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Standard Specification for Anesthetic Equipment—Scavenging Systems for Anesthetic Gases¹

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1. Scope

1.1 This specification covers the minimum performance and safety requirements to be used for systems for scavenging excess anesthetic gases from operating rooms. It applies to scavenging from breathing machines for medical use, extracorporeal oxygenators, and anesthetic breathing machines. It is not intended to apply to machines designed exclusively for dental use.

NOTE 1—This standard supercedes ANSI Z79.11-1982.²

2. Referenced Documents

2.1 *ANSI Standard:*

ANSI/NFPA 99, Health Care Facilities²

3. Terminology

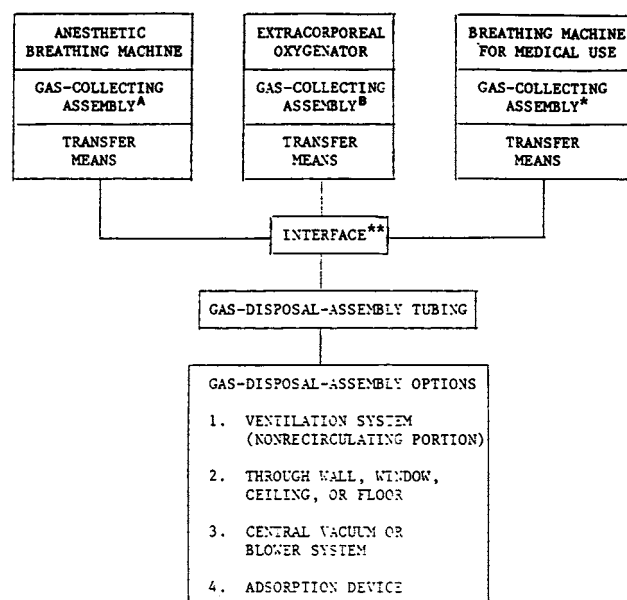
3.1 *Descriptions of Terms Specific to This Standard:*

3.1.1 *adjustable pressure-limiting valve*—a device to limit pressure in an anesthetic breathing circuit by controlling the rate of escape of excess anesthetic gases.

3.1.2 *adsorption device*—a device intended to remove some or all excess anesthetic agents by adsorbing them or converting them to harmless substances.

3.1.3 *excess-anesthetic-gas scavenging systems*—systems that collect and remove the excess anesthetic gases and vapors released from equipment used in administering anesthetics under normal operating conditions or exhaled by the patient. Scavenging is intended to reduce ambient concentrations of anesthetic agents in anesthetizing areas. The apparatus usually consists of a gas-collecting assembly, a transfer means between the gas-collecting assembly and an interface, and disposal tubing between the interface and a gas-disposal assembly. (See Fig. 1.)

3.1.4 *gas-collecting assembly*—a device that attaches to or is an integral part of the anesthetic breathing machine, extra-



^A The gas-collecting assembly may be an integral part of the anesthetic breathing machine, breathing machine for medical use, or extracorporeal oxygenator.

^B The interface may be an integral part of the gas-collecting assembly or some other portion of the scavenging system.

FIG. 1 Schematic of Scavenging Systems for Excess Anesthetic Gases

corporeal oxygenator, or breathing machine for medical use. Its function is to capture excess anesthetic gas and deliver it to the transfer means.

3.1.5 *gas-disposal assembly*—the means by which the excess gas is ultimately eliminated. It may be a ventilation system, vacuum or blower system, or adsorber.

3.1.6 *gas-disposal-assembly tubing*—a means of conducting the excess anesthetic gases from the interface to the gas-disposal assembly.

3.1.7 *interface*—a portion of the scavenging system that provides positive and negative pressure relief and may provide reservoir capacity. It may be an independent device or an integral part of some other portion of the gas-scavenging system, such as the gas-collecting assembly.

¹ This specification is under the jurisdiction of ASTM Committee F-29 on Anesthetic and Respiratory Equipment and is the direct responsibility of Subcommittee F29.01.05 on Anesthetic Gas Scavenging Systems.

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² Available from American National Standards Institute, 1430 Broadway, New York, NY 10018.

3.1.8 *transfer means*—a means of conveying excess gas from the gas-collecting assembly to the interface when the interface is not an integral part of the gas-collecting assembly.

4. Requirements

4.1 General Requirements:

4.1.1 Scavenging systems shall meet the requirements given in 4.2 through 4.7. Flow and pressure measurements for all test procedures shall be made with instruments accurate to within $\pm 20\%$ of full scale.

4.2 Duration of Function:

4.2.1 Scavenging systems should function for an indefinite period of time. If the design imposes time limitations (as in the case of adsorbers), these limitations should be stated on the device and in an instruction manual.

4.3 Pressure Limits:

4.3.1 *Negative Pressure (Normal Operation)*—The maximum allowable negative pressure in the scavenging system immediately downstream of the gas-collecting assembly during normal administration of anesthesia (excess gas flows of 10 L/min or less) shall be tested at an excess gas flow rate of zero and shall be 0.5 cm H₂O.

4.3.2 *Positive Pressure (Normal Operation)*—The positive pressure in the scavenging system immediately downstream of the gas-collecting assembly during normal administration of anesthesia (excess gas flows of 10 L/min or less) shall be tested at an excess gas flow rate of 10 L/min and shall be near the ambient pressure.

4.3.3 *Positive Pressure (Normal Operation-Oxygen Flush)*—With a 75-L/min flow for 5 s, the positive pressure immediately downstream of the gas-collecting assembly shall be less than 10 cm H₂O.

4.3.4 *Positive Pressure (Normal Operation-Occluded System)*—In the event of any obstruction or fault in the scavenging system downstream of the interface, the maximum allowable positive pressure immediately downstream of the gas-collecting assembly shall be tested at 10 L/min excess gas flow rate and shall be less than 10 cm H₂O during normal administration of anesthesia (excess gas flows of 10 L/min or less).³

4.3.5 *Positive Pressure (Occluded System-Oxygen Flush)*—In the event of any obstruction or fault in the scavenging system downstream of the interface, the maximum allowable positive pressure immediately downstream of the gas-collecting assembly shall be tested at a continuous flow of 75 L/min for 5 s and shall be less than 15 cm H₂O.³

4.3.6 *Positive/Negative Pressure (Extracorporeal Oxygenator)*—A scavenging system to be used with an extracorporeal oxygenator shall maintain pressure downstream of the extracorporeal oxygenator between atmospheric pressure and -0.25 cm H₂O at all gas flows intended for use in the oxygenator. If a system is designed to be used with an extracorporeal oxygenator and meets the requirements of 4.3.1, 4.3.2, and 4.3.4, the device shall carry a warning label indicating that it will exert pressures between atmospheric

pressure and -0.5 cm H₂O on the oxygenator gas vent and that compatibility must be checked.

4.3.6.1 If a system is not designed to be used with an extracorporeal oxygenator, the device should be prominently marked with a statement that it is not intended for use with an extracorporeal oxygenator and the instruction manual shall also contain such a statement.

4.4 Leakage:

4.4.1 The leak rate of gas from the scavenging system shall be less than 100 L/min during normal administration of anesthesia (excess gas flows of 10 L/min or less). Test procedures used by the manufacturers should be presented in the instruction manual and shall be available upon request. The test shall include all components that can possibly leak into the operating room; that is, the 100 mL/min leak rate applies to the entire system, starting with the gas-collecting assembly and ending with the gas-disposal assembly, where it leaves the operating room.

4.5 Fire and Electrical Safety:

4.5.1 Scavenging devices shall comply with the applicable provisions of ANSI/NFPA No. 99, with respect to fire and electrical hazards. The manufacturer shall state in the instruction manual any applicable limitations of use derived from ANSI/NFPA 99.

4.6 Design and Maintenance:

4.6.1 All components of the scavenging system shall be free of sharp edges and corners.

4.6.2 All components requiring periodic service, cleaning, or calibration shall be designed to facilitate these operations.

4.6.3 The manufacturer shall recommend the intervals at which servicing, cleaning, and calibration are to be performed, and shall furnish directions for the performance of these services in an instruction manual.

4.6.4 All components of the scavenging system shall be resistant to concentrations of anesthetic agents commonly encountered in clinical practice, patient secretions, and blood.

4.7 External Power:

4.7.1 If an external power source such as electricity, compressed gas, or vacuum is required for operation, there shall be a clearly visible label instructing the operator to activate the power source before use and the instruction manual shall contain a similar instruction.

5. Significance and Use

5.1 The proper application will help both to protect the safety of the patient and to reduce the exposure of operating-room personnel to trace levels of anesthetic gases.

6. Component Requirements

6.1 The individual components of a scavenging system shall meet the requirements given in 6.1-6.5 through .

6.2 Gas-Collecting Assembly:

6.2.1 *Safety*—If the direction of flow at any terminal of the gas-collecting assembly is critical to the functioning of the assembly, the direction shall be clearly identified and the inlet and outlet shall not readily be interchangeable.

6.2.2 *Outlet Connection Size*—The outlet connection shall be either a 19-mm or a 30-mm male fitting and should be conical with a basic taper of 1:40 on the male.

³ In the event of such obstruction or fault, it is recognized that gases may be spilled into the room.