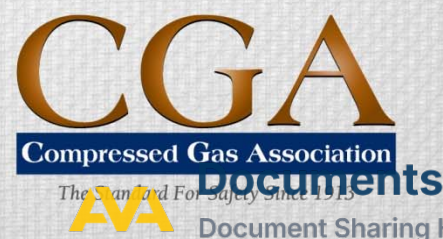


CGA E-10—2018

**GUIDELINE FOR THE
MAINTENANCE OF MEDICAL
GAS AND VACUUM SYSTEMS
IN HEALTH CARE FACILITIES**

FIFTH EDITION



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NOTE—Technical changes from the previous edition are underlined.

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1 Introduction

A planned preventative maintenance program can prevent potentially hazardous conditions and unexpected loss of service. It can also reduce the economic burden of leakage and emergency repairs. This publication is intended as a starting point for the development of a planned preventative maintenance program for centrally piped medical gas and vacuum systems. It describes minimal procedures and schedules and should be supplemented with the requirements and guidelines issued by manufacturers for specific equipment.

The specifications in this publication are common to most installations. Users are encouraged to plan and schedule maintenance as required based on the conditions within a facility. A system's compliance with all applicable federal, state or provincial/territorial, and local standards is assumed. When a system does not comply with applicable regulations, it should be brought into compliance before implementation of a preventative maintenance plan.

2 Scope

This publication contains information on the maintenance of centrally piped medical gas and vacuum systems in hospitals and other health care facilities.

This publication does not apply to construction or repair of any component of a medical gas system.

3 Definitions

For purposes of this publication, the following definitions apply.

3.1 Publication terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May

Indicates that the procedure is optional.

3.1.4 Will

Is used only to indicate the future, not a degree of requirement.

3.1.5 Can

Indicates a possibility or ability.

3.2 Technical definitions

3.2.1 Alarm sensor

Switch, transducer, or other device that allows an alarm to sense an environmental condition.

NOTE—Common alarm sensors include pressure switches, pressure transmitters, vacuum switches, vacuum transmitters, and float switches.

3.2.2 Alarm system

Warning system consisting of alarm panels and associated actuating devices that provide audible and visible signals.

3.2.2.1 Area alarm system

Alarm system that monitors the pressure in the pipelines of medical gas and vacuum systems that serve a specific area.

3.2.2.2 Local alarm system

Alarm system that monitors the functions of medical gas and vacuum system source equipment at the equipment site.

3.2.2.3 Master alarm system

Alarm system that monitors the operation and condition of medical gas and vacuum supply sources including the pressure in the main lines of medical gas and vacuum systems.

3.2.3 Bulk system

Assembly of equipment, e.g., storage containers, pressure regulators, pressure relief devices, vaporizers, manifolds, and interconnecting piping.

3.2.3.1 Bulk nitrous oxide system

Bulk system that has a storage capacity of more than 3 200 lb (1451 kg) [approximately 28 000 ft³ (793 m³)] of nitrous oxide at standard temperature and pressure (STP).

NOTE—See NFPA 99, *Standard for Healthcare Facilities*, and CSA Z305.1, *Nonflammable Medical Gas Piping Systems*, for additional information [1, 2].¹

3.2.3.2 Bulk oxygen system

Bulk system that has a capacity of more than 20 000 ft³ (566 m³) of oxygen at STP, including unconnected reserves on hand at the site.

NOTE—A bulk oxygen system terminates at the point where oxygen at service pressure first enters the supply line. The oxygen containers may be stationary or movable, and the oxygen may be stored as gas or liquid. See NFPA 99 and CSA Z305.1 for additional information [1, 2].

3.2.4 Carbon dioxide

Compound that exists as a colorless, odorless gas that is about 1.5 times heavier than air at atmospheric temperature and pressure.

3.2.5 Compressed air

3.2.5.1 Dental air

Compressed air that is supplied in cylinders and that complies at a minimum with CGA Grade D as stated in [CGA G-7.1](#), *Commodity Specification for Air*; or locally compressed indoor or outdoor atmospheric air to which no contaminants in the form of particulate matter, odor, oil vapor, or other gases have been added by a compressor system [3].

NOTE—Local atmospheric air may not be equal in purity or dryness to the commodity specification Grade D.

3.2.5.2 Instrument air

Compressed air used to power medical devices, e.g., surgical tools, ceiling arms, etc.

NOTE—Instrument air is not intended for human respiration. Instrument air and medical air systems are distinct and mutually exclusive.

3.2.5.3 Medical air

Air supplied from cylinders, bulk containers, or medical air compressors; or air reconstituted from oxygen United States Pharmacopeia (USP) and nitrogen National Formulary (NF) that meets the requirements of medical air USP.

3.2.6 Container

Insulated pressure vessel used for the storage of gases in liquid form.

3.2.7 Cylinder

Supply container for high pressure gases or gas mixtures at pressures that may exceed 2 000 psi (13 790 kPa).²

¹ References are shown by bracketed numbers and are listed in order of appearance in the reference section.

² kPa shall indicate gauge pressure unless otherwise noted as (kPa, abs) for absolute pressure or (kPa, differential) for differential pressure. All kPa values are rounded off per [CGA P-11](#), *Metric Practice Guide for the Compressed Gas Industry* [4].

3.2.8 Distribution system

Pipeline assembly that includes the source valve, warning systems, actuating wiring, interconnecting piping, and all other components including the station outlets/inlets.

3.2.9 Flowmeter

Device for measuring volumetric flow rates of gases and liquids.

3.2.10 Health care facility

Buildings or portions of buildings in which medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided.

NOTE—Health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and permanent or movable ambulatory care centers.

3.2.11 Manifold

Piping, fittings, and control equipment used to connect cylinders to a piped gas system.

3.2.12 Medical air compressor

Compressor designed to exclude oil from the air stream and compression chamber that does not add any toxic or flammable contaminants to the compressed air under normal operating conditions or a single fault condition.

3.2.13 Nitrogen

Element that is a clear, colorless, odorless, and tasteless gas at atmospheric temperature and pressure.

NOTE—Nitrogen makes up approximately 80% of the earth's atmosphere.

3.2.14 Nitrous oxide

Inorganic compound (one of the oxides of nitrogen) that is a sweet-smelling gas at atmospheric temperature and pressure.

NOTE—Nitrous oxide can induce the first and second stages of anesthesia when inhaled; the oxygen in the compound will be released under conditions of combustion, creating an oxygen-enriched atmosphere.

3.2.15 Oxygen

Element that is a colorless, odorless, tasteless gas at atmospheric temperature and pressure.

3.2.16 Piping system

Tubing or conduit comprising main lines, risers, and branch lines.

3.2.16.1.1 Main line

Piping that connects the source to risers, branches, or both, e.g., pumps, receivers.

3.2.16.1.2 Riser

Vertical pipe connecting the system of main lines with the branch lines on various levels of a facility.

3.2.16.1.3 Branch line

Section or portion of a piping system that serve a room or group of rooms on the same level of a facility.

NOTE—Branch lines are also called lateral lines.

3.2.17 Pressure gauge

Instrument or device that indicates the pressure relative to atmospheric pressure.

3.2.18 Standard cubic feet per minute (scfm)

Unit that expresses the measure of the volume of a gas flowing at standard conditions: 70 °F at 1 atm (21.1 °C at 101.3 kPa [29.92 in of Hg]).

3.2.19 Station inlet

Inlet point in a piped vacuum distribution system where the user makes connections and disconnections.

3.2.20 Station outlet

Outlet point in a piped medical gas distribution system where the user makes connections and disconnections.

3.2.21 Supply

3.2.21.1 Operating supply

Portion of the source system that supplies the pipeline.

NOTE—An operating supply may consist of a primary and a secondary subsystem that supply the system alternately as each is exhausted.

3.2.21.1.1 Primary supply

Portion of the operating supply that initially supplies the pipeline.

3.2.21.1.2 Secondary supply

Portion of the operating supply that automatically supplies the system when the primary system is exhausted or fails to operate.

3.2.21.2 Reserve supply

Portion of the operating supply that automatically supplies the system if the primary and/or secondary supply fail.

NOTE—The reserve supply only functions in an emergency; it is not part of the normal operating procedure.

3.2.22 Support gas

Nitrogen or instrument air used to support equipment used in medical procedures.

NOTE—Support gas is not intended for human respiration. Support gas and medical air systems are distinct and mutually exclusive.

3.2.23 Terminal outlet/terminal inlet

Terminal point of a piped gas (vacuum) system where connections are made by the user.

3.2.24 Vacuum system

Central vacuum-producing equipment with pressure and operating controls, shutoff valves, alarm warning systems, gauges, and a network of piping extending to and terminating with suitable station inlets at locations where patient suction may be required.

3.2.25 Valves

3.2.25.1 Check valve

Valve that only permits flow in one direction and that automatically closes upon flow in the opposite direction.

3.2.25.2 Demand valve

Gas-specific valve that permits flow only when a mating part is engaged.

3.2.25.3 Service valve

Shutoff valve located on the floor lateral line adjacent to the riser pipeline and prior to any zone valves located on the floor.

3.2.25.4 Source valve

Valve located at the immediate outlet of the source of supply upstream of the main line shutoff valve so the entire source of supply including all accessory devices can be isolated from the pipeline system.

3.2.25.5 Zone valve

Valve that shuts off the flow of gas in sections of the piping during an emergency.

NOTE—Zone valves are located in boxes that can be accessed by floor personnel in the event of an emergency.