

SEMI F71-1102

TEST METHOD FOR TEMPERATURE CYCLE OF GAS DELIVERY SYSTEM

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NOTICE: The section symbol (§) is used to reference a numbered section, paragraph, or header and all subordinate paragraphs, headers, and embedded material (i.e., EXCEPTIONs, lists) therein. The paragraph symbol (§) is used to reference a particular numbered paragraph and embedded material therein. When duplicated (i.e., §§ and §§) the symbols are used to reference more than one section or paragraph, respectively.

NOTICE: This Standard or Safety Guideline has an Inactive Status because the conditions to maintain Current Status have not been met. Inactive Standards or Safety Guidelines are available from SEMI and continue to be valid for use.

1 Purpose

1.1 The purpose of this Test Method is to provide a standardized methodology and procedure for the leakage performance of gas delivery systems temperature cycling.

2 Scope

2.1 This Test Method applies to gas delivery systems installed in semiconductor manufacturing equipment.

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 Referenced Standards and Documents

3.1 *SEMI Standards and Safety Guidelines*

SEMI F1 — Specification for Leak Integrity of High-Purity Gas Piping System and Components

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

4 Terminology

4.1 Definitions

4.1.1 *gas delivery system* — a system installed in semiconductor manufacturing equipment to deliver process and carrier gases to reactors, which typically consists of tubing, fittings, valves, filters, mass flow controllers and regulators.

4.1.2 *helium leak test* — testing shall be conducted per procedure outlined of inboard leak test in SEMI F1.

4.1.3 *T-max* — the maximum set temperature of the temperature cycle test.

4.1.4 *T-min* — the minimum set temperature of the temperature cycle test.

5 Apparatus

5.1 *Helium Leak Detector* — The detector has appropriate detection sensitivity according to SEMI F1.

5.2 *Constant Temperature Oven* — The constant temperature oven should have the capacity to accommodate the test configuration and maintain the elevated T-max temperature to $\pm 5^{\circ}\text{C}$.

5.3 *Freezer* — The freezer should have the capacity to accommodate the test configuration and maintain the T-min temperature to $\pm 5^{\circ}\text{C}$.

5.4 *Thermocouple* — The thermocouple should make contact with the sample and should take measures of a noise.

6 Test Specimen and Condition

- 6.1 The temperature cycling test should be performed using a typical gas delivery system configuration. An example is shown in Figure 1.
- 6.2 The influence of heat expansion is not easily measured with a single component. Therefore, use a gas panel having a minimum of three lines as an assembled sample. An example is shown in Figure 1.
- 6.3 A set temperature (T-max, T-min) at the temperature cycle must be within the range of the rated temperature of components used in the gas panel.
- 6.4 The sealing surface used in the gas delivery system shall not have any scratches or other defects which are visible to non-magnified normal vision.
- 6.5 Install the thermocouple in approximately the center of the gas panel to be tested.
- 6.6 The user can arbitrarily decide heating and cooling temperatures in temperature cycle examination according to the purpose of use.
- 6.7 The helium leak test shall be performed only at room temperature ($22 \pm 4^\circ\text{C}$), not during heating or cooling.

7 Procedure

- 7.1 A typical gas delivery system configuration is shown in Figure 1. The following test procedure shall be interpreted to apply to the actual test target and deviations from the procedure in this Test Method shall be recorded along with the test results. (The condition of heated T-max and cooling T-min was taken up here as an example.)
- 7.2 Perform the helium leak test and confirm whether there is leakage in the gas panel before starting temperature cycle examination. Connect all flow path in the gas panel to helium leak detector and plug all open end connections before the helium leak test is executed. Abort testing if leakage is detected and record leaking points and leak rate.
- 7.3 Put the test sample in the constant temperature oven and apply heat until the test sample reaches T-max. Maintain the temperature for 10 ± 1 minutes.
- 7.4 Remove the sample from the constant temperature oven and cool down to the room temperature and perform helium leak test.
- 7.5 Put the test sample in the freezer and cool until the test sample reaches T-min. Maintain the temperature for 10 ± 1 minutes.
- 7.6 Remove the sample from the freezer and equilibrate to the room temperature and perform helium leak test.
- 7.7 Repeat ¶¶ 7.2 through 7.6 for five cycles. The temperature cycles should be recorded and plotted as shown in Figure 2.

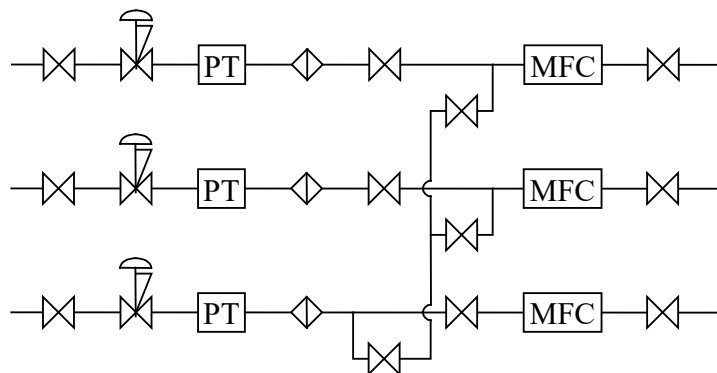


Figure 1
Typical Gas Delivery System Configuration