

# SEMI F4-0200

## SPECIFICATION FOR PNEUMATICALLY ACTUATED CYLINDER VALVES

This specification was technically approved by the Global Facilities Committee and is the direct responsibility of the North American Facilities Committee. Current edition approved by the North American Regional Standards Committee on December 15, 1999. Initially available on [www.semi.org](http://www.semi.org) February 2000; to be published February 2000. Originally published in 1990; previously published February 1998.

### 1 Purpose

1.1 This specification establishes the minimum design and performance requirements for pneumatically actuated cylinder valves used in semiconductor manufacturing. It is also intended as an aid in the procurement of these valves.

### 2 Scope

2.1 This specification applies to pneumatically actuated valves for use on cylinders containing gases used in semiconductor manufacturing facilities and in comparable research and development areas.

2.2 This specification does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this specification to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

### 3 Limitations

3.1 This specification is not a replacement for safety regulations. It is the responsibility of the user to ensure that pneumatically actuated cylinder valves comply with all applicable safety regulations.

3.2 This specification excludes design or performance requirements for any electrically operated devices used in conjunction with, or as a replacement for, pneumatic actuators.

### 4 Referenced Standards

#### 4.1 SEMI Standards

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

SEMI F19 — Specification for the Finish of the Wetted Surfaces of Electropolished 316L Stainless Steel Components

SEMI F20 — Specification for 316L Stainless Steel Bar, Extruded Shapes, Plate and Investment Castings for Components Used in High Purity Semiconductor Manufacturing Applications

SEMI F32 — Test Method for Determination of Flow Coefficient for High Purity Shutoff Valves

SEMI S5 — Safety Guideline for Flow Limiting Devices

#### 4.2 ASME Document<sup>1</sup>

B1.1 — Unified Inch Screw Threads (UN and UNR Thread Form)

#### 4.3 CGA Standards<sup>2</sup>

CGA G-4.1 — Cleaning Equipment for Oxygen Service

CGA S-1.1 — Pressure Relief Device Standards - Part 1 - Cylinders for Compressed Gases

CGA S-7 — Method for Selecting Pressure Relief Devices for Compressed Gas Mixtures for Cylinders

CGA V-1 — Compressed Gas Cylinder Valve Outlet and Inlet Connections

CGA V-9 — Compressed Gas Association Standard for Compressed Gas Cylinder Valves

#### 4.4 ISO Standards<sup>3</sup>

ISO 68 — General Purpose Screw Threads - Basic Profile

ISO 261 — General Purpose Metric Screw Threads - General Plan

#### 4.5 US Code of Federal Regulations<sup>4</sup>

Title 49 CFR, Parts 100–199 — Transportation

NOTE 1: As listed or revised, all documents cited shall be the latest publications of adopted standards.

### 5 Terminology

5.1 *burst pressure* — a pressure at which rupture or uncontrolled leakage of one or more of the pressure retaining components of the device occurs.

1 American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017

2 Compressed Gas Association, Inc., 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202

3 International Organization for Standardization, Case Postale 56, Geneva 20, CH-1211, Switzerland

4 Department of Transportation, Superintendent of Documents, U.S. Government Printing Office, Mail Stop: SSOP, Washington, D.C. 20402-9328

5.2 *cylinder* — a pressure vessel designed for pressures higher than 276 kPa (40 psia), having a circular cross-section, and a maximum water capacity of less than 454 kg (1,000 lbs.). It does not include a portable tank, multi-unit tank car tank, cargo tank, or tank car.

5.3 *cylinder valve* — a mechanical device attached to a compressed gas cylinder that permits flow into or out of the cylinder when the device is in the open position and prevents flow when in the closed position.

5.4 *disconnect shutoff* — a device, which will not permit the flow of gas through an open cylinder valve without attachment to an outlet connector.

5.5 *flow coefficient (Cv)* — a numeric constant used to characterize the flow capacity of a valve.

5.6 *manual locking device* — a device used to prevent the cylinder valve from opening during transportation or service.

5.7 *manual override* — a device used for opening the cylinder valve manually.

5.8 *normal temperature* — a temperature of 21°C ± 6°C (70°F ± 10°F).

5.9 *normally closed* — a design in which the cylinder valve closure member automatically assumes the closed position upon loss of compressed gas to the actuator.

5.10 *packless valve* — a valve with a diaphragm or bellows stem seal instead of a packing or O-ring seal at the stem.

5.11 *pneumatic actuator* — a device which converts compressed gas pressure into mechanical motion and force to move the cylinder valve closure member.

5.12 *proof pressure* — a pressure greater than the cylinder valve's rated pressure that the cylinder valve can withstand without impairing its ability to meet the leak rate limits specified in SEMI F1 upon return to rated pressure.

5.13 *rated pressure* — the pressure at which the cylinder valve can meet the performance and qualification requirements of this specification. Rated pressure shall be specified by the manufacturer.

5.14 *valve closure member* — that part of the cylinder valve which is positioned in the flow stream to permit or obstruct flow, depending on its closure position.

5.15 *wetted surface* — surface within the interior of the cylinder valve, which is in contact with the controlled gas. The surface in contact with the gas used to actuate the cylinder valve is not, for the purpose of this specification, considered a "wetted surface".

## 6 Design Requirements

6.1 *General* — Components not covered by this specification or CGA Standards shall be constructed such that they do not compromise the safety, substantiality, and durability of the valve or actuator.

6.2 *Configuration* — The cylinder valve shall be a packless valve design with a normally closed actuator.

6.3 *Size* — The cylinder valve and actuator shall be of a design size which permits the use of a protective transportation cover which satisfies the requirements of 49 CFR Section 173.40(d)(2).

6.4 *Materials* — Ferrous materials used for the wetted surfaces shall be per SEMI F20. Other materials may be supplied to satisfy specific material or performance requirements, provided they are compatible with the gas service.

6.5 *Inlet* — The inlet of the cylinder valve shall have tapered external threads as specified by CGA V-1 or other recognized governmental or industry standards for the connection of cylinder valves to gas cylinders.

6.6 *Outlet* — The outlet of the cylinder valve shall conform to a CGA 630/710 series connection in accordance with CGA V-1 or other recognized governmental or industry standards for the outlet connections of gas cylinder valves.

6.7 *Actuator Pressure* — The actuating pressure required to open the cylinder valve fully shall not exceed 550 kPa (gauge) (80 psig).

6.8 *Manual Override* — A manual override shall be supplied.

6.9 *Vents* — Vent hole(s) for mass spectrometer helium leak testing shall be supplied at appropriate locations.

6.10 *Internal Volume* — The wetted surfaces should be configured, and the internal volume minimized, to enhance the efficacy of purging.

6.11 *Particle Control* — The design should minimize accumulation and generation of particles.

6.12 *Threaded Fasteners* — Threaded fasteners used in the covers, housings, casings, and any external mounting brackets shall have threads conforming to, as applicable, the ASME B1.1, ISO 68, or ISO 261 standards.

6.13 *Cleanliness* — The cylinder valve and actuator shall be cleaned, as a minimum, per CGA Standard G-4.1.