Technical Note
TNFTS0511

Thermo Scientific Horizon Fog Testing System

Scott Pratt, Thermo Fisher Scientific, Newington, NH, USA

Key Words:

- Fogging
- Outgassing
- DIN 75201
- ISO 6452/2000
- Gravimetric Method
- Reflectometric Method
- Refrigeration System

Preface

By nature volatile organic compounds (VOC) easily evaporate from a large variety of natural and manmade materials. The smell you may associate with fresh paint, adhesives or other building materials and that "new car smell" are all composed of VOCs.

The term "fogging" primarily refers to the evaporated volatile organic compounds of vinyl (PVC), textiles or leather condensing onto glass. These materials are used to a great extent for the interior components of motor vehicles. High temperatures, such as those possible in a closed vehicle sitting in direct sunlight, accelerate the evaporation process and the VOC vapors trapped within the vehicle then condense on the windows and the windshield, possibly impairing the view and causing dangerous driving conditions. As the evaporation continues over time the VOC content depletes resulting in material fatigue and premature aging where the interior components become hard and brittle.

Thermo Scientific fog testing system

Thermo Scientific Horizon Fog Testing System

The Horizon Fog Testing System consists of a controller which is fitted to a large-volume bath vessel specifically designed for the fogging test. Additional features assist in the proper set up of the system to enable accurate, repeatable testing:

1. High capacity heaters are used for fast heating to set point temperature.
2. The unique pump nozzle ensures circulation around all six beakers to maintain the specified temperature accuracy of ±0.5°C throughout the entire bath providing consistent results.
3. A bubble level and four adjusting feet for levelling the bath side to side and front to back assure that the heat transfer fluid level is the same for all six glass beakers. (ie, if the equipment is not level the results from beaker to beaker will be vary because the beakers are not equally immersed)
4. The bath area is covered with a sealed frame that holds six glass beakers and prevents heat transfer fluid vapors from corrupting the test results.
5. Because fog test fluid expands when heated, a liquid level indicator shows that the fluid is at the correct level when the required temperature is reached.
6. Water flows through a manifold distribution system keeping all six cooling plates at the same temperature for repeatable results.

We have three recommended choices for a refrigerated bath circulator or recirculating chiller as follows:

Accel 250 LC:
When cost and space are important, this recirculating chiller is an economical choice and the small footprint saves space in the lab.

SC 100-A 10:
This refrigerated bath/circulator heats and cools across a wide temperature range with an internal bath as well as the capability to circulate externally so that it can serve other applications within your lab or facility.

PC200-A28
This refrigerated bath/circulator also heats and cools across a wide temperature range with an internal bath as well as the capability to circulate externally. The PC200 controller has the ability to provide real-time graphs with temperature ramping using the internal or external temperature sensor. Pair it with the PC-FTS and the matching controllers will simplify using the Horizon FTS.

Additional components include:

- **Cooling plates[2] (6 needed)**
  These are made of a stainless steel top with an aluminum contact surface. They have an internal passage through which the temperature controlled water flows. Their purpose is to maintain the square glass plates or aluminum foil discs at the prescribed temperature causing the VOC vapor to condense onto them.

- **Tubing Kit**
  This kit includes pre-cut and cut-to-fit tubing and hose clamps needed to connect the cooling plates to the circulator. The tubing delivers temperature controlled water from the circulator to the cooling plates.

- **Sample cutter** (1 needed)
  This device cuts an 80 mm[2] diameter sample of leather, plastic films and plastic or rubber coated cloth that is placed on to the bottom of the beaker.

- **Glass beakers[2]** (6 needed)
  The flat-bottom beakers fit into the holes of the sealed frame. They are made from heat-resistant glass and hold the cut samples during testing.

- **Metal rings[2]** (6 needed)
  Made from chrome-plated steel. These are placed on top of the test sample to secure the sample against the base of the beaker.

- **Fluoroelastomer sealing rings[2] and support rings** (6 needed)
  These O-rings form a seal between the top of the beakers and the glass plates so that the VOC vapors released from the sample do not escape from the beaker.
  Note: The sealing rings have a limited life and should be replaced as needed.
  The support rings are mounted inside the sealing rings. This helps stabilize the Fluoroelastomer sealing ring when placed on top on the beaker.

- **Heat transfer liquid FOG 150[2]**
  (4 x 10 litre containers necessary)
  This is used as the heat transfer fluid in the fogging bath. It is soluble in water and can be used up to temperatures of 150°C.

- **Set of covers** (1 needed)
  Two covers are included in the set and are used to cover the openings of the temperature controlled bath. This prevents contamination and/or evaporation of the heat transfer liquid if not using all six beakers and also speeds time to temperature when heating to the fogging set point.

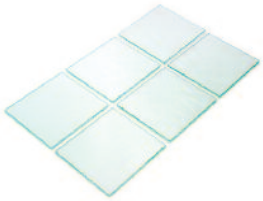
Fogging Test Methods

In 1992 test procedures and equipment requirements for fog testing were originally developed and published in the "DIN 75201 standard" to determine the amount of undesired evaporation from the interior components of automobiles. This DIN standard was widely adopted by ISO, SAE and proprietary manufacturer's standards. All of the standards (whether DIN, ISO, SAE or proprietary) use some type of reflective or gravimetric test based on, or similar to the methods outline below:

Reflectometric method (gloss method):
During this method, the test sample is heated to 100°C for 3 hours releasing VOCs from sample which then condense on a glass plate that is cooled to 21°C. In this way the evaporation and condensation process which normally takes place in motor vehicles is simulated. The amount of fogging condensation on the glass plate is then qualitatively recorded by measuring the 60° reflection value using a hand held reflectometer. A 60° reflection value of the same glass plate without condensation that was taken before the test serves as a reference.

Accessories for the Reflectometric Method (gloss method)

Square glass plates (6 needed)



The high quality floated glass plates are manufactured specifically for the relflectrometric method described above. The glass plates are placed on top of the beaker along with the sealing rings.

Note: The glass plates have a limited life and should be replaced as needed.

Frame for the glass plates (1 needed)

After the process of condensation is formed on the glass plate, it is ready for the reflective test. The black-painted aluminum frame is placed over the square glass plate to prevent the Reflectometer from contacting the glass plate and smearing or affecting the fog.

Reflectometer (1 needed)

This handheld reflectometer works according to the reflective principle, i.e. the directed reflection of the material sample is measured within an angle of 60°. A calibration standard is included.

Gravimetric method:
During this method the test sample is heated to 100°C for 16 hours. The volatile components condense on an aluminium foil disc cooled to 21°C which has been previously weighed and its mass recorded. The amount of fogging condensation is determined by weighing the foil again after the test and subtracting that mass from the first measurement so that the mass of the condensation is measured.

Accessories for the Gravimetric Method

Set of round foils (1 container needed)

The set contains 200 foils with slip sheets in between to protect the foils. The slip sheet is removed and the foil is placed on top of the sealing rings. During the fogging process the condensation collects on the foils.

Round glass plates (6 needed)

These go between the aluminum foil discs and the cooling blocks to keep the foil in place, sealed to the beaker and flat.

References:

1. DIN 75201: Determination of the windscreen fogging characteristics of trim materials in motor vehicles.
2. ISO 6452: Rubber- or plastic coated fabrics - determination of fogging characteristics of trim materials in the interior of automobiles"

In addition to these offices, Thermo Fisher Scientific maintains a network of representative organizations throughout the world.

Benelux
Tel. +31 (0) 76 579 55 55
info.tc.nl@thermofisher.com

China
Tel. +81 3 5826 1616
info.tc.china@thermofisher.com

France
Tel. +33 (0) 1 60 92 48 00
info.tc.fr@thermofisher.com

Germany
Tel. +49 (0) 721 4 09 44 44
info.tc.de@thermofisher.com

India
Tel. +91 (22) 27 78 11 01
Contact.lpg.in@thermofisher.com

Japan
Tel. +81 45 453 9220
info.lpg.jp@thermofisher.com

USA
Tel. 603 436 9444
info.tc.us@thermofisher.com

www.thermoscientific.com/fts

TNFTS0511

Ihr Kontakt / Your contact:

PSL Systemtechnik GmbH
sales@psl-systemtechnik.com
+49 5522 31250 0

Thermo SCIENTIFIC