# NFPA 99 Med Gas Requirements

**Michele Mucia**

**Senior Director Healthcare Industry Solutions**

**315-246-4750**

# AGENDA

- **NFPA DISCLAIMER**
- **REQUIREMENTS NFPA 99**
- **INSPECTIONS DEFINTIONS**
- **MAINTENANCE APPROACH AND DEFINITIONS**
- **OEM OR ACM APPROACHES**
- **CERTIFICATION REQUIREMENTS**

# NFPA & Nuvolo Disclaimer

- Although the speaker is an active member of the NFPA, the views and opinions expressed in this presentation are purely those of the presenter and shall not be considered the official position of NFPA or any of its Technical Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation. Refer to the entire texts of all referenced documents.

# NFPA 99 Medical Gas Inspection & Maintenance Testing

- 5.1.12.1.2 Inspection and testing shall include all components of the system, or portions thereof, including, but not limited to, gas bulk source(s); manifolds; compressed air source systems (e.g., compressors, dryers, filters, regulators); source alarms and monitoring safeguards; master alarms; pipelines; isolation valves; area alarms; zone valves; and station inlets (vacuum) and outlets (pressure gases).

# Testing & Inspection or Maintenance

- 5.1.14.2.2 Maintenance Programs.
- 5.1.14.2.2.1 Inventories. Inventories of medical gas, vacuum, WAGD, and medical support gas systems shall include at least all source subsystems, control valves, alarms, manufactured assemblies containing patient gases, and outlets.
- 5.1.14.2.2.2* Inspection Schedules. Scheduled inspections for equipment and procedures shall be established through the risk assessment of the facility and developed with consideration of the original equipment manufacturer recommendations and other recommendations as required by the authority having jurisdiction.
- 5.1.14.2.2.3 Inspection Procedures. The facility shall be permitted to use any inspection procedure(s) or testing methods established through its own risk assessment.
- 5.1.14.2.2.4 Maintenance Schedules. Scheduled maintenance for equipment and procedures shall be established through the risk assessment of the facility and developed with consideration of the original equipment manufacturer recommendations and other recommendations as required by the authority having jurisdiction.

# Medical Gas Testing & Inspections

| | | | |
|---|---|---|---|
| Testing of medical gas outlets/inlets. E3.5 (a) | Checking all outlets – leakage, flow, pressure, damage and wear. Particular attention paid to critical care areas (ICU, CCU, NICU, Surgery, Recovery, ER, etc.). | Bulk liquid systems. E3.5(b) & (c) | Test operation of the reserve and reserve-in-use signal. Test proper level activation switch. Test complete system operation in conjunction with the bulk gas supplier. |
| Manifold systems. E3.5(d) & (e), E3.3(d) | Test proper function of reserve-in-use switch. Test operation of changeover to secondary supply. Leak check valves, pigtails, regulators. Inspect pigtails for physical damage. | • Pressure gauges. E3.5(f) | Test accuracy and function of all pressure gauges. |
| Air compressor. E3.5(g) & E3.3(a)(b) | Conduct performance tests, check intake filters. Function test automatic alternating controls, correct operation of pressure switch. Check for frequency of pump starts and duration of runs and cut in/out. Check hour meters for required maintenance schedule in accordance with manufacturer instructions. Test audible and visual signals. | Dew point and CO monitor. E3.5(h) | Calibrate and test operation. Test audible and visual signals. |

# NFPA 99 Maintenance

- 5.1.14.4.7 Procedures, as specified, shall be established for the following:
- (1) Maintenance program for the medical air compressor supply system in accordance with the manufacturer's recommendations
- (2) Facility testing and calibration procedure that ensures carbon monoxide monitors are calibrated at least annually or more often if recommended by the manufacturer
- (3) Maintenance program for both the medical–surgical vacuum piping system and the secondary equipment attached to medical–surgical vacuum station inlets to ensure the continued good performance of the entire medical–surgical vacuum system
- (4) Maintenance program for the WAGD system to ensure performance

# Frequency and Testing

5.1.14.2.2.3 Inspection Procedures. The facility shall be permitted to use any inspection procedure(s) or testing methods established through its own risk assessment.

5.1.12.3.1.3 Testing shall be conducted by a party technically competent and experienced in the field of medical gas and vacuum pipeline testing and meeting the requirements o ASSE 6030, Professional Qualifications Standard for Medical Gas Systems Verifiers.

# Completing Internal Maintenance & Repairs

5.1.14.2.2.5 Qualifications. Persons maintaining these systems shall be qualified to perform these operations. Appropriate qualification shall be demonstrated by any of the following:

(1) Training and certification through the health care facility by which such persons are employed to work with specific equipment as installed in that facility

(2) Credentialing to the requirements of ASSE 6040, Professional Qualification Standard for Medical Gas Maintenance Personnel

(3) Credentialing to the requirements of ASSE 6030, Professional Qualification Standard for Medical Gas Systems Verifiers

# Testing and Inspection Feature

5.1.14.2.3.2 Manufactured Assemblies Employing Flexible Connection(s) Between the User Terminal and the Piping System.

(A) Nonstationary booms and articulating assemblies, other than head walls utilizing flexible connectors, shall be tested for leaks, per manufacturer's recommendations, every 18 months or at a duration as determined by a risk assessment.

# Medical Gas Testing and Inspections

- Moisture removal systems.
- Check for proper operation of aftercooler, dryer drains, receiver drains, sight gauges, etc.
- Vacuum system.
- Conduct performance tests. Function test automatic alternating controls, correct operation of vacuum switch. Check for frequency of pump starts and duration of runs and cut in/out. Check hour meters for required maintenance schedule in accordance with manufacturer instructions.
- Test audible and visual signals.
- Area and master alarms.
- Activate all audible and visual test buttons, check panel gauges/pressure readouts and compare to line pressures.
- Shut-off valves.
- External leakage test. Operation test.
- Gas contamination.
- Test for contamination due to debris or accumulated foreign matter (e.g., scale, hydrocarbons, moisture, or particulate matter.
- Labeling.
- Inspection for proper gas label, correct directional flow, proper color code, room (areas) controlled and warning signage.

# Medical Gas Quality

**Table 5.1.12.3.11 Gas Concentrations**

| Medical Gas | Concentration |
|---|---|
| Oxygen | ≥99% oxygen |
| Nitrous oxide | ≥99% nitrous oxide |
| Nitrogen | ≤1% oxygen or ≥99% nitrogen |
| Medical air | 19.5%–23.5% oxygen |
| Other gases | As specified by ±1%, unless otherwise specified |

**You need to ensure the quality testing meets the above requirements on the final reports**

# Medical Gas Master Alarms

5.1.9.2.1 The master alarm system shall consist of two or more alarm panels located in at least two separate locations, as follows:

(1) One master alarm panel shall be located in the office or work space of the on-site individual responsible for the maintenance of the medical gas and vacuum piping systems.

(2) In order to ensure continuous surveillance of the medical gas and vacuum systems while the facility is in operation, the second master alarm panel shall be located in an area of continuous observation (e.g., the telephone switchboard, security office, or other continuously staffed location).

5.1.9.2.2 A centralized computer system shall be permitted to be substituted for one of the master alarms required in 5.1.9.2.1 if the computer system complies with 5.1.9.4.

# OEM or AEM Process…

5.1.10.11.8.2 Manufacturer's instructions shall include directions and information deemed by the manufacturer to be adequate for attaining proper operation, testing, and maintenance of the medical gas and vacuum systems.

If utilizing the AEM option, need to demonstrate empirical evidence that the process is equal to or greater than what the OEM requires.

# Medical Vacuum Unit

**205F**

| PROCEDURE | SCHEDULE |
|---|---|
| • Follow electrical safety procedure. | Q,S |
| • Check oil level. | Q,S |
| • Blow discharge drip leg. | Q,S |
| • Check unit for unusual vibration. | Q,S |
| • Check V-belt, adjust as needed. | Q,S |
| • Check pump rotation for direction and free operation. | Q,S |
| • Record vacuum pump cut-in and cut-out pressures. | Q,S |
| • Note unit pump down-running time. | Q,S |
| • Check alternator operation. | Q,S |
| • Check cooling water flow and drain. | Q,S |
| • Drain liquid from vacuum tank. | Q,S |
| • On reciprocating units, remove, clean and reinstall vacuum pump valves. Check for excessive heat. Check valve seats. | Q,S |
| • Clean unit. | Q,S |
| • Inspect electrical connections and control contacts. | S |
| • Check low oil switch operation. | S |
| • Change oil. | S |
| • Record suction-line filter pressure drop. Change filter as needed. | S |

AHSE AEM

# OEM LAYOUT

Medical Gas and Vacuum Source Equipment Maintenance Program

| | | | |
|---|---|---|---|
| **Liquid-Ring Medical Vacuum Pump System** | Vacuum Exhaust Drip Leg | Daily / Adjust as needed | Check for accumulated moisture. |
| | Pump/Bearing Housing | Weekly / Adjust as needed | Check Temperature. Should not exceed 140°F. |
| | Safety Relief Valve | Monthly / Adjust as needed | Check operation and manually release pressure. Replace as needed. |
| | Nuts, Bolts, and Fittings | Monthly | Inspect and tighten as needed. |
| | Vacuum Exhaust | Quarterly | Inspect for proper clearances and obstructions. |
| | Water Solenoid Valves | Semi-Annually | Check operation and replace as needed. |
| | Water Line Strainers | Semi-Annually | Inspect screens and clean as needed. |
| | Reservoir Tank Sight Glass | Semi-Annually | Inpect and clean as needed. |
| | Inlet Check Valves | Annually | Inspect hinge, pins, pivots, springs, and clapper for wear and replace as needed. |
| | Reservoir Inspection Plate | Annually | Inspect for debris and accummulated water deposits. Replace as needed. |
| | Vacuum System Alarms | Annually | Check operation. |
| | Pump Bearings | Every 20,000 hours | Replace pump bearings. |
| | Seal Water Flow Control Valves | Every 4 years | Replace valves. |
| | Water Solenoid Valves | Every 4 years | Replace or rebuild valves. |
| | Control Panel Lights and Accessories | As needed | Check operation and replace bulbs and accessories as needed. |
| | Vacuum Gauges | As needed | Check operation and replace as needed. |
| | Room Condition (Ambient Temperature) | As needed | Check for acceptable room conditions. |

# Inspection, Testing and Run to Failure? Failure?

If the maintenance is not being accomplished on the medical gas system equipment, we are running to failure

Under the utility equipment standards, this will become a more reviewed area of compliance in the future

Show AEM or OEM process on maintenance

# Thank You!

**Senior Director Healthcare Industry Solutions**

**Nuvolo**

**NFPA 99 Principal Fundamentals**

**315-246-4750**