Chromatography (IC)	an analytical technique that separates ions and polar molecules based on their charge	Pros: Highly selective, low limits of detection, wide analytical range Cons: high cost of infrastructure maintenance and operating expense

Measurement of Airborne Aqueous Salt Particles

- Measure the concentrations of uncaptured and re-entrained particles downstream
- Challenges
  - High humidity environment
  - Wide particle size range (submicron to supermicron)
  - Droplet may be water condensate with no salt
  - High concentration because of high volume of salt mist upstream

SFP Flame Photometer

- Measure the concentration of a standard NaCl. aerosol both before and after it has passed through an air filtration device.
- Better than 10ng/m³ giving a minimum detectable penetration of less than 0,0005%. with a challenge aerosol of 13mg/m³.
- Continuous indication of mass concentrations up to 13mg/m³, but for short periods up to 20mg/m³ if calibrated to this level.

Pros: Used in other filter test methods

Cons: Only detects Na, not K? Not size selective.

ti-Stage Liquid Impinger (MSLI)

ti-Stage Liquid Impinger (MSLI) is a versatile five-stage liquid impinger which can be used for
ning the particle size (aerodynamic size distribution) of DPIs in the case of USP Chapter <601>
MDIs, DPIs and nebulisers in the case of Ph.Eur. Chapter 2.9.18.

I is available in a range of materials: aluminium, 316 stainless steel or titanium. This choice
exibility in terms of corrosion resistance, weight and cost. It is fitted with PTFE seals as
d.

gn is such that at a flow rate of 60 L/min, the cut-off diameters of Stages 1, 2, 3 and 4 are 13, 6.8,
1.7 microns. Stage 5 comprises an integral paper filter to capture the remaining fraction of
s less than 1.7 microns.

I has, by definition, no inter-stage losses and is suitable for use throughout the range 30 – 100
Unlike the ACI, NGI and MMI, the collection stages of the MSLI are kept moist which helps to
he problem of re-entrainment sometimes experienced when using more conventional
rs. It employs the same induction port as other impactors.

prehensive product details, specifications and part numbers, please request a copy of our
e “Quality Solutions for Inhaler Testing”.

More Information

Inhaler Testing Virtual Brochu

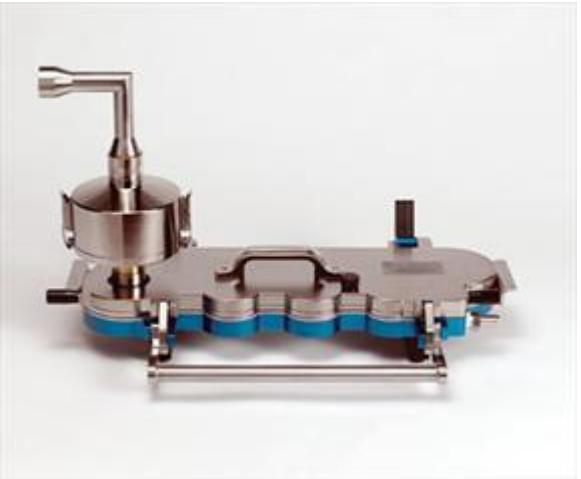
Inhaler Testing Brochure 2015
MB)

Next Generation Impactor (NGI)

- The NGI has seven stages, five of which are in the range 0.5 to 5 microns plus a micro-orifice collector which acts as a final filter and a horizontal planar layout adopted for ease of operation and automation.

- The air flow passes through the impactor in a saw tooth pattern. Particle sizing is achieved by successively increasing the velocity of the air stream by forcing it though a series of nozzles containing progressively reducing jet diameters.

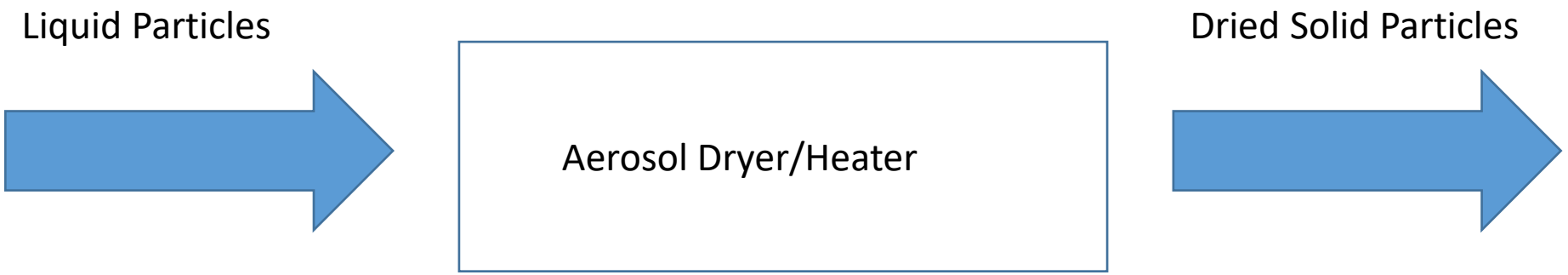
- The resultant samples from each stage are collected in a series of collection cups. A removable tray holds all the sample collection cups such that all the cups can be removed and/or replaced in one single operation.



MARPLE MILLER IMPACTORS

- The MARPLE-MILLER IMPACTOR (MMI™) is a five-stage impactor with collection cups instead of the conventional collection plates. Originally designed for mass size distribution by chemical analysis of inhalable pharmaceutical aerosols, the MMI has also found a variety of non-pharmaceutical uses including size distribution analysis of oil mist, and soot particles from crankcase blowby of diesel engines. Cut-size diameters are 10, 5, 2.5, 1.25, and 0.625 µm. Easily removable collection cups allow direct weighing of collected particles or droplets. Solvent can be added to the collection cups for sample extraction and subsequent chemical analysis. The Model 150 is designed for 30LPM and the Model 160 is designed for 60LPM.

Conditioning Step



Liquid particle concentration maybe inferred from the measured concentration of dried solid particles

ELPI®+ (Electrical Low Pressure Impactor)

- Wide particle size range; 6 nm – 10 µm
- 14 particle size fractions
- 10 Hz sampling rate
- Possibility to collect size classified particles for chemical analysis

Laser Particle Counters/Sizers