SECTION 226400 - MEDICAL GAS ALARMS

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY

This Section is appropriate for large (Level 1 and Level 2) medical facilities. A small medical or dental facility may only require a Level 3 alarm system with an area or dental alarm panel. See "Medical Gas System Categories" Article in the Evaluations for a description of the types of medical gas systems included in Level 1, Level 2, and Level 3 medical facilities.

* + - * 1. Section Includes:

Master alarm panels.

Anesthetizing-area alarm panels.

Area alarm panels.

Dental-area alarm panels.

Local alarm panels.

Computer-interface cabinet.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. Low Voltage: As defined in NFPA 70 “Standard for Electrical Safety in the Workplace” for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
			1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).Product Data: For each type of product.
				4. Shop Drawings: Include diagrams for power, signal, and control wiring.
				5. Qualification Data: For [**Installer**] [**and**] [**testing agency**].
				6. Product Test Reports: For each alarm panel, for tests performed by a qualified testing agency.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For alarm panels[**and computer-interface cabinet**] to include in emergency, operation, and maintenance manuals.
			2. QUALITY ASSURANCE
				1. Installer Qualifications: Qualify Installers for air, vacuum, and gas piping systems for healthcare facilities according to ASSE Standard #6010 “Medical Gas System Installer” for medical-gas-system installers.

Retain "Testing Agency Qualifications" paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article.

* + - * 1. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the air, vacuum, and gas piping testing indicated, that is[**a member of the Medical Gas Professional Healthcare Organization or is**] an NRTL, and that is acceptable to authorities having jurisdiction.

Qualify testing personnel for air, vacuum, and gas piping systems for healthcare facilities according to ASSE Standard #6020 “Medical Gas System Inspector” for medical-gas-system inspectors and ASSE Standard #6030 “Medical Gas System Verifier” for medical-gas-system verifiers.

1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

* + - 1. SYSTEM DESCRIPTION
				1. Gas and Vacuum Systems Monitored:

Retain only the systems specified to be monitored by alarms.

Carbon dioxide, designated "medical carbon dioxide."

Dental compressed air, designated "dental air."

Dental vacuum, designated "dental vacuum."

Gas-powered-tool compressed air, designated "instrument air."

Healthcare laboratory air, designated "medical laboratory air."

Healthcare laboratory vacuum, designated "medical laboratory vacuum."

Helium, designated "medical helium."

Medical compressed air, designated "medical air."

Medical-surgical vacuum, designated "medical vacuum."

Nitrogen, designated "medical nitrogen."

Nitrous oxide, designated "medical nitrous oxide."

Oral evacuation, designated "HVE."

Oxygen, designated "medical oxygen."

Waste anesthetic gas disposal, designated "WAGD."

* + - 1. MANUFACTURERS

Alarm-system components in this Section are for medical air, vacuum, and gas piping systems. Alarm systems are similar, but may not be interchangeable, among manufacturers. For a single manufacturer's system, delete other manufacturers from list of manufacturers and re-edit the following articles to suit retained manufacturer's system.

* + - * 1. Source Limitations: Obtain medical alarm systems and components from single manufacturer.
			1. GENERAL REQUIREMENTS FOR ALARM PANELS
				1. Description: Factory wired with audible and color-coded visible signals to indicate specified functions.

Mounting: [**Exposed, surface**] [**Recessed**] installation.

Enclosures: Fabricated from minimum 0.047-inch- thick steel or minimum 0.05-inch- thick aluminum, with knockouts for electrical and piping connections.

Coordinate "Components" paragraph below with electrical distribution system.

* + - * 1. Components: Designed for continuous service and to operate on power supplied from [**120**] [**240**] [**277**]-V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
				2. Dew Point Monitors: Continuous line monitoring, having panel with gage or digital display, pipeline sensing element, electrical connections for alarm system, factory- or field-installed valved bypass, and visual and cancelable audio signal for dryer site and master alarm panels. Alarm signals when pressure dew point rises above 39 deg F at 55 psig.

Chilled-mirror method in "Operation" subparagraph below requires less-frequent calibration, but availability may be limited.

Operation: [**Chilled-mirror method**] [**or**] [**hygrometer moisture analyzer with sensor probe**].

* + - * 1. Pressure Switches or Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.

Low-Pressure Operating Range: 0 to 100 psig.

High-Pressure Operating Range: Up to 250 psig.

* + - * 1. Carbon-Monoxide Monitors: Panel with gage or digital display, pipeline sensing element, electrical connections for alarm system, and factory- or field-installed valved bypass. Alarm signals when carbon-monoxide level rises above 10 ppm.
				2. Vacuum Switches or Pressure Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.

Vacuum Operating Range: 0 to 30 in. Hg.

* + - 1. MASTER ALARM PANELS

Copy "Master Alarm Panels" paragraph below and re-edit for each type of master alarm panel required.

Insert letter and number combination to complete designation. Use these designations to identify master alarm panels.

* + - * 1. Master Alarm Panels <**Insert designation**>: Separate trouble alarm signals and indicators for each system.

Standards: Comply with NFPA 99 “Health Care Facilities Code” and UL 544 “Medical and Dental Equipment”.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

Include alarm signals when the following conditions exist:

Air in "Medical Air" subparagraph below is for medical air from medical air compressors.

Medical Air: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above 39 deg F at 55 psig, carbon-monoxide level rises above 10 ppm, and high water level is reached in receiver for liquid-ring, medical air compressor systems.

Dental Air: Pressure drops below [**65 psig**] <**Insert value**> or rises above [**110 psig**] <**Insert value**>, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above [**50 deg F**] <**Insert temperature**> at [**125 psig**] <**Insert value**>, and carbon-monoxide level rises above 10 ppm.

Air in "Instrument Air" subparagraph below is for medical air from medical air manifold system.

Instrument Air: Pressure drops below [**165 psig**] <**Insert value**> or rises above [**185 psig**] <**Insert value**>.

Medical Vacuum: Vacuum drops below [**12 in. Hg**] <**Insert value**> and backup vacuum pump is in operation.

WAGD: Vacuum drops below [**12 in. Hg**] <**Insert value**>.

Dental Vacuum: Vacuum drops below [**6 in. Hg**] <**Insert value**> and backup vacuum producer is in operation.

HVE: [**4 in. Hg**] <**Insert value**> and backup vacuum producer is in operation.

Medical Carbon Dioxide: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**> and changeover is made to alternate bank.

Medical Helium: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**> and changeover is made to alternate bank.

Medical Nitrogen: Pressure drops below [**145 psig**] <**Insert value**> or rises above [**200 psig**] <**Insert value**> and changeover is made to alternate bank.

Retain either "Medical Nitrous Oxide" subparagraph below. First is for bulk nitrous-oxide storage tank system with cylinder reserve; second is for nitrous-oxide manifold system.

Medical Nitrous Oxide: Liquid level is low, pressure downstream from main shutoff valve drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>, changeover is made to reserve, reserve is in use, and reserve level is low.

Medical Nitrous Oxide: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**> and changeover is made to alternate bank.

Retain either "Medical Oxygen" subparagraph below. First is for bulk oxygen storage tank system with cylinder reserve; second is for oxygen manifold system.

Medical Oxygen: Liquid level is low, pressure downstream from main shutoff valve drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>, changeover is made to reserve, reserve is in use, reserve level is low, and reserve pressure is low.

Medical Oxygen: Pressure downstream from main shutoff valve drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**> and changeover is made to alternate bank.

* + - 1. ANESTHETIZING-AREA ALARM PANELS

Copy "Anesthetizing-Area Alarm Panels" paragraph below and re-edit for each type of anesthetizing-area alarm panel required.

Insert letter and number combination to complete designation. Use these designations to identify anesthetizing-area alarm panels.

* + - * 1. Anesthetizing-Area Alarm Panels <**Insert designation**>: Separate trouble alarm signals and indicators for each system.

Standards: Comply with NFPA 99 “Health Care Facilities Code” and UL 544 “Medical and Dental Equipment”.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

Include alarm signals when the following conditions exist:

Medical Air: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>.

Instrument Air: Pressure drops below [**165 psig**] <**Insert value**> or rises above [**185 psig**] <**Insert value**>.

Medical Vacuum: Vacuum drops below [**12 in. Hg**] <**Insert value**>.

WAGD: Vacuum drops below [**12 in. Hg**] <**Insert value**>.

Medical Carbon Dioxide: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>.

Medical Helium: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>.

Medical Nitrogen: Pressure drops below [**145 psig**] <**Insert value**> or rises above [**200 psig**] <**Insert value**>.

Medical Nitrous Oxide: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>.

Medical Oxygen: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>.

* + - 1. AREA ALARM PANELS

Copy "Area Alarm Panels" paragraph below and re-edit for each type of area alarm panel required.

Insert letter and number combination to complete designation. Use these designations to identify area alarm panels.

* + - * 1. Area Alarm Panels <**Insert designation**>: Separate trouble alarm signals and indicators for each system.

Standards: Comply with NFPA 99 “Health Care Facilities Code” and UL 544 “Medical and Dental Equipment”.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

Include alarm signals when the following condition exists:

Medical Air: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>.

Medical Vacuum: Vacuum drops below [**12 in. Hg**] <**Insert value**>.

Medical Oxygen: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>.

* + - 1. DENTAL-AREA ALARM PANELS

Copy "Dental-Area Alarm Panels" paragraph below and re-edit for each type of dental-area alarm panel required.

Insert letter and number combination to complete designation. Use these designations to identify dental-area alarm panels.

* + - * 1. Dental-Area Alarm Panels <**Insert designation**>: Separate trouble alarm signals and indicators for each system.

Standards: Comply with NFPA 99 “Health Care Facilities Code” and UL 544 “Medical and Dental Equipment”.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

Include alarm signals when the following conditions exist:

A small dental office or clinic typically would have dental air and dental vacuum systems. Other systems may be required in dental schools or in offices where operations are performed.

Dental Air: Pressure drops below [**65 psig**] <**Insert value**> or rises above [**110 psig**] <**Insert value**>, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above [**50 deg F**] <**Insert temperature**> at [**125 psig**] <**Insert value**>, and carbon-monoxide level rises above 10 ppm.

Instrument Air: Pressure drops below [**165 psig**] <**Insert value**> or rises above [**185 psig**] <**Insert value**>.

Dental Vacuum: Vacuum drops below [**6 in. Hg**] <**Insert value**> and backup vacuum producer is in operation.

HVE: Vacuum drops below [**4 in. Hg**] <**Insert value**> and backup vacuum producer is in operation.

Medical Nitrogen: Pressure drops below [**145 psig**] <**Insert value**> or rises above [**200 psig**] <**Insert value**> and changeover is made to alternate bank.

Retain either "Medical Nitrous Oxide" subparagraph below. First is for bulk nitrous-oxide storage tank system with cylinder reserve; second is for nitrous-oxide manifold system.

Medical Nitrous Oxide: Liquid level is low, pressure downstream from main shutoff valve drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>, changeover is made to reserve, reserve is in use, and reserve level is low.

Medical Nitrous Oxide: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**> and changeover is made to alternate bank.

Retain either "Medical Oxygen" subparagraph below. First is for bulk oxygen storage tank system with cylinder reserve; second is for oxygen manifold system.

Medical Oxygen: Liquid level is low, pressure downstream from main shutoff valve drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>, changeover is made to reserve, reserve is in use, reserve level is low, and reserve pressure is low.

Medical Oxygen: Pressure downstream from main shutoff valve drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**> and changeover is made to alternate bank.

* + - 1. LOCAL ALARM PANELS

Copy "Local Alarm Panels" paragraph below and re-edit for each type of local alarm panel required.

Insert letter and number combination to complete designation. Use these designations to identify local alarm panels.

* + - * 1. Local Alarm Panels <**Insert designation**>: Separate trouble alarm signals and indicators for each system.

Standards: Comply with NFPA 99 “Health Care Facilities Code” and UL 544 “Medical and Dental Equipment”.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

Include alarm signals when the following conditions exist:

Medical Air: Pressure drops below [**40 psig**] <**Insert value**> or rises above [**60 psig**] <**Insert value**>, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above 39 deg F at 55 psig, carbon-monoxide level rises above 10 ppm, and the following:

[**Oil-Free**] [**Oilless**] [**Oil-Free, Rotary-Screw**] Air Compressor: High discharge-air temperature and high water level in receiver.

Liquid-Ring Air Compressor: High water level in receiver and high water level in separator.

Dental Air: Pressure drops below 65 psig or rises above 110 psig, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above 50 deg F at 125 psig, carbon-monoxide level rises above 10 ppm, high discharge-air temperature, and high water level is in receiver.

Instrument Air: Pressure drops below 165 psig or rises above 185 psig, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above 39 deg F at 55 psig, and high water level is in receiver.

Medical Vacuum: Vacuum drops below [**12 in. Hg**] <**Insert value**>, backup vacuum producer is in operation, and high water level is in receiver.

WAGD: Vacuum drops below [**12 in. Hg**] <**Insert value**>, backup vacuum producer is in operation, and high water level is in receiver.

Dental Vacuum Equipment: Vacuum drops below [**6 in. Hg**] <**Insert value**>, backup vacuum pump is in operation, and high water level is in receiver.

HVE Vacuum Equipment: Vacuum drops below [**4 in. Hg**] <**Insert value**>, backup turbine exhauster is in operation, and high water level is in receiver.

* + - 1. COMPUTER-INTERFACE CABINET

Retain this article for connection of air, vacuum, and gas alarm panels to facility computer.

* + - * 1. Description:

Wall-mounted, welded-steel, control cabinet with gasketed door.

Mounting brackets.

Grounding device.

White-enamel finish.

Factory-installed signal circuit boards.

Power transformer.

Circuit breaker.

Wiring terminal board, and internal wiring capable of interfacing [**20**] <**Insert number**> alarm signals.

1. EXECUTION
	* + 1. ALARM-PANEL INSTALLATION

Show locations and types of alarm panels on Drawings.

* + - * 1. Install alarm panels in locations required by and according to NFPA 99 “Health Care Facilities Code”.
				2. Install computer-interface cabinet with connection to alarm panels and facility computer.
			1. CONNECTIONS

Coordinate piping installations and specialty arrangements with Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Comply with requirements for piping specified in Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities," Section 226213 "Vacuum Piping for Laboratory and Healthcare Facilities," and Section 226313 "Gas Piping for Laboratory and Healthcare Facilities." Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Where installing piping adjacent to alarm panels, allow space for service and maintenance.
			1. IDENTIFICATION
				1. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" and according to NFPA 99 “Health Care Facilities Code”.
			2. FIELD QUALITY CONTROL

Retain "Testing Agency," "Manufacturer's Field Service," and "Perform the following tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" paragraph or if retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

* + - * 1. Testing Agency: [**Director’s Representative will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following tests and inspections[**with Company Field Advisor per OGS Spec Section 014216**]:

Perform each visual and mechanical inspection.

Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.

Test and adjust controls and safeties. Replace damaged and malfunctioning panels and equipment.

* + - * 1. Alarm panels will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. STARTUP SERVICE
				1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to perform**] [**Perform**] startup service.

Complete installation and startup checks according to manufacturer's written instructions.

<**Insert startup steps if any**>.

* + - 1. ADJUSTING
				1. Adjust initial alarm panel pressure and vacuum set points.
			2. DEMONSTRATION
				1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to train**] [**Train**] Director’s Representative's Facility’s maintenance personnel to adjust, operate, and maintain [**alarm panels**] [**and**] [**computer-interface cabinet**].

END OF SECTION 226400