

SEMI E28-92 (Reapproved 0299) GUIDELINE FOR PRESSURE SPECIFICATIONS OF THE MASS FLOW CONTROLLER

This guideline was technically reapproved by the Facilities Committee and is the direct responsibility of the North American Facilities Committee. Current edition approved by the North American Regional Standards Committee in October 1998. Initially available at www.semi.org February 1999; to be published February 1999. Originally published in 1992.

1 Purpose

The purpose of this guideline is to establish a uniform, worldwide means to describe pressure parameters as they relate to mass flow controllers. It is intended to prevent confusion and misunderstanding between manufacturers and users.

2 Scope

This guideline contains definitions of terms which describe gas pressure in mass flow controllers as used in the semiconductor industry. SI units are the reference units for this document.

3 Applicable Documents

3.1 SEMI Standard

SEMI E12 — Standard for Standard Pressure and Standard Temperature for Flow Units Used in Mass Flow Meters and Mass Flow Controllers

4 Definition of Terms

4.1 *units of pressure* — Several units of pressure are commonly used in conjunction with MFC's. The Pascal is the preferred unit of pressure for use within the semiconductor industry. Units of pressure include the following:

- Pascal (Pa)
- Pounds per square inch (psi)
- Torr (T)
- Kilograms per square centimeter (kg/cm^2)
- Bar (B)

NOTE: Units of pressure are sometimes expressed as an equivalent height of a column of some liquid, such as millimeters of mercury or inches of water. These units require correction to some standard for liquid density and gravity. As these corrections are neither broadly standardized nor often even addressed, their use should be avoided.

4.2 *absolute pressure* — The pressure measured relative to zero pressure (perfect vacuum). (See Figure 1.)

NOTE: Absolute pressure is the pressure illustrated by the ideal gas law, $PV = nRT$. For example, when the number of moles, n , equals zero (no molecules), absolute pressure, P ,

equals zero. To indicate unambiguously that a pressure measurement is absolute, the following abbreviations should be used:

- Pa — Pascal (absolute assumed)
- psi (a) — Pounds per square inch, absolute
- Torr — Torr (absolute assumed)
- kg/cm^2 (a) — Kilograms per square centimeter, absolute
- B (a) — Bar, absolute

Units such as Pascal and Torr are customarily absolute units.

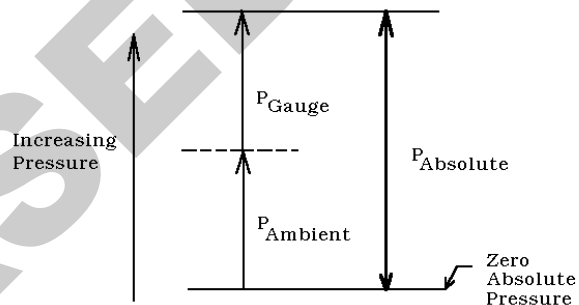


Figure 1
Relationship Between Absolute, Gauge,
and Ambient Pressure

4.3 *differential pressure* — The difference in absolute pressure between two points of measurement in a system. (See Figure 2.)

NOTE — To indicate unambiguously that a pressure measurement is differential, the following abbreviations should be used:

- Pa (d) — Pascal, differential
- psi (d) — Pounds per square inch, differential
- Torr (d) — Torr, differential
- kg/cm^2 (d) — Kilograms per square centimeter, differential
- B (d) — Bar, differential

4.3.1 Gauge pressures may also be used in the differential pressure calculation if consistency is maintained. A common error would be to take the difference between an inlet gauge pressure and an outlet absolute pressure without first converting to common units.

4.3.2 As it applies to an MFC, differential pressure is usually the measured difference in pressures between the gas inlet and outlet fittings of the MFC.

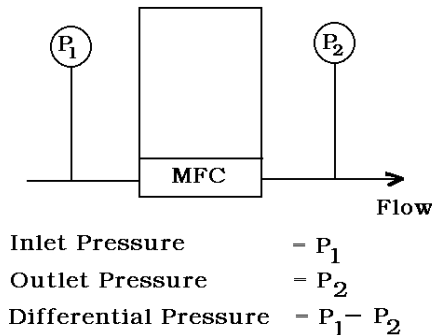


Figure 2
Definition of Differential Pressure for MFCs

4.4 *ambient pressure* — The absolute pressure of the medium surrounding the MFC. (See Figure 3.)

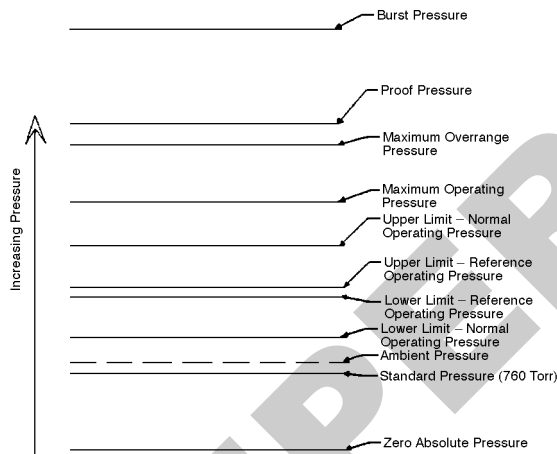


Figure 3
Pressure Definitions for MFCs

4.5 *reference ambient* — The composition and pressure range of the ambient medium surrounding the MFC within which performance specifications apply without requiring correction for changes in the ambient medium.

4.6 *gauge pressure* — The differential pressure measured relative to ambient pressure. For example, when the pressure within a system equals the prevailing ambient pressure, the gauge pressure equals zero. (See Figure 1.)

NOTE — To indicate unambiguously that a pressure measurement is gauge, the following abbreviations should be used:

Pa (g) — Pascal, gauge
 psi (g) — Pounds per square inch, gauge
 Torr (g) — Torr, gauge
 kg/cm² — Kilograms per square centimeter, gauge
 B (g) — Bar, gauge

NOTE : The performance of MFCs can vary significantly with gas density. Atmospheric pressure varies with the weather and altitude at various geographical locations. Gauge pressure units commonly reference atmospheric pressure. Therefore, the same gauge pressures measured at different geographical locations may correspond to different gas densities. For this reason, the use of gauge pressure units with MFCs can be imprecise and should be avoided.

4.7 *inlet pressure* — The pressure at the inlet fitting of the MFC. (See Figure 2.)

4.8 *outlet pressure* — The pressure at the outlet fitting of the MFC. (See Figure 2.)

NOTE: To completely specify the pressure operating environment for MFCs, at least two of the following three pressures must be listed: inlet, outlet, and differential.

4.9 *MFC calibration pressure, inlet and outlet* — The inlet and outlet pressure at which the MFC was calibrated. (See Figure 3.)

4.10 *reference operating pressure, inlet and outlet* — The range of gas pressures on the inlet of the MFC and across the MFC within which performance specifications apply without requiring correction for gas pressure effects. (See Figure 3.)

4.11 *normal operating pressure, inlet and outlet* — The pressure range within which the MFC meets its stated performance specifications. (See Figure 3.)

4.12 *normal operating differential pressure* — The range of differential pressure (see Section 4.3) required by the MFC to meet its stated performance specifications.

NOTE: The upper and lower limits are dependent upon the absolute inlet or outlet pressure. These limits are manufacturer-specific.

4.13 *maximum operating pressure* — Operation is permitted up to this inlet pressure, but performance is not specified above normal operating pressure. (See Figure 3.)

4.14 *maximum overrange pressure* — The maximum gas pressure to which the MFC may be subjected without degrading specified performance. When returned to normal operating pressure, the MFC must require no adjustment to return to specified performance. (See Figure 3.)