

# SEMI F76-0303 (Reapproved 1110) TEST METHOD FOR EVALUATION OF PARTICLE CONTRIBUTION FROM GAS SYSTEM COMPONENTS EXPOSED TO CORROSIVE GAS

This Standard was technically approved by the Gases Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on August 27, 2010. Initially available at [www.semi.org](http://www.semi.org) in October 2010. Originally published March 2003.

**NOTICE:** This Document was reapproved with minor editorial changes.

## 1 Purpose

1.1 This is a test method to compare gas handling components for potential particle generation in corrosive gas service. It is intended as a practical means of generating performance data for a group of components to be compared in a selection process.

## 2 Scope

2.1 This Test Method applies to valves, particle filters, and low pressure regulators.

**NOTICE:** SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

## 3 Limitations

3.1 This Test Method is not intended to provide insight into fundamental corrosion mechanisms.

3.2 Since the test is to be conducted on fully functional gas system components, it is not designed to determine the suitability of specific materials of construction for corrosive gas service. Such factors as component design, flow path, weld quality, cleanliness of construction and manufacturing methods can affect the results of this test making the material of construction only one of many factors.

3.3 This Test Method is not designed to provide reliability or failure data. It is expected that the data produced will be relative; that is, the data will be most useful when groups of components are compared to each other.

3.4 This Test Method is not designed to evaluate parameters besides particle contribution, for instance leak rate or regulator drift.

3.5 Components to be tested must be capable of withstanding the bake temperature of 100°C for filters and 70°C for valves and regulators.

3.6 This Test Method applies to HCl which is a reducing environment. Results may not be indicative of performance in corrosive oxidizing environments such as Cl<sub>2</sub>.

## 4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

SEMI C59 — Specifications and Guidelines for Nitrogen

SEMI E66 — Test Method for Determining Particle Contribution by Mass Flow Controllers

SEMI F43 — Test Method for Determination of Particle Contribution by Point-of-use Gas Purifiers and Gas Filters

4.2 *ASTM Standard*<sup>1</sup>

ASTM F1394-92 — Standard Test Method for Determination of Particle Contribution from Gas Distribution System Valves

<sup>1</sup> ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: +1.610.832.9585, Fax: +1.610.832.9555, <http://www.astm.org>

#### 4.3 SEMATECH Document<sup>2</sup>

SEMASPEC #93021510A-STD — Test Method for Determination of Particle Contribution by Low Pressure Regulators in Gas Distribution Systems

**NOTICE:** Unless otherwise indicated, all documents cited shall be the latest published versions.

### 5 Terminology

#### 5.1 Definitions

5.1.1 *cycle purge* — a procedure which employs alternating cycles of vacuum and pressure for the purpose of evacuating a gas system or a portion of a gas system of impurities or active gases.

5.1.2 *particle filter* — a device that removes small particles from a gas stream with high efficiency.

5.1.3 *point-of-use purifier* — an inline device that removes homogeneous impurities such as moisture and oxygen. An integral particle filter is typically included in the same housing to remove particles.

5.1.4 *regulator* — a valve designed to reduce a high incoming pressure to a lower outlet pressure by automatically opening to allow flow until a desired, pre-set pressure on the outlet side is reached, and then automatically throttling to stop further pressure increase.

5.1.5 *valve* — a device that controls the flow or pressure of a gas. Valve functions can include shut-off, metering, backflow prevention, and pressure relief.

### 6 Summary of Method

6.1 This Test Method is designed to provide comparative results for similar components. It is not intended to replicate process condition or actual use conditions. Components will be compared for their particle shedding performance after being exposed to moisture and corrosive gases, in this case hydrogen chloride (HCl) gas. The component will be exposed alternately to corrosive gas and then to 100 ppm moisture content nitrogen gas several times. The particle shed performance before and after exposure will be compared. The overall test sequence is outlined in Figure 2.

### 7 Apparatus

#### 7.1 Corrosive Gas Exposure Apparatus

7.1.1 The corrosive gas exposure will be carried out using the apparatus shown in Figure 1.

7.1.2 *Moisture Generator* — Moisture generation is achieved using a permeation-source-type moisture generator. The permeation source should be selected to provide 100 ppm H<sub>2</sub>O in a flow of 500 sccm nitrogen. Records should be kept on the age of the permeation source so that a reliable source of moisture can be maintained.

7.1.3 *Vacuum Generator* — A Venturi or similar device capable of producing a rough vacuum of 85,000 pascals (25 in. of mercury).

7.1.4 *Point of HCl Introduction* — The point at which gaseous hydrogen chloride HCl and N<sub>2</sub> join the system (point A in Figure 1) should be designed so that the dead volume between the check valves is minimized. The check valves following V1 and V2 should be nearly joined to each other so as to minimize this volume.

<sup>2</sup> SEMATECH, 257 Fuller Road, Suite 2200, Albany, NY 12203, USA; Telephone: +1.518.649.1000, <http://www.sematech.org>

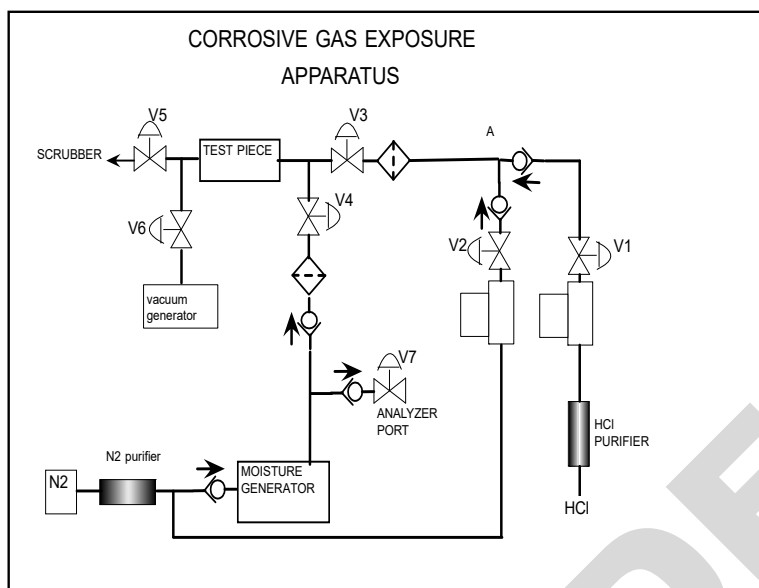


**Figure 1**  
**Corrosive Gas Exposure Apparatus**

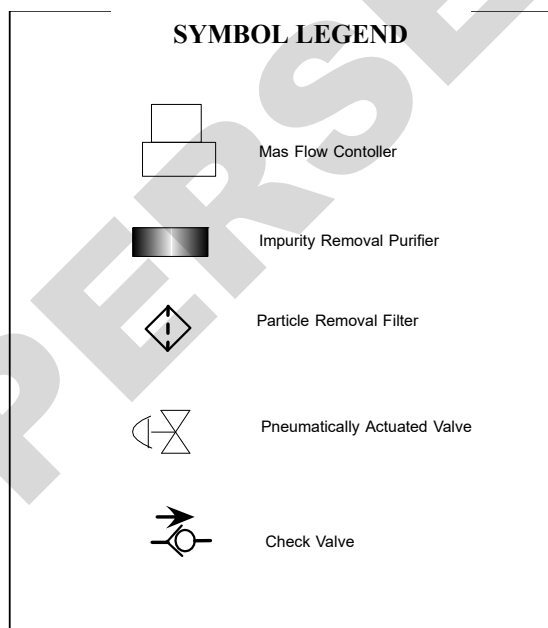


**Figure 2**  
**Legend to Figure 1**

## 8 Reagents and Materials

8.1 *Nitrogen* — Nitrogen with less than 50 ppbv moisture is to be used. This can be accomplished with a point-of-use purifier as shown in Figure 1 or by using 99.99999% quality bulk nitrogen according to SEMI C59.

8.2 *Hydrogen Chloride* — Gaseous HCl should contain less than 1 ppmv H<sub>2</sub>O. The HCl purifier shown in Figure 1 is optional unless the source gas contains greater than 1 ppmv H<sub>2</sub>O.