Medical Gas and Vacuum Systems of Today

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Our Presenter

- Owner & founder of Purely Med Gas, Inc.
- Actively involved in the Medical Gas and Vacuum field for 40 yrs
- Instructor NFPA 99 & ASSE 6000 credentialing courses since 1994
- Credentialed ASSE 6010 Installer, ASSE 6020 Inspector, ASSE 6030 Verifier, ASSE 6040 Service Tech, ASSE 6050 Instructor
- Licensed Master Plumber
- Member of ASSE 6000 & CGA M-1 Technical Committees
- Member of ASHE, NFPA, ASSE, ASPE, WHEA, UA and MGPHO
- Consultant to facilities, engineers, architectural firms, regulatory agencies and contractors
NFPA 99 Health Care Facilities

- National Fire Protection Association
- Revised every three years
### Medical Gas Systems

<table>
<thead>
<tr>
<th>Gas Type</th>
<th>Pressure</th>
<th>Medical Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oxygen</strong></td>
<td>50-55 psi</td>
<td>Respiratory</td>
</tr>
<tr>
<td><strong>Medical Air</strong></td>
<td>50-55 psi</td>
<td>Respiratory</td>
</tr>
<tr>
<td><strong>Nitrous Oxide</strong></td>
<td>50-55 psi</td>
<td>Anesthesia</td>
</tr>
<tr>
<td><strong>Carbon Dioxide</strong></td>
<td>50-55 psi</td>
<td>Surgical</td>
</tr>
<tr>
<td><strong>Helium</strong></td>
<td>50-55 psi</td>
<td>Respiratory</td>
</tr>
<tr>
<td><strong>Vacuum</strong></td>
<td>15-30” Hg</td>
<td>Suction</td>
</tr>
<tr>
<td><strong>WAGD</strong></td>
<td>As required</td>
<td>Waste Anesthetic Gas Disposal</td>
</tr>
</tbody>
</table>

- **Medical Gas:** Used in the application of human respiration and the calibration of medical devices used for human respiration.
Support Gas Systems

<table>
<thead>
<tr>
<th>Nitrogen</th>
<th>160-185 psi</th>
<th>Support / Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument Air</td>
<td>160-185 psi</td>
<td>Support</td>
</tr>
</tbody>
</table>

Support Gas: Nitrogen or Instrument Air used to support medical procedures by operating medical-surgical (tools, booms, devices, etc.) and **not** resired as part of any treatment.
Risk Categories

The Sudden Failure of Equipment or System is Likely to Cause:

- 1: Major injury or death of patients or caregivers
- 2: Minor injury to patients or caregivers
- 3: Not likely to cause injury to patients or caregivers
- 4: No impact on patient care

*Categories Determined by Risk Assessment*
Central Supply Systems/Source Equipment

- Bulk Cryogenic Liquid Systems
- Manifolds for Cylinder systems
- Manifolds for Cryogenic liquid containers
- Medical Air Compressor systems
- Medical Air Proportioning Systems (NEW)
- Instrument Air Systems
- Vacuum Producers
- WAGD Producers
Permitted Locations for Medical Gases

- Medical Gases shall be piped only into areas where the gases will be used under the direction of licensed medical professionals

- Patient use

- Operation and calibration of patient medical devices
NFPA 99 2012 Update

Medical Vacuum System Use:

- **5.1.14.1.14:** The medical-surgical vacuum and WAGD systems shall not be used for nonmedical applications.

- **A.5.1.14.1.4:** Other examples of prohibited use of medical-surgical vacuum would be scope cleaning, decontamination, and laser plume.
Electrical Power

- Electrical power for all medical gas source equipment and alarms shall be from the Emergency electrical service

- **Alarms** - Life Safety Branch

- **Source Equipment** - Essential Equipment Branch

- NFPA 99 2005 Chapter 4

- NFPA 70 (National Electric Code)
Cylinder Room Door Signage

Positive Pressure Gases
No Smoking or Open Flame
Room May Have Insufficient Oxygen
Open Door and Allow Room to Ventilate Before Entering
Cylinder Supports:

- **1999**: “Cylinders in service and in storage shall be individually secured and located to prevent falling or being knocked over.”

- **2012**: “They shall be provided with racks, chains, or other fastenings to secure all cylinders from falling, whether connected, unconnected, full, or empty.”
Personnel who handle Medical Gas cylinders shall be trained on the risks associated with their handling and use.
Cylinder Storage / Manifold Rooms

~ Room Identification
~ Ventilation
~ Relief to Outdoors

~ Secured Entry
~ 1 hour fire rating
~ Exposure to hot/cold
~ Pipe and Valve I.D.

~ Electrical Protected
~ No Flammable or Combustibles
Warning Systems
Warning Systems
5.1.9

- Master Alarms 5.1.9.2
- Area Alarms 5.1.9.3
- Local Alarms 5.1.9.5
Computer as Master Alarm

- Continuous uninterrupted power
- Attended or remote signaling
- Supervised signal interface devices
- Signaling devices Life safety branch*
- Wiring supervised or protected
- Audio alert required
- Med gas signal interrupts lesser priority signal
3.3.63 General Anesthesia and Levels of Sedation / Analgesia

- Minimal Sedation
- Moderate Sedation / Analgesia (Conscious Sedation)
- Deep Sedation / Analgesia
- General Anesthesia
5.1.4.8.7 Zone Valves. A zone valve shall be located immediately outside each vital life-support area, critical care area, and anesthetizing location of moderate sedation, deep sedation, or general anesthesia, in each medical gas or vacuum line, or both, and located so as to be readily accessible in an emergency.

5.1.9.3* Area Alarms. Area alarm panels shall be provided to monitor all medical gas, medical–surgical vacuum, and piped WAGD systems supplying the following:

(1) Anesthetizing locations where moderate sedation, deep sedation, or general anesthesia is administered.

(2) *Critical care areas
5.1.5.16: Required where Nitrous Oxide or Anesthetic Gas is intended to be administered

- Not interchangeable with Vacuum

- Flow as required by anesthetic gas machines
Pipe Labeling

- Every 20 feet
- Once in each room minimum
- Each side of every wall penetration
- Each floor level
Valve Identification

- Name of Gas or Vacuum system
- Room or Areas served
- A caution to not close or open the valve except in an emergency

*Ensure these are kept current / accurate following all modifications…*
Zone Valves

- Located within Corridor
- Always visible / readily accessible
- Labeled to identify Area served
Zone Valve Locations
Piping Distribution (testing)

- **5.1.12.2.6.7** The 24-hour standing pressure test of the positive pressure system shall be witnessed by the authority having jurisdiction or its designee. A form indicating that this test has been performed and witnessed shall be provided to the verifier at the start of the tests required in 5.1.12.3.

- **5.1.12.2.7.6** same as above for Vacuum
System Verification

- Required when a system is breached: pipeline intrusion or component replacement
- System meets NFPA 99 Standards
- Proper equipment and materials were used
- Work was performed & pretested by credentialed installers
- Systems are functioning properly
- Gas purity/particulates are safe for patient use
- Documentation for facility record
“Flameless” Axially Swaged Fitting

- Fitting Body
- Primary/Inboard Seal
- Main Seal
- Isolation/Outboard Seal
- Tool Flange
- Driver/Swage Ring
- Tube
**NFPA 99 2012 EDITION: 5.1.10.7.1**

Axially swaged, elastic strain preload fittings providing metal-to-metal seals, having a temperature rating not less than 538°C (1000°F) and a pressure rating not less than 2070 kPa (300 psi), and that, when complete, are permanent and nonseparable shall be permitted to be used to join copper or stainless steel tube.

**NFPA 99 2018 EDITION: 5.1.10.7.1**

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Benefits

- No Brazing - No Open Flame
- No Flammable Gas in Patient Area
- No Burn Permits / Fire Watch
- Smoke & Fire Alarms Remain On
- Reduce Damage to Surroundings
- No Cool Down
- No Nitrogen Purge
- No Particulate
- Reduce Verification Time
- Return to System Use Sooner
- Cost Savings
Valve Assemblies

- Ball Valve with copper extensions & 2 Lokring couplings
Area Alarm Transducers

- Gauge Port Couplings
Inventories

A current list which includes:

- Source Equipment
- Valves
- Alarms
- Manufactured Assemblies
- Outlets/Inlets
Inspection

- Scheduled inspections for equipment and procedures per manufacturer and authority having jurisdiction requirements.

Maintenance

- Scheduled maintenance for equipment and procedures established through risk assessment, equipment manufacturer and authority having jurisdiction requirements.
## Medical Gas Personnel Credentials

<table>
<thead>
<tr>
<th>Credential</th>
<th>1999</th>
<th>2002</th>
<th>2012</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSE 6010 Installer</td>
<td>-</td>
<td>X*</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ASSE 6030 Verifier</td>
<td>-</td>
<td>X*</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ASSE 6040 Maintenance Tech</td>
<td>-</td>
<td>-</td>
<td>X*</td>
<td>X</td>
</tr>
</tbody>
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Thank You!

For Additional Training/More Information:

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414-699-4757