

# 2007 Bulk Cryogenic Medical Gas System Reminder List

## Applicable Codes and Standards

CBC 2007, CEC 2007, CFC 2007

NFPA 55 2005, NFPA 99 2005

### I. APPLICABILITY

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| 1. | The design, installation and testing of medical gas and vacuum systems shall be in accordance with NFPA 99-2005, <i>Standard for Health Care Facilities</i> .  | <b>CBC, Sec. 1224.4.6.2</b> |
| 2. | The performance, installation and testing of Level 1 piped medical gas and vacuum systems shall be in accordance with Section 5.1 of NFPA 99, 2005 edition. Wherever the terms medical gas or vacuum occur, the provisions of Section 5.1 apply to all piped systems for oxygen, nitrous oxide, medical air, carbon dioxide, helium, medical-surgical vacuum, waste anesthetic gas disposal, and mixtures thereof. Wherever the name of a specific gas or vacuum occurs, the provision applies only to that gas. | <b>NFPA 99, Sec. 5.1.1</b>  |
| 3. | The installation of bulk oxygen systems in excess of 20,000 cu. ft. shall be in accordance with NFPA 55, 2005 edition.   | <b>CFC, Sec. 4001.1</b>     |
| 4. | Rooms or areas where medical gases are stored or used in quantities exceeding the maximum allowable quantity per control area as set forth in Section 2703.1 shall be in accordance with the California Building Code for high-hazard Group H occupancies.   | <b>CFC, Sec. 3001.1</b>     |

### CHK

### NA

### II. BULK OXYGEN SYSTEMS

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| <input type="checkbox"/> | <input type="checkbox"/> | 1. Systems shall be located aboveground out of doors or in detached ventilated buildings of fire-resistive or noncombustible construction used exclusively for the system.             | <b>NFPA 55, Sec. 9.3</b>             |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Stationary tanks shall be marked in accordance with NFPA 704.   | <b>NFPA 55, Sec. 8.4.1.2</b>         |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. Hazard identification signs in accordance with NFPA 704 shall be provided at entrances to the cryogenic enclosure.  | <b>NFPA 55, Sec. 8.4.1.3</b>         |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. Stationary containers shall be placarded with the identity of their contents.   | <b>NFPA 55, Sec. 8.4.2</b>           |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. Container inlet and outlet connections, liquid-level limit controls, valves and pressure gauges shall be identified with a permanent tag or schematic drawing attached to the tank. | <b>NFPA 55, Sec. 8.4.4.1</b>         |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. Emergency shutoff valves shall be identified, visible and indicated by means of a sign.   | <b>NFPA 55, Sec. 8.4.6</b>           |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. Systems shall not be located within 5 ft. of overhead power lines.  | <b>NFPA 55, Sec. 9.3.2</b>           |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. Systems shall not be located within 15 ft. of overhead piping containing hazardous materials.   | <b>NFPA 55, Sec. 9.3.2</b>           |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. Systems shall not be located on rooftops of buildings or other structures.  | <b>NFPA 55, Sec. 9.3.1</b>           |
| <input type="checkbox"/> | <input type="checkbox"/> | 10. Bulk cryogenic liquid system sites shall include a concrete pad designed for the weight, dynamic loads, wind loads, surface loading and complying with seismic requirements.       | <b>NFPA 99, Sec. 5.1.3.4.13.3(1)</b> |

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| <input type="checkbox"/> | <input type="checkbox"/> | 11. Bulk cryogenic liquid system sites shall include permanent anchors holding the components to the pad in accordance with design requirements.   | <b>NFPA 99, Sec. 5.1.3.4.13.3(2)</b>                  |
| <input type="checkbox"/> | <input type="checkbox"/> | 12. Bulk cryogenic liquid system sites shall include a complete enclosure in accordance with NFPA 99, Sec. 5.1.3.3.2(3).   | <b>NFPA 99, Sec. 5.1.3.4.13.3(3)</b>                  |
| <input type="checkbox"/> | <input type="checkbox"/> | 13. Bulk cryogenic liquid system sites shall include concrete or crushed stone completely filling the enclosed space.  | <b>NFPA 99, Sec. 5.1.3.4.13.3(4)</b>                  |
| <input type="checkbox"/> | <input type="checkbox"/> | 14. Bulk cryogenic liquid system sites shall include an allowance for at least 3 ft. of clearance around storage containers, vaporizers, and the pressure regulating manifold.   | <b>NFPA 99, Sec. 5.1.3.4.13.3(6)</b>                  |
| <input type="checkbox"/> | <input type="checkbox"/> | 15. Bulk cryogenic liquid system sites shall include a vehicle pad in compliance with NFPA 55, Sec. 9.3.2.3.   | <b>NFPA 99, Sec. 5.1.3.4.13.3(5)</b>                  |
| <input type="checkbox"/> | <input type="checkbox"/> | 16. The equipment pad and vehicle pad shall drain away from any building, parked vehicles or combustible materials.  | <b>NFPA 99, Sec. 5.1.3.4.13.4(1)</b>                  |
| <input type="checkbox"/> | <input type="checkbox"/> | 17. The equipment pad and vehicle pad shall have no drain within the pad or closer than 8 ft. from the edge of the pad.  | <b>NFPA 99, Sec. 5.1.3.4.13.4(2)</b>                  |
| <input type="checkbox"/> | <input type="checkbox"/> | 18. Delivery connections, pressure-relief device outlets, mobile supply equipment, and liquid withdrawal connections shall be at least 8 ft. from inlets to underground sewer or drainage systems.   | <b>NFPA 55, Sec. 9.3.2</b>                            |
| <input type="checkbox"/> | <input type="checkbox"/> | 19. Noncombustible surfacing required under mobile supply equipment at least the full width of the delivery vehicle and at least 8 ft. in the direction of the vehicle axis.   | <b>NFPA 55, Sec. 9.3.2.3</b>                          |
| <input type="checkbox"/> | <input type="checkbox"/> | 20. Asphaltic or bitumastic paving shall not be considered to be noncombustible surfacing for the purposes of liquid delivery parking and connection protection. Expansion joint fillers shall also be noncombustible.   | <b>NFPA 55, Sec. 9.3.2</b>                            |
| <input type="checkbox"/> | <input type="checkbox"/> | 21. The area surrounding stationary containers shall be provided with a means to prevent accidental discharge from endangering personnel, containers, equipment, and adjacent structures and from entering enclosed spaces.  | <b>NFPA 55, Sec. 8.12.2.5.1</b>                       |
| <input type="checkbox"/> | <input type="checkbox"/> | 22. The stationary container shall not be placed where spilled or discharged fluids will be retained around the container unless special features permit including; crushed rock utilized as a heat sink, topographical conditions, nature of occupancy, proximity to structures, capacity of containers and character of fluids stored. | <b>NFPA 55, Sec. 8.12.2.5.2 &amp; Sec. 8.12.5.2.3</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | 23. The grade for a distance of not less than 50 ft. from cryogenic storage and delivery systems shall be higher than the grade on which flammable or combustible liquids are stored or used.  | <b>NFPA 55, Sec. 8.12.2.5.4</b>                       |
| <input type="checkbox"/> | <input type="checkbox"/> | 24. When a grade differential between cryogenic systems and flammable and combustible liquid storage or use areas cannot be provided, curbs or other means of drainage control are required.   | <b>NFPA 55, Sec. 8.12.2.5.4.1</b>                     |
| <input type="checkbox"/> | <input type="checkbox"/> | 25. Bulk oxygen system(s) shall be at least 50 ft. from Type III, IV or V construction (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).  | <b>NFPA 55, Sec. 9.3.2</b>                            |
| <input type="checkbox"/> | <input type="checkbox"/> | 26. Bulk oxygen system(s) shall be at least 1 ft. from Type I or II construction.  | <b>NFPA 55, Sec. 9.3.2</b>                            |
| <input type="checkbox"/> | <input type="checkbox"/> | 27. High-pressure gas or liquefied gas regulators, pressure-relief devices, vaporizers, manifolds, and interconnected piping shall be at least 10 ft. from wall openings in adjacent structures.   | <b>NFPA 55, Sec. 9.3.2</b>                            |

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| <input type="checkbox"/> | <input type="checkbox"/> | <b>28.</b> Bulk oxygen system(s) shall be at least 25 ft. from all classes of flammable and combustible liquids stored above ground, 1000 gallons or less (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).   | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>29.</b> Bulk oxygen system(s) shall be at least 50 ft. from all classes of flammable and combustible liquids stored above ground, more than 1000 gallons (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions). | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>30.</b> Bulk oxygen system(s) shall be at least 15 ft. from all classes of flammable and combustible liquids stored in belowground tanks and vaults (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).      | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>31.</b> Bulk storage container(s) shall be at least 25 ft. from filling and vent connections or other openings to belowground tanks or vaults (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).            | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>32.</b> Bulk oxygen system(s) shall be at least 75 ft. from liquefied hydrogen (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).   | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>33.</b> Bulk oxygen system(s) shall be at least 25 ft. from liquefied flammable gasses stored above ground, 1000 gallons or less (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).                         | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>34.</b> Bulk oxygen system(s) shall be at least 50 ft. from liquefied flammable gasses stored above ground, more than 1000 gallons (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).                       | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>35.</b> Bulk oxygen system(s) shall be at least 25 ft. from nonliquefied or dissolved flammable gasses stored above ground, 25,000 cu. ft. or less (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).       | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>37.</b> Bulk oxygen system(s) shall be at least 50 ft. from nonliquefied or dissolved flammable gasses stored above ground, more than 25,000 cu. ft. (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).     | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>38.</b> Bulk oxygen system(s) shall be at least 50 ft. from solid materials that burn rapidly, such as paper or excelsior (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).                                | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>39.</b> Bulk oxygen system(s) shall be at least 25 ft. from solid materials that burn slowly, such as heavy timber or coal (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).                               | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>40.</b> Stationary cryogenic containers shall be at least 15 ft. from combustible materials such as paper, leaves, weeds, dry grass or debris (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).            | <b>NFPA 55,<br/>Sec. 8.6.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>41.</b> Bulk oxygen system(s) shall be at least 50 ft. from places of public assembly.  | <b>NFPA 55,<br/>Sec. 9.3.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>42.</b> Primary pressure-relief device discharge vent, and filling and vent connections shall be at least 50 ft. from areas occupied by nonambulatory patients.   | <b>NFPA 55,<br/>Sec. 9.3.2</b> |

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| <input type="checkbox"/> | <input type="checkbox"/> | <b>43.</b> Bulk oxygen system(s) shall be at least 10 ft. from public sidewalks or parked vehicles (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).   | <b>NFPA 55,<br/>Sec. 9.3.2</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>44.</b> Bulk oxygen system(s) shall be at least 5 ft. from property lines (does not apply where 2-hour fire barrier interrupts line of sight to uninsulated portions).   | <b>NFPA 55,<br/>Sec. 9.3.2</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>45.</b> Bulk oxygen system(s) shall not be installed within enclosed courts. See NFPA 55, Sec. 8.12.2.6.1.   | <b>NFPA 55,<br/>Sec. 9.3.2</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>46.</b> Bulk oxygen system(s) shall be sited so that they are open to the surrounding environment except that encroachment by building walls of unlimited height shall be permitted when in accordance with the distances specified by Table 8.6.2   | <b>NFPA 55,<br/>Sec. 8.12.2.6.2</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>47.</b> When exterior building walls encroach on the system to form a court, the system shall be located a distance not less than the height of the wall from at least two court walls.  | <b>NFPA 55,<br/>Sec.<br/>8.12.2.6.2.1</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>48.</b> The required distance between exterior building walls forming a court shall be determined without regard to fire barrier walls used to allow for encroachment by fire exposures.   | <b>NFPA 55,<br/>Sec.<br/>8.12.2.6.2.2</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>49.</b> Outdoor locations surrounded by impermeable walls shall have protected ventilation openings located at the base of each wall to allow free circulation of air within the enclosure. Walls that are shared with other enclosures or with buildings shall be permitted to not have openings. | <b>NFPA 99, Sec.<br/>5.1.3.3.3.3</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>50.</b> Where fire barrier walls are provided, they shall be without openings or penetrations other than protected penetrations and shall be an independent structure or the exterior wall of an adjacent building.  | <b>NFPA 55, Sec.<br/>8.6.2.1.1, Sec.<br/>8.6.2.1.1.1 &amp;<br/>Sec. 8.6.2.1.2</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>51.</b> A fire barrier wall shall be located not less than 5 ft. from any exposure.  | <b>NFPA 55, Sec.<br/>8.6.2.1.3</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>52.</b> A fire barrier wall shall have not more than two sides at 90 degree directions, or not more than three sides with connecting angles of 135 degrees.  | <b>NFPA 55, Sec.<br/>8.6.2.1.3</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>53.</b> The bulk system shall be a minimum distance of 1 ft. from a fire barrier wall.   | <b>NFPA 55, Sec.<br/>8.6.2.1.5</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>54.</b> Liquid oxygen and high pressure gaseous storage container(s) shall be fabricated from materials meeting ASME Boiler & Pressure Vessel Code or shall meet U.S. DOT Regulations for 4L containers.   | <b>NFPA 55,<br/>Sec. 8.2</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>55.</b> Containers, valves, valve seats, lubricants, fittings, gaskets, and interconnecting equipment including hoses, shall be compatible with oxygen under the conditions of temperature and pressure to which the components are exposed.   | <b>NFPA 55,<br/>Sec. 9.2.1</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>56.</b> Liquid oxygen and high pressure gaseous storage container(s) shall be equipped with safety relief devices as required by ASME Boiler & Pressure Vessel Code or U.S. DOT.   | <b>NFPA 55,<br/>Sec. 7.1.2.5.2 &amp;<br/>8.2.4.1.1</b>                            |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>57.</b> Pressure relief devices shall be designed or located so that moisture cannot freeze and interfere with the proper operation of the device.   | <b>NFPA 55,<br/>Sec. 7.1.2.5.6 &amp;<br/>Sec. 8.3.4</b>                           |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>58.</b> Pressure-relief devices shall discharge upward and unobstructed to the open air to prevent impingement of escaping gas upon the container, adjacent structures or personnel.   | <b>NFPA 55, Sec.<br/>7.1.2.5.5, Sec.<br/>8.2.4.6.1 &amp; Sec.<br/>8.3.3</b>       |

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| <input type="checkbox"/> | <input type="checkbox"/> | <b>59.</b> Shutoff valves installed between pressure relief valves and containers shall not be installed unless of the locking type and their use is limited to service-related work.  | <b>NFPA 55, Sec. 8.2.4.7.2.1</b>                               |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>60.</b> Shutoff valves controlling multiple pressure-relief valves shall be installed so that either the type of valve installed or the arrangement provides the full required flow through the minimum number of required relief valves at all times.  | <b>NFPA 55, Sec. 8.2.4.7.2.2</b>                               |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>61.</b> Liquid oxygen tanks and vaporizers shall be adequately anchored and supported with concrete or masonry foundations or structural steel supports on concrete or masonry foundations.   | <b>NFPA 55, Sec. 8.2.3, 8.2.3.3, 8.5.3 &amp; 8.5.4</b>         |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>62.</b> Piping shall be designed and constructed to allow for expansion, contraction due to temperature changes and vibration, settlement, and fire exposure.   | <b>NFPA 55, Sec. 8.5.4 &amp; 8.13.2.2</b>                      |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>63.</b> Heat exchangers, vaporizers, insulation casings surrounding containers, vessels, and coaxial piping systems in which liquefied oxygen could be trapped shall be provided with a pressure-relief device.   | <b>NFPA 55, Sec. 8.2.4.3</b>                                   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>64.</b> Heat used in vaporizers shall be indirectly supplied mediums such as steam, air, water, etc. If electric heaters are used, the vaporizer shall be electrically grounded.  | <b>NFPA 55, Sec. 9.4.2</b>                                     |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>65.</b> Guard posts or other means shall be provided to protect compressed gas containers, cylinders, tanks, and systems indoors and outdoors from vehicular damage.  | <b>NFPA 55, Sec. 7.1.4.3.2 &amp; 8.5.5</b>                     |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>66.</b> Areas used for the storage of containers and systems shall be secured against unauthorized entry and tampering.   | <b>NFPA 55, Sec. 8.5.2 &amp; Sec. 8.5.5</b>                    |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>67.</b> Accessible shutoff valves shall be located on all container connections as close to the container as practical except at pressure relief valves.  | <b>NFPA 55, Sec. 8.13.5 &amp; 8.13.5.2</b>                     |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>68.</b> Any enclosure containing oxygen control or operating equipment shall be vented.   | <b>NFPA 55, Sec. 9.4.3.2</b>                                   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>69.</b> Bulk oxygen installations are not considered hazardous (classified) locations as defined in CEC, Article 500.   | <b>NFPA 55, Sec. 9.4.5</b>                                     |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>70.</b> Task illumination and receptacles provided at the bulk oxygen installation which are needed for effective hospital operation shall be connected to the critical branch of the essential electrical system.  | <b>NFPA 99, Sec. 5.1.3.3.2(8) &amp; CEC, Sec. 517-33(A)(9)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>71.</b> The bulk system shall include a fill circuit consisting of a nonremovable product-specific fill connection, a means to cap and secure the fill connection inlet, a minimum 100 mesh Monel or brass strainer, a check valve to prevent backflow, a fill hose purge valve, supports to hold fill piping off the ground, a secure connection between the vessel and the fill piping and supports as necessary to hold the fill line in position during all operations. | <b>NFPA 99, Sec. 5.1.3.4.13.7</b>                              |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>72.</b> The bulk system fill connection, top and bottom fill valves, hose purge valve, vent valve, full try/cock, liquid level and tank pressure gauges shall be readily accessible to delivery personnel.  | <b>NFPA 99, Sec. 5.1.3.4.13.2</b>                              |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>73.</b> Bulk cryogenic sources shall include one or more main supply vessel(s) of sufficient capacity.  | <b>NFPA 99, Sec. 5.1.3.4.13.5(1)</b>                           |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>74.</b> Bulk cryogenic sources shall include a contents gauge on each main vessel(s).   | <b>NFPA 99, Sec. 5.1.3.4.13.5(2)</b>                           |

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| <input type="checkbox"/> | <input type="checkbox"/> | <b>75.</b> Bulk cryogenic sources shall include a reserve supply sized for greater than an average day's supply, with the appropriate size vessel or number of cylinders.  | <b>NFPA 99, Sec. 5.1.3.4.13.5(3)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>76.</b> The bulk cryogenic source reserve supply shall be a second cryogenic vessel or a gas cylinder header having sufficient gas cylinders for an average day's supply but not less than three.   | <b>NFPA 99, Sec. 5.1.3.4.13.6(1)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>77.</b> Bulk cryogenic sources shall include at least two main vessel relief valves and rupture discs installed downstream of a three-way (three-port) valve.   | <b>NFPA 99, Sec. 5.1.3.4.13.5(4)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>78.</b> Bulk cryogenic sources shall include a check valve located in the primary supply piping upstream of the intersection with a secondary or reserve supply.  | <b>NFPA 99, Sec. 5.1.3.4.13.5(5)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>79.</b> The bulk cryogenic reserve supply shall have an actuating switch/sensor monitoring internal pressure of the reserve cryogenic liquid vessel (if provided).  | <b>NFPA 99, Sec. 5.1.3.4.13.6(2)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>80.</b> The bulk cryogenic reserve supply shall have a contents gauge monitoring liquid level in the reserve cryogenic liquid vessel (if provided).   | <b>NFPA 99, Sec. 5.1.3.4.13.6(3)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>81.</b> The bulk cryogenic reserve supply shall have a check valve to prevent backflow into the reserve system.   | <b>NFPA 99, Sec. 5.1.3.4.13.6(4)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>82.</b> The bulk cryogenic reserve supply shall have a pressure switch monitoring the pressure in the gas cylinder header (if provided).  | <b>NFPA 99, Sec. 5.1.3.4.13.6(5)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>83.</b> Bulk cryogenic liquid sources shall automatically prevent the reserve supply from supplying the system until the main supply is reduced.  | <b>NFPA 99, Sec. 5.1.3.4.13.8(1)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>84.</b> Bulk cryogenic liquid sources shall automatically activate the reserve supply when the main supply cannot supply the system.  | <b>NFPA 99, Sec. 5.1.3.4.13.8(2)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>85.</b> Bulk cryogenic liquid sources shall automatically operate as required for systems with primary, secondary and reserve supplies when more than one main supply vessel is provided in accordance with NFPA 99, Sec. 5.1.3.4.12.4.   | <b>NFPA 99, Sec. 5.1.3.4.13.8(3)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>86.</b> Bulk cryogenic liquid sources are permitted to automatically alternate roles of primary, secondary and reserve using an operating cascade in accordance with NFPA 99, Sec. 5.1.3.4.12.4.  | <b>NFPA 99, Sec. 5.1.3.4.13.8(4)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>87.</b> Where a cryogenic vessel is used as the reserve, the reserve vessel shall include an economizer connected to the line upstream of the final line regulator in accordance with NFPA 99, Sec. 5.1.3.4.12.6.   | <b>NFPA 99, Sec. 5.1.3.4.13.8(5)</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>88.</b> Bulk systems shall actuate a local signal and an indicator at the master alarm panel before the mains supply reaches an average day's supply, when the reserve supply is operating, when the reserve supply falls to one day's average supply, when the reserve is a cryogenic vessel, when the pressure falls too low and when there is more than one main supply vessel, when the secondary vessel begins to supply the system indicating changeover. | <b>NFPA 99, Sec. 5.1.3.4.13.9</b>      |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>89.</b> Where vaporizers are required, they are permitted to operate either by ambient heat transfer or an external heat source (e.g., electric heater, hot water, steam).  | <b>NFPA 99, Sec. 5.1.3.4.13.10 (1)</b> |

- 90.** Where vaporizers are provided, they shall be designed to provide adequate capacity for the facility's peak and average flow rates under local conditions, seasonal conditions for weather and humidity and structures that obstruct circulation flow and sunlight. **NFPA 99, Sec. 5.1.3.4.13.10 (2)**
- 91.** Vaporizers shall have piping and manual/automatic valving to allow operating vaporizer(s) or sections of a vaporizer to be switched to a nonoperating vaporizer or nonoperating section of a vaporizer to de-ice through an arrangement that allows continuous flow to the facility through either or both vaporizers and/or sections of the vaporizer if valving switchover partially hangs up or fails. **NFPA 99, Sec. 5.1.3.4.13.10 (3)**
- 92.** Where a vaporizer requires an external heat source, the flow from the source of supply shall be unaffected by the loss of the external heat source by providing a reserve ambient heat transfer vaporizer of sufficient capacity for one day's average supply piped accordingly or a reserve noncryogenic source capable of providing at least a one day's average supply. **NFPA 99, Sec. 5.1.3.4.13.11 (1) & (2)**
- 93.** Electric wall fixtures, switches, receptacles, etc. shall be located at least 5 ft. above the floor. **NFPA 99, Sec. 5.1.3.3.2(5)**

**CHK    NA    III. PIPED MEDICAL GAS SYSTEMS - SUPPLY**

- 1.** Patient medical gas systems shall conform to the requirements for Level 1 gas systems. **NFPA 99, Sec. 13-3.5.1**
- 2.** Task illumination and receptacles provided at the medical gas supply location which are needed for effective hospital operation shall be connected to the critical branch of the essential electrical system. **NFPA 99, Sec. 5.1.3.3.2(8) & CEC, Sec. 517-33(A)(9)**
- 3.** Medical gas central supply systems shall not be piped to, or used for, any purpose except patient care. Medical air shall be used only in the application of human respiration and calibration of medical devices for respiratory application. **NFPA 99, Sec. 5.1.3.4.2**
- 4.** Central supply systems shall have duplex final pressure regulators installed in parallel. with isolation valves before each regulator and an isolation/check valve after each regulator. **NFPA 99, Sec. 5.1.3.4.5.1**
- 5.** A manual shut-off valve shall be installed before each central supply system final pressure regulator. **NFPA 99, Sec. 5.1.3.4.5.1**
- 6.** A manual shut-off valve or check valve shall be installed after each central supply system final pressure regulator. **NFPA 99, Sec. 5.1.3.4.5.1**
- 7.** A pressure relief valve shall be installed between each final pressure regulator and before the source valve. **NFPA 99, Sec. 5.1.3.4.6.3(1)**
- 8.** A pressure relief valve shall be installed in the main line set a 50% above normal line pressure. **NFPA 99, Sec. 5.1.3.4.6.3(2)**
- 9.** Pressure relief valves shall vent to the exterior except that relief valves for compressed air systems having a capacity of less than 3,000 cu. ft. are permitted to be diffused locally by a means that will not restrict flow. **NFPA 99, Sec. 5.1.3.4.6.1(4)**
- 10.** When vented to the exterior, relief valve discharge lines shall be of the same materials and construction as distribution lines. **NFPA 99, Sec. 5.1.3.4.6.2**
- 11.** When vented to the exterior, relief valve discharge lines shall be labeled. **NFPA 99, Sec. 5.1.3.4.6.4**

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| <input type="checkbox"/> | <input type="checkbox"/> | <b>12.</b> Vent discharge terminal shall be turned down and screened to prevent the entry of rain, snow or vermin.  | <b>NFPA 99, Sec. 5.1.3.4.6.1(8)</b>                        |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>13.</b> The relief valve vent discharge shall not be smaller than the size of the relief valve outlet.   | <b>NFPA 99, Sec. 5.1.3.4.6.1(5)</b>                        |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>14.</b> Where two or more relief valves discharge into a common vent line, the internal cross-sectional area shall be not less than the aggregate cross-sectional area of all vent discharge lines served.   | <b>NFPA 99, Sec. 5.1.3.4.6.1(6)</b>                        |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>15.</b> An inlet for connecting a temporary emergency supply shall be incorporated into the medical gas system where the bulk oxygen central supply system is outside and remote from the building served or there is no reserve supply sufficient for an average day's supply located in the building or there are multiple freestanding buildings served from a single oxygen source. Where multiple buildings are served, each building shall have a separate emergency connection. | <b>NFPA 99, Sec. 5.1.3.4.14</b>                            |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>16.</b> The emergency supply inlet shall be located on the exterior of the building served at a location accessible by emergency supply vehicles at all times in all weather conditions.   | <b>NFPA 99, Sec. 5.1.3.4.14.1</b>                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>17.</b> Noncombustible surfacing is required under mobile supply equipment at least the full width of the delivery vehicle and at least 8 ft. in the direction of the vehicle axis.  | <b>NFPA 55, Sec. 9.3.2.3</b>                               |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>18.</b> Delivery connections, pressure-relief device outlets, mobile supply equipment, and liquid withdrawal connections shall be at least 8 ft. from inlets to underground sewer or drainage systems.   | <b>NFPA 55, Sec. 9.3.2.3</b>                               |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>19.</b> The emergency supply inlet shall be physically protected from tampering and unauthorized access.   | <b>NFPA 99, Sec. 5.1.3.4.14.2(1)</b>                       |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>20.</b> The emergency supply inlet shall be installed immediately downstream of the main supply shut-off valve and provided with any valves necessary to allow emergency supply of oxygen and to isolate the piping to the normal source of supply.  | <b>NFPA 99, Sec. 5.1.3.4.14.1(2) &amp; 5.1.3.4.14.2(6)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>21.</b> The emergency supply inlet shall have one check valve between the normal supply shut-off and the emergency inlet and one check valve between the main line and the emergency inlet shut-off valve.   | <b>NFPA 99, Sec. 5.1.3.4.14.2(4)</b>                       |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>22.</b> The emergency supply inlet shall be provided with a pressure relief valve set at 50% above normal line pressure.   | <b>NFPA 99, Sec. 5.1.3.4.14.2(5)</b>                       |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>23.</b> The emergency supply inlet shall be National Pipe Thread sized to accommodate 100% of the system demand.   | <b>NFPA 99, Sec. 5.1.3.4.14.2(2)</b>                       |

**CHK**

**NA**

**IV. PIPED MEDICAL GAS SYSTEMS – ALARMS**

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|--------------------------|--------------------------|---|---|
| <input type="checkbox"/> | <input type="checkbox"/> | <b>1.</b> All local, master, and area medical gas alarm panels shall provide: (1) separate visual indication for each condition monitored, (2) visual indicators that remain in alarm until the situation is resolved, (3) cancelable audible indication of alarm condition, and (4) a visual means to check or indicate LED or lamp failure. | <b>NFPA 99, Sec. 5.1.9.1(1), (2), (3) &amp; (4)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>2.</b> Local, master and area medical gas alarms shall indicate a visual and audible signal if the monitored condition occurs or the if wiring to the sensor switch is disconnected.   | <b>NFPA 99, Sec. 5.1.9.1(5)</b>                     |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>3.</b> The audible indication of medical gas alarm panels shall produce a minimum of 80dBA measured at 3 ft. from the alarm.   | <b>NFPA 99, Sec. 5.1.9.1(3)</b>                     |

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|--------------------------|--------------------------|--|---|
| <input type="checkbox"/> | <input type="checkbox"/> | <b>4.</b> A second indicated condition occurring while a medical gas alarm panel is silenced shall cause the audible signal to reinitiate.   | <b>NFPA 99, Sec. 5.1.9.1(8)</b>                               |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>5.</b> Medical gas alarms shall be labeled to indicate the type of gas they serve and the room(s) or area(s) they serve.  | <b>NFPA 99, Sec. 5.1.9.1(6) &amp; (7)</b>                     |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>6.</b> Master alarms shall be connected by dedicated wiring directly to the sensors or switches.  | <b>NFPA 99, Sec. 5.1.9.2.3</b>                                |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>7.</b> A master medical gas alarm panel shall be provided to monitor the operation and condition of the source of supply and the reserve, and the pressure of the medical gas piping system.  | <b>NFPA 99, Sec. 5.1.9.2</b>                                  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>8.</b> One of the two required master medical gas alarm panels shall be located in the principal working area of the individual responsible for maintenance of the medical gas system.  | <b>NFPA 99, Sec. 5.1.9.2.1(1)</b>                             |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>9.</b> One of the two required master medical gas alarm panels shall be located to assure continuous surveillance during the operating hours of the facility (e.g. telephone switchboard, security office, nurse station, or other continuously staffed location).  | <b>NFPA 99, Sec. 5.1.9.2.1(2)</b>                             |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>10.</b> A centralized computer system shall be permitted to be substituted for one of the required master alarms.   | <b>NFPA 99, Sec. 5.1.9.2.2</b>                                |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>11.</b> Local, master and area medical gas alarms shall be powered by the Life Safety Branch of the Emergency Power System.   | <b>NFPA 99, Sec. 5.1.9.1 (9) &amp; CEC, Sec. 517-32(C)(2)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>12.</b> All wiring to pressure switches and sensors shall be supervised or in conduit or raceways.  | <b>NFPA 99, Sec. 5.1.9.1(11) &amp; CEC, Sec. 517.30(C)3</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>13.</b> All pressure switches and sensors shall be provided with a gas specific demand check fitting to facilitate service, testing and replacement except zone valve gauges.   | <b>NFPA 99, Sec. 5.1.8.2.3 &amp; Sec. 5.8.2.3.1</b>           |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>14.</b> Demand check valves shall be provided for all monitors.   | <b>NFPA 99, Sec. 5.1.8.2.4</b>                                |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>15.</b> A master medical gas alarm panel shall provide a visual and audible indication for each of the following conditions: (1) bulk system changeover (manifold or alternating-type), (2) bulk cryogenic liquid system reaches an average day's supply, (3) reserve in use, (4) cylinder reserve quantity low, (5) cryogenic liquid system reserve is low, (6) cryogenic liquid storage unit used as reserve for bulk system is low, (7) low or high line pressure (20% above or below normal operating pressure), (8) vacuum pressure in main vacuum line drops to or below 12 in., (9) alarm indications from source equipment local alarm panels, (10) medical air dew point high alarm, (11) WAGD low alarm and (12) instrument air dew point high alarm. | <b>NFPA 99, Sec. 5.1.9.2.4</b>                                |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>16.</b> Computer systems used to substitute for alarms shall be in continuous uninterrupted operation with power supplies as needed to ensure such reliability.   | <b>NFPA 99, Sec. 5.1.9.4.1(1)</b>                             |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>17.</b> Computer systems used to substitute for alarms shall be continuously attended by responsible individuals or provide remote signaling of responsible parties (e.g., pagers, auto dialers, or other such means).  | <b>NFPA 99, Sec. 5.1.9.4.1(2)</b>                             |

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| <input type="checkbox"/> | <input type="checkbox"/> | <b>18.</b> Where computer systems used to substitute for alarms rely on signal interface devices (e.g., electronic interfaces, other alarm panels, 4-20 mA cards, etc.), such interfaces shall be supervised such that failure shall initiate an alarm.  | <b>NFPA 99, Sec. 5.1.9.4.1(3)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>19.</b> If the computer does not power the signaling switches/sensors, the power supply for the switches/sensors shall be from the life safety branch of the emergency electrical system.   | <b>NFPA 99, Sec. 5.1.9.4.1(4)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>20.</b> Computer systems shall be permitted to connect directly to the sensors/switches in the same manner as an alarm panel if operation of other alarm panels is not impaired.  | <b>NFPA 99, Sec. 5.1.9.4.1(5)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>21.</b> Wiring from computer systems to signaling switches/sensors shall be supervised or in conduit or raceways.   | <b>NFPA 99, Sec. 5.1.9.4.1(6)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>22.</b> Computer systems shall be provided with an audio alert.   | <b>NFPA 99, Sec. 5.1.9.4.1(7)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>23.</b> Operating systems for computer systems used as a substitute for master alarms shall allocate medical gas alarms the priority of a life safety signal.   | <b>NFPA 99, Sec. 5.1.9.4.2(1)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>24.</b> A medical gas alarm signal shall interrupt any other activity of lesser priority to run the alarm algorithm(s).   | <b>NFPA 99, Sec. 5.1.9.4.2(2)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>25.</b> The alarm algorithm shall activate an audible alert, any remote signaling protocol and display the specific alarm condition.  | <b>NFPA 99, Sec. 5.1.9.4.2(3)</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>26.</b> The alarm algorithm shall provide (1) separate visual indication for each condition monitored, (2) visual indicators that remain in alarm until the situation is resolved, (3) cancelable audible indication of alarm condition, (4) indicate a visual and audible signal if the monitored condition occurs or the if wiring to the sensor switch is disconnected, (5) labels to indicate the type of gas they serve and the room(s) or area(s) they serve and (6) reinitiation of the audible signal if a second indicated condition occurs while a medical gas alarm panel is silenced. | <b>NFPA 99, Sec. 5.1.9.4.2(4)</b> |

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**NA**

**V. PIPED MEDICAL GAS SYSTEMS – SHUTOFF VALVES**

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|--------------------------|--------------------------|--|---|
| <input type="checkbox"/> | <input type="checkbox"/> | <b>1.</b> Shutoff valves accessible to other than authorized personnel shall be installed in valve boxes with frangible or removable windows large enough to permit manual operation..   | <b>NFPA 99, Sec. 5.1.4.2.1</b>                    |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>2.</b> A source valve shall be placed at the immediate connection of each source system to the piped distribution system to permit the entire source of supply, including all accessory devices, to be isolated from the facility. The source valve shall be located in the immediate vicinity of the source equipment. | <b>NFPA 99, Sec. 5.1.4.4 &amp; Sec. 5.1.4.4.1</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>3.</b> A source valve shall be labeled “ <b>SOURCE VALVE FOR THE (SOURCE NAME).</b> ”   | <b>NFPA 99, Sec. 5.1.11.2.3</b>                   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>4.</b> The main supply line shall be provided with a shutoff valve inside of the building except where the source and source valve are located in the building served or the source system is physically mounted to the wall of the building in the immediate vicinity of the source valve.                             | <b>NFPA 99, Sec. 5.1.4.5</b>                      |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>5.</b> The main supply line shutoff valve shall be located to permit access by authorized personnel only (e.g., in a ceiling or a locked room).   | <b>NFPA 99, Sec. 5.1.4.5.1</b>                    |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>6.</b> The main supply line shutoff valve shall be located on the facility side of the source valve and outside of the source room, enclosure, or where the main line first enters the building.  | <b>NFPA 99, Sec. 5.1.4.5.2</b>                    |

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|--------------------------|--------------------------|---|---------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | 7. The main valve shall be identified " <b>MAIN LINE VALVE FOR THE (GAS/VACUUM NAME) SERVING THE (NAME OF THE BUILDING).</b> "  | <b>NFPA 99, Sec. 5.1.11.2.4</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. All shutoff valves shall be identified with the name or chemical symbol for the specific system, the room or area served and a caution to not close or open valve except in an emergency.  | <b>NFPA 99, Sec. 5.1.11.2.1</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. When positive pressure gas systems operate at a pressure other than 50 psi to 55 psi or a pressure of 160 psi to 185 psi for nitrogen or instrument air, the valve identification shall also include the nonstandard operating pressure. | <b>NFPA 99, Sec. 5.1.11.2.2</b> |

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**NA**

**VI. PIPED MEDICAL GAS SYSTEMS – DISTRIBUTION**

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| <input type="checkbox"/> | <input type="checkbox"/> | 1. Tubes, valves, fittings, station outlets and other piping components in medical gas systems shall have been cleaned for oxygen service by the manufacturer prior to installation, except that fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer. | <b>NFPA 99, Sec. 5.1.10.1.1</b>                                    |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Each length of tube shall be delivered plugged or capped by the manufacturer and kept sealed until prepared for installation. Fittings, valves and other components shall be delivered sealed, labeled and kept sealed until prepared for installation.                                      | <b>NFPA 99, Sec. 5.1.10.1.2</b><br><b>NFPA 99, Sec. 5.1.10.1.3</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. Piping shall be hard-drawn seamless copper ASTM B 819 for medical gas service and each length of tubing shall be permanently labeled Type K or L and bear one of the following markings: <b>OXY, MED, OXY/MED, ACR/OXY, or ACR/MED</b> , in blue for Type L and green for Type K.            | <b>NFPA 99, Sec. 5.1.10.1.4 &amp; 5.1.10.1.5</b>                   |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. For piping for systems operated above 185 psi, Type K copper shall be used for sizes larger than DN80 (NPS 3) (3-1/8 in. O.D.).  | <b>NFPA 99, Sec. 5.1.10.1.4</b>                                    |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. Piping systems shall be designed and sized to deliver the required flow rates for the utilization pressures.   | <b>NFPA 99, Sec. 5.1.10.10.1.1</b>                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. Mains and branches in medical gas piping systems shall be not less than DN15 (NPS 1/2) (5/8 in. O.D.) size.  | <b>NFPA 99, Sec. 5.1.10.10.1.2</b>                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. Runouts to alarm panels and connecting tubing for gauges and alarm devices shall be permitted to be DN8 (NPS 1/4) (3/8 in. O.D.) size.   | <b>NFPA 99, Sec. 5.1.10.10.1.5</b>                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. Piping shall be supported from the structure in accordance with MSS SP-69.   | <b>NFPA 99, Sec. 5.1.10.10.4.1</b>                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. Hangers for copper tube shall comply with MSS SP-58.   | <b>NFPA 99, Sec. 5.1.10.10.4.2</b>                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | 10. Hangers for medical gas piping shall have a copper finish and be sized for copper tube.   | <b>NFPA 99, Sec. 5.1.10.10.4.3</b>                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | 11. In potentially damp locations, hangers or supports that are in contact with the tube shall be plastic-coated or otherwise insulated from the tube.  | <b>NFPA 99, Sec. 5.1.10.10.4.4</b>                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | 12. Maximum hanger spacing shall be 5 ft. for ¼ in. tubing; 6ft. for 3/8 and ½ in. tubing; 7 ft. for ¾ in. tubing; 8 ft. for 1 in. tubing; 9 ft. for 1 ¼ in. tubing; and 10 ft. for 1 ½ in. tubing.   | <b>NFPA 99, Sec. 5.1.10.10.4.5</b>                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | 13. Vertical risers of all sizes shall be supported at every floor but not to exceed 15 ft.   | <b>NFPA 99, Sec. 5.1.10.10.4.5</b>                                 |

- 14.** Where required, medical gas and vacuum piping shall be seismically restrained against earthquakes in accordance with the applicable building code. **NFPA 99, Sec. 5.1.10.10.4.6**
- 15.** Flared and compression-type connections and unions in medical gas systems are prohibited. This includes connections to station outlets, alarm devices, etc. **NFPA 99, Sec. 5.1.10.8**
- 16.** Threaded connections shall be limited to devices such as pressure/vacuum gauges, alarm devices, check valves and source equipment. Threaded joints shall be tapered threads complying with ASME B1.20.1. **NFPA 99, Sec. 5.1.10.4**
- 17.** Turns, off-sets and changes in directions shall be made with fittings; bending of tubing is prohibited. **NFPA 99, Sec. 5.1.10.3.1**
- 18.** Runouts from horizontal piping shall be taken off above the centerline of the main or branch pipe and rise vertically or at an angle of not more than 45 degrees from vertical. **NFPA 99, Sec. 5.1.10.10.6**
- 19.** Medical gas piping shall be protected from freezing, corrosion, and physical damage. **NFPA 99, Sec. 5.1.10.10.2**
- 20.** Piping exposed in corridors and other areas subject to physical damage from carts, stretchers, portable equipment, or vehicles shall be suitably protected. **NFPA 99, Sec. 5.1.10.10.2.1**
- 21.** Piping underground within buildings or embedded in concrete floors or concrete walls shall be in a continuous conduit. **NFPA 99, Sec. 5.1.10.10.2.2**
- 22.** Pipe risers shall be permitted to be installed in pipe shafts if protected from physical damage, excessive heat, corrosion, or contact with oil. **NFPA 99, Sec. 5.1.10.10.3.1**
- 23.** Piping shall not be installed in kitchens, elevator shafts, elevator machine rooms, areas with open flames and electrical service equipment over 600 volts except room locations for medical air compressor supply systems and medical-surgical vacuum pump supply systems and room locations containing secondary electrical distribution circuit panels and breakers having a maximum voltage of 600 volts. **NFPA 99, Sec. 5.1.10.10.3.2**
- 24.** Where medical gas piping is installed in the same trench or tunnel as fuel gas lines, fuel oil lines, electric lines, steam lines and similar utilities, the space shall be naturally or mechanically ventilated to limit temperatures in the space to 130 degrees. **NFPA 99, Sec. 5.1.10.10.3.3**
- 25.** Medical gas piping shall not be located where subject to contact with oil, including flooding caused by major oil leaks. **NFPA 99, Sec. 5.1.10.10.3.4**
- 26.** Hoses and flexible connectors shall be no longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions. **NFPA 99, Sec. 5.1.10.10.7.1**
- 27.** Hoses and flexible connectors shall have a minimum burst pressure of 1000 psig. **NFPA 99, Sec. 5.1.10.10.7.2**
- 28.** Where an existing system is being converted for operation at another pressure or for another gas, the existing system shall comply with the provisions of a new system. **NFPA 99, Sec. 5.1.10.10.10.1**
- 29.** Piping shall be labeled by stenciling or adhesive markers that identify patient medical gas, support gas, or vacuum system including the name of the gas/vacuum system or chemical symbol, the color code and where positive pressure systems operate at pressures other than standard gauge pressure, the label shall include the operating pressure. **NFPA 99, Sec. 5.1.11.1.1**

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|--------------------------|--------------------------|--|---------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | 30. Pipe labels shall be located at intervals of not more than 20 ft., at least once in or above every room, on both sides of walls or partitions penetrated by piping and at east once in every story height of riser piping. | <b>NFPA 99, Sec. 5.1.11.1.2</b> |
|--------------------------|--------------------------|--|---------------------------------|

**CHK**

**NA**

**VII. UNDERGROUND PIPING OUTSIDE OF BUILDINGS**

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|--------------------------|--------------------------|--|-------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. Medical gas piping shall be buried below the local level of frost penetration.  | <b>NFPA 99, Sec. 5.1.10.10.5.1</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Underground installations shall be protected from damage during backfilling using conduit, cover or other enclosure.  | <b>NFPA 99, Sec. 5.1.10.10.5.2</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. When protected by conduit, cover or other enclosure, access to joints shall be provided and the conduit, cover or enclosure shall be self draining and not retain groundwater in prolonged contact with the pipe. | <b>NFPA 99, Sec. 5.1.10.10.5.3</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. Buried piping that will be subject to surface loads shall be buried at a depth that will protect the piping or its enclosure from excessive stresses.   | <b>NFPA 99, Sec. 5.1.10.10.5.4</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. The minimum cover for buried pipe outside of buildings shall be 36 inches; where physical damage is not likely to occur, minimum bury depth may be reduced to 18 inches.  | <b>NFPA 99, Sec. 5.1.10.10.5.5</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. Trenches shall be excavated so that the pipe or its enclosure has firm, substantial continuous bearing on the trench bottom.  | <b>NFPA 99, Sec. 5.1.10.10.5.6</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. Backfill shall be clean and compacted so as to protect and uniformly support the pipe or its enclosure.   | <b>NFPA 99, Sec. 5.1.10.10.5.7</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. A continuous tape or marker shall be placed directly above buried pipe identifying the pipeline by specific name.   | <b>NFPA 99, Sec. 5.1.10.10.5.8</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. Continuous warning means shall be provided above buried piping approximately ½ of the depth of bury.  | <b>NFPA 99, Sec. 5.1.10.10.5.9</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | 10. Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be sealed to prevent the entrance of ground water into the building.   | <b>NFPA 99, Sec. 5.1.10.10.5.10</b> |

**APPLICABLE CODES AND STANDARDS**

**2007 California Building Code – Part 2, Title 24, CCR  
(2006 International Building Code and 2007 California Amendments)**

**2007 California Electrical Code – Part 3, Title 24, CCR  
(2005 National Electrical Code and 2007 California Amendments)**

**2007 California Fire Code – Part 9, Title 24, CCR  
(2006 International Fire Code and 2007 California Amendments)**

**National Fire Protection Association (NFPA)  
NFPA 55 *Storage Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders and Tanks*, 2005 Edition**

**NFPA 99 *Health Care Facilities*, 2005 Edition**

**NOTE:**

**Compliance with all items on this list does not necessarily assure compliance with all provisions of the applicable codes and standards. This reminder list should be used only by persons with a comprehensive knowledge of the applicable codes and standards.**

OSHPD Policy Intent Notices and Code Application Notices.

<http://www.oshpd.ca.gov/FDD/Regulations/CANs/index.html>

OSHPD Project Review Status

<http://w>

OSHPD Public Use Forms

<http://www.oshpd.ca.gov/FDD/Forms/index.html>