Swagelok

# SCF Series Ultrahigh-Purity Gas Filters Technical Report

## Scope

This technical report provides data on the Swagelok® SCF series filter. The report covers:

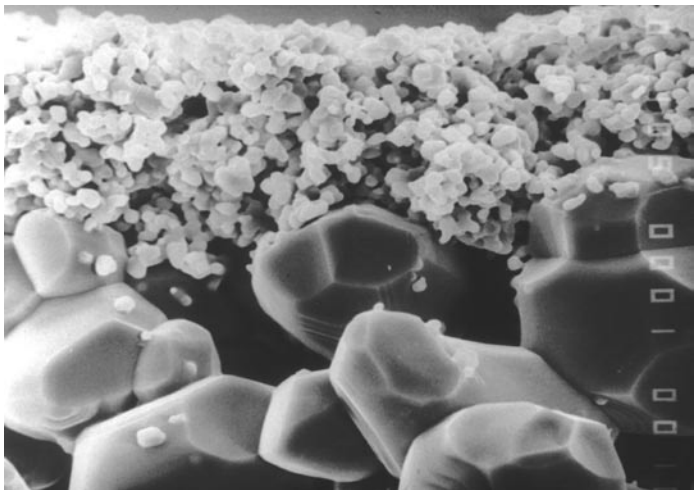
- surface finish specifications
- Membralox® filter construction
- particle removal
- particle shedding
- moisture analysis
- hydrocarbon analysis
- oxygen analysis.

## Surface Finish

Statistical process control (SPC) allows Swagelok to provide consistent surface finishes, as described in Specification SC-01. The roughness average ($R_a$) specification we have established for the wetted surfaces of SCF series filters manufactured with a Swagelok P finish is 5 µin. (0.13 µm) $R_a$ on average.

## Membralox Filter Construction

Membralox ceramic filters are constructed with layers of material of decreasing pore sizes. This allows particles of larger size to be caught in the outer zone while trapping smaller particles in the inner zone. The benefits of multiple layers are longer life and higher efficiency.



A scanning electron microscope image shows the two membrane layers of the filter: ultrafine and fine (as shown from top to bottom).

## Particle Removal

Filter efficiency of SCF series filters is 99.9999999 % at 0.003 µm particles and higher.

Eight filters were tested in accordance with SEMI F38-0699 guidelines:

- Particle loading: $5 \times 10^9$ particles on each filter.

**30 std L/min Model**

| | Filter 1 | Filter 2 | Filter 3 | Filter 4 |
|---|---|---|---|---|
| Efficiency, % | > 99.9999999 | > 99.9999999 | > 99.9999999 | > 99.9999999 |

**225 std L/min Model**

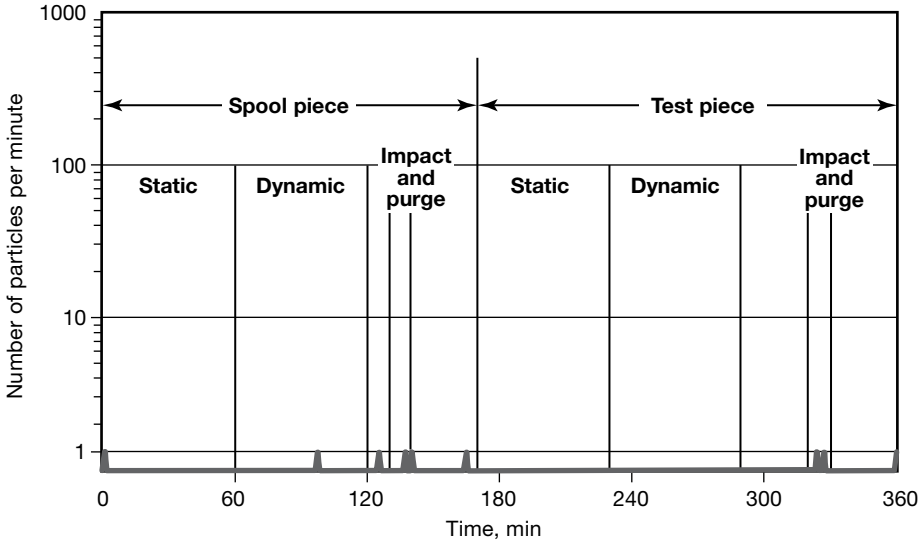
| | Filter 1 | Filter 2 | Filter 3 | Filter 4 |
|---|---|---|---|---|
| Efficiency, % | > 99.9999999 | > 99.9999999 | > 99.9999999 | > 99.9999999 |

## *Particle Shedding*

SCF series filters performed better than the guidelines when subjected to dynamic, static, and impact flow. According to the guidelines, the particle emission test results must be equal to or less than 2 particles per standard cubic foot.

Eight filters were tested in accordance with SEMASPEC 90120390B-STD.

The graph at the right represents a typical result from one of the eight filters tested.



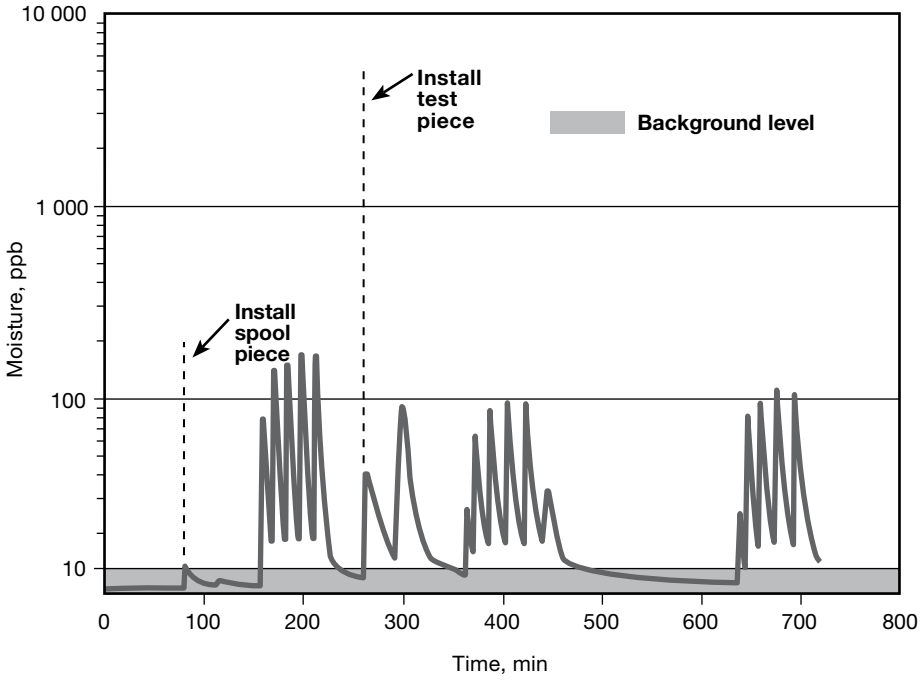

## *Moisture Analysis*

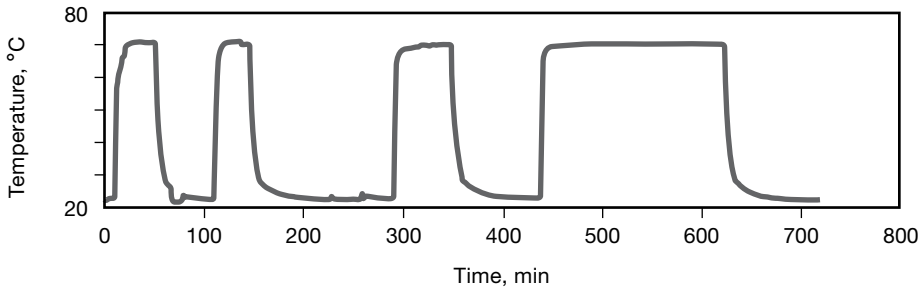
SCF series filters dried down to a level of 20 ppb $H_2O$ within 1 hour, compared to 6 hours recommended by the test guidelines.

Eight filters were tested in accordance with SEMI E49.8-96 guidelines.

- The test gas was pure nitrogen.
- The flow rate was 1.28 std L/min.

The upper graph represents a typical result from one of the eight filters tested. The lower graph shows the pattern of elevated temperatures that were applied to the filters during testing to enhance the moisture sensitivity of the system.



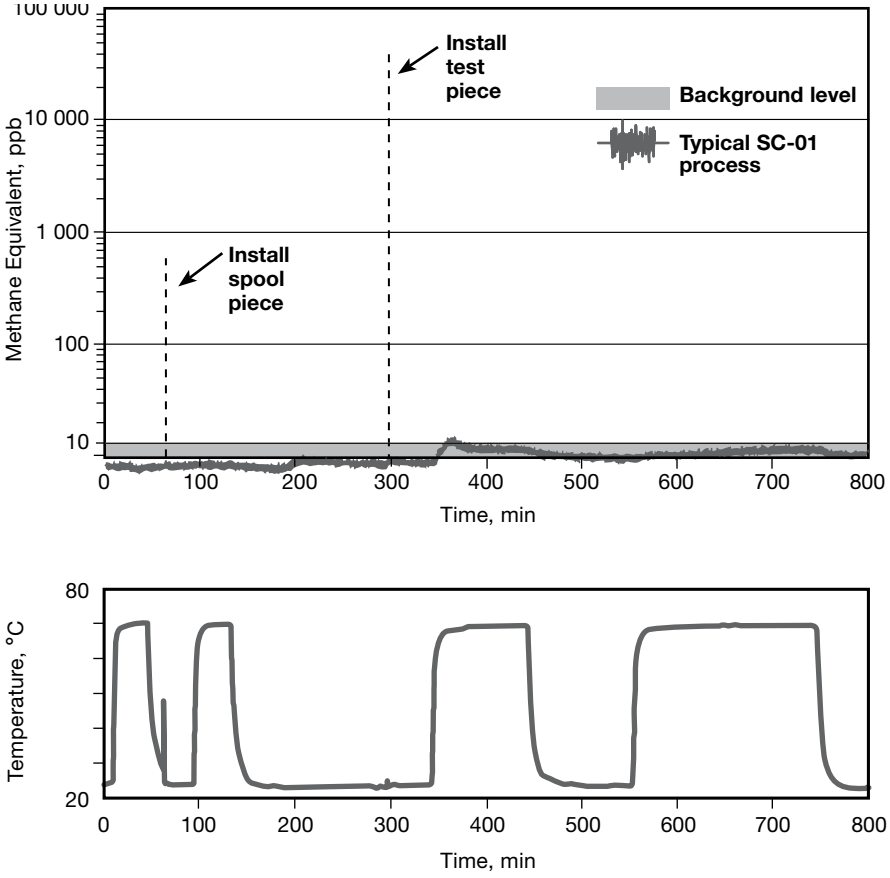
## *Hydrocarbon Analysis*

Hydrocarbon residues in SCF series filters recover to 10 ppb methane equivalent within 5 minutes, compared to 30 minutes recommended by the test guidelines.

Four filters were tested in accordance with SEMASPEC 90120396B-STD.

- The test gas was pure nitrogen.
- The flow rate was 1.28 std L/min.

The upper graph represents a typical result from one of the four filters tested. The lower graph shows the pattern of elevated temperatures that were applied to the filters during testing to drive off any hydrocarbon residues in the system.



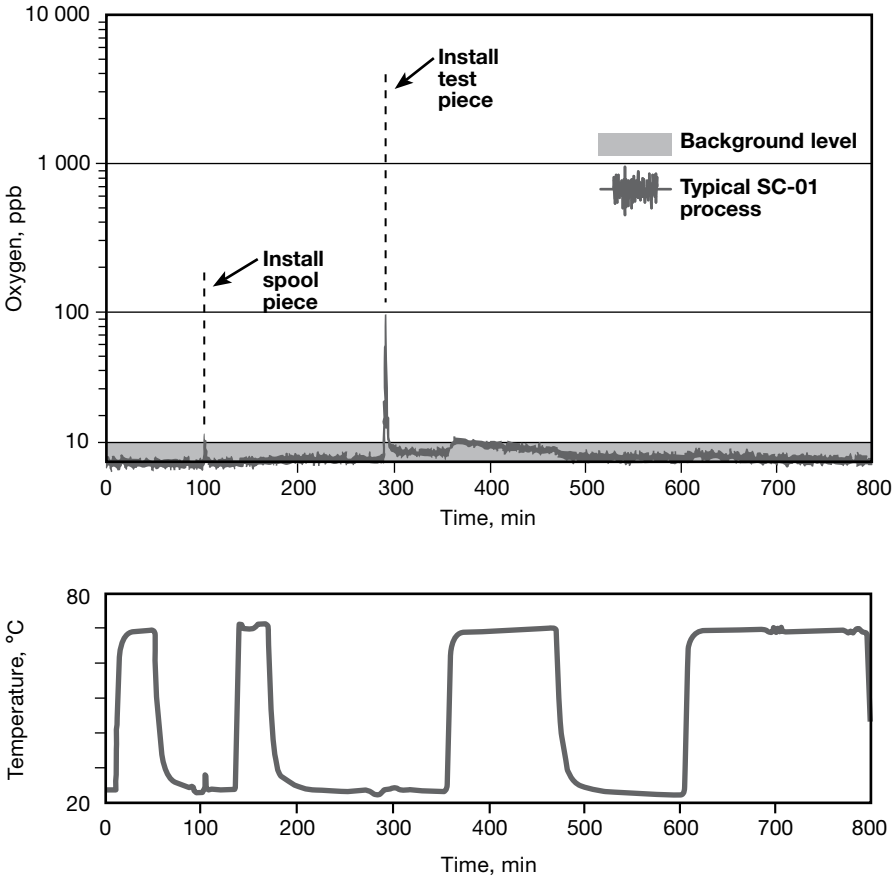

## *Oxygen Analysis*

Oxygen residues in SCF series filters recover to 10 ppb oxygen within 10 minutes, compared to 30 minutes recommended by the test guidelines.

Six filters were tested in accordance with SEMASPEC 90120398B-STD.

- The test gas was pure nitrogen.
- The flow rate was 1.28 std L/min.

The upper graph represents a typical result from one of the six filters tested. The lower graph shows the pattern of elevated temperatures that were applied to the filters during testing to drive off any oxygen residues in the system.



## Referenced Documents

### *SEMI Specification*[1]

SEMI F38-0699 Test Method for Efficiency Qualification of Point-of-Use Gas Filters

SEMI E49.8-96 Guide for High Purity Gas Distribution Systems in Semiconductor Manufacturing Equipment

### *SEMATECH SEMASPECS*[2]

93021511A-STD Test Method for Determination of Particle Contribution by Filters in Gas Distribution Systems

90120390B-STD Test Method for Determination of Particle Contribution by Valves in Gas Distribution Systems

90120391B-STD Test Method for Determination of Helium Leak Rate for Gas Distribution System Components

90120393B-STD Test Method for Determination of Filter Flow Pressure Drop Curves for Gas Distribution System Components

90120396B-STD Test Method for Determination of Total Hydrocarbon by Gas Distribution System Components

90120397B-STD Test Method for Determination of Moisture Contribution by Gas Distribution System Components

90120398B-STD Test Method for Determination of Oxygen Contribution by Gas Distribution System Components

### *Swagelok Specification*

*Ultrahigh-Purity Process Specification (SC-01),* MS-06-63

1. Semiconductor Equipment and Materials International, 3801 Zanker Rd., San Jose, CA 95134.
2. SEMATECH, Inc., 2706 Montopolis Dr., Austin, TX 78741.

**Safe Product Selection**
**When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, materials compatibility, adequate ratings, and proper installation, operation, and maintenance are the responsibilities of the system designer and user.**


September 2008, R3
MS-06-97-E