S.O.P. #: 600-25

SUBJECT: OXYGEN DELIVERY SYSTEMS: INVENTORY, INSPECTION AND MAINTENANCE OF TRANSFILLING STATIONS & OXYGEN CYLINDERS

DIVISION: EMERGENCY MEDICAL SERVICES

Objective: To assure the proper methods of safe oxygen storage, handling and transfilling cylinders. Be familiar with the hazards associated with the delivery and use of oxygen.

Oxygen delivery systems are a potential source of serious hazards if the distribution system and cylinders are not properly stored, installed and maintained.

All personnel are responsible for following appropriate safety precautions related to the carrying of oxygen cylinders, transfilling of oxygen and the delivery of oxygen therapy to patients.

Section 1: Portable Oxygen Cylinders: General storage, maintenance and handling:

A. The portable cylinders utilized by Baltimore County Fire Department are size "D" or "Jumbo D." No other portable cylinder is currently used.

B. "D" cylinders contain approximately 350 liters of oxygen at 2,000 to 2,200 pounds per square inch (PSI) when full.

C. All small portable cylinders are owned and maintained by Baltimore County Fire Department.

D. The Department utilized a threaded fitting (CGA 540) vs. the pin- index system.

E. Maintenance and handling:

1. Store portable cylinders in a clean, dry location away from direct sunlight.
2. Secure cylinders at all times. Do not allow cylinders to roll freely.
3. Do not allow smoking around cylinders.
4. Do not allow cylinders to come in contact with grease, oils or other combustible material.
5. Perform an external examination of each cylinder before, during and after each use. Special attention to any dents, gouges, arc burns, or dings to the cylinder wall. If discovered, remove from service and send to BA shop.
6. Inspect the hand wheel and valve stem for damage.
7. Inspect the (CGA) treads for damage or excessive wear.
8. Dirty cylinders should be cleaned with warm water and mild detergent. Do not use bleach or alcohol.
9. Never open a cylinder without a regulator attached, doing so can result in ear injury.
10. The Breathing Apparatus Technician shall perform all repairs.
11. Portable oxygen cylinders shall be changed at a minimum of 500 PSI.

12. Cylinders should not be allowed to go completely empty.
13. Assure all cylinders are within Hydrostatic date.
    a. Any cylinder that has aged beyond its hydrostatic test date shall immediately be removed from service and sent to the Breathing Apparatus shop for testing.

Section 2: Oxygen cascade systems: General storage, maintenance, handling and transfilling.

A. Baltimore County maintains a contract with a local vendor to supply Medical Grade (Oxygen USP) oxygen to designated transfilling stations. Transfilling stations shall not accept any other forms of compressed gases.

B. Company commanders along with the District EMS Lieutenant will determine the number of spare large (H & M) cylinders required for their area.

    a. Note 1: Several stations with cascade systems have established a predetermined delivery date with our vendor.
    b. The Company Commanders at stations with oxygen cascade systems are responsible for ordering the necessary quantity of cylinders and assuring all paperwork is complete.
    c. Given the total number of oxygen cascade systems in Baltimore County Career and Volunteer stations, there should be no justification for an "Emergency Delivery" of oxygen cylinders from the vendor. If a particular fill station is out of spare cylinders, units should go elsewhere to fill/ exchange their cylinders.

C. Transfilling of oxygen will only be done at those designated transfilling stations within Baltimore County Fire Department, no exceptions.

D. The cascade systems are not intended to transfill any other type of oxygen cylinders, other than those used for patient care, i.e. an acetylene torch oxygen cylinder.

E. Medical Grade oxygen cylinders have a higher percentage of pure oxygen when compared to Industrial Grade oxygen that contains impurities.

F. The work area around the oxygen cascade system shall be clean and free of any combustible material at all times.

G. All cylinders connected to the cascade system shall be fastened/secured to the wall.

H. All spare or empty cylinders shall be secured in the up-right position. Full cylinders shall have their bonnets or protective caps in place, protecting the valve and thread assembly.

I. Empty cylinders shall be clearly identified and stored together.

J. Each new cascade system is equipped with a pressure-reducing regulator. Do not adjust, modify or tamper with the settings of the regulator.

K. "H" cylinders contain approximately 6,900 liters of oxygen under 2,000 to 2,300 PSI.

L. EMS District Officers, along with station commanders will conduct an inspection of each oxygen cascade system, during the months of: January, April, July and October.

M. Maintenance and Handling:

1. Do not allow smoking around cylinders.
2. Do not allow cylinders to come in contact with grease, oils or other combustible material.
3. The work area around the cascade system shall be clean. No items are to be stored near or around the cascade system.
4. Store cylinders in an area where temperature is not less than 50^{o}F or more than 100 degrees Fahrenheit.
5. Do not store cylinders in area of public assembly.
6. Do not alter, remove any warning or identifications labels from cylinders.
7. Perform an external examination of each cylinder before changing cylinders in cascade system.
8. Inspect the hand wheel or valve stem for damage.
9. Inspect the (CGA) treads for damage or excessive wearing.
10. Inspect the braided whips for damage, i.e. bends/frays.
11. The Breathing Apparatus Technician shall perform all repairs to the cascade system.
12. In-line cylinders of the cascade system shall be changed out, as “Empty” at no less then 500PSI.
13. Cylinders should not be allowed to go completely empty.

N. Medical Grade, oxygen cascade, transfilling stations.

1. The following Career stations have a Medical Grade, oxygen cascade, transfilling station.

Towson, Station 1	Catonsville, Station 4	Garrison, Station 19
Randallstown, Station 18	Middle River, Station 12	
Fullerton, Station 8	Eastview, Station 15	

2. The following Volunteer stations have a Medical Grade, oxygen cascade, transfilling station.

Arbutus, Station 350	Arcadia, Station 430	Cockeysville, Station 390
English Consul, Station 370	Hereford Ambo, Station 530	Jacksonville, Station 470
Kingsville, Station 480	Lansdowne, Station 360	Liberty Road, Station 460
Middle River , Station 520	Owings Mills, Station 310	Pikesville, Station 320
Reisterstown, Station 410	Rosedale, Station 280	White Marsh, Station 200
Woodlawn, Station 330		

Section 3: Procedure for filling portable cylinders:

A. Only oxygen cylinders carried and utilized by Baltimore County are permitted to be refilled using our cascade systems. No other company or department is permitted to use the oxygen cascade systems.

1. Assure the work area is clean.
2. Inspect the portable cylinder for any contaminants.
3. Place the portable cylinder inside the holding bracket.
4. Inspect the external threads on the portable cylinder.
5. Inspect the internal threads and nylon tip on the connecting hose to assure they are not worn or damaged.

6. Connect the cascade hose/CGA 540 fitting to the portable cylinder.
    a. If excess tightening of the hand wheel is required to stop a leak at the connecting threads, immediately turn off the cylinders and check the internal threads of the CGA fitting for excessive wear.
7. Close bleeder valve.
8. Slowly open the portable cylinder. Note PSI remaining in cylinder.
9. Slowly open valve, using H cylinder that is above the closest pressure remaining in the portable cylinder.
10. Cascade cylinders are numbered from lowest pressure remaining in cylinder to highest PSI remaining.
    a. For example: cylinder 1 has 900 PSI, cylinder (2) has 1500 PSI, cylinder (3) has 1800 PSI, and cylinder (4) has 2000.
    b. Numbers for cylinders are moved as cylinders are exchanged out of system.
11. Monitor external temperature of portable cylinder during filling. The cylinder is usually warm to touch. If the portable cylinder (s) become hot to touch immediately turn off the cascade system and close all valves. Do not submerge a cylinder in water. Allow cylinder (s) to cool before continuing.
12. After the pressure has equalized, close the fill valves and slowly open the next H cylinder. Continue this until the portable cylinder PSI is equal to the highest H cylinder in the bank of 4.
13. After portable cylinder is completely full, close all valves and decrease pressure in system before disconnecting and removing cylinder.
14. Do not leave any valve in the open position, even when the cylinder is empty. Doing so may allow moisture to diffuse through an open valve, causing contamination and corrosion within the cylinder.
15. Do not paint any cylinder.
16. Precaution: If any unusual circumstances arise during the re-filling procedure, immediately shut off all valves.

Section 4: On-Board Medic unit oxygen system:

A. The medic unit on-board oxygen systems must be maintained in accordance with the original equipment (OEM) specification. Fire Maintenance or the Breathing Apparatus Technician shall perform all repairs.

B. Each medic unit shall carry one (1) large H size oxygen cylinder.

C. No tools or equipment are permitted within the On-Board oxygen cylinder compartment. This compartment shall be kept clean at all times.

D. All On-Board H cylinders shall be secured to the lifting device with a minimum of 2 straps.

E. Use extreme caution while operating the oxygen cylinder-lifting device and while moving cylinder. Be aware of potential pinching and crushing injuries.

F. On-Board H cylinders shall be changed out at a minimum of 500 PSI.

G. Electric switches control the On-Board oxygen systems. In the event of an electrical failure, each unit has an “Emergency By-Pass” switch located on the action wall. The By-Pass switch should normally remain in the closed position and should not be used as an “on-off” switch.

H. Baltimore County medic units utilize the OHIO flush mount oxygen outlet and each unit is issued two (2) flow regulators with a capacity to flow 0-25 liters per minute. Do not engrave regulators.

Section 5: Portable oxygen regulators:

A. Maintenance and handling

1. Inspect regulator before and after each use.
2. When changing cylinders, inspect internal threads of regulator for excessive wear.
3. Ensure that the regulator is set with the flow knobs in the off position before attaching and opening the cylinder.
4. Check for leaks. Immediately turn off oxygen cylinder if a leak is determined.
5. Regulators needing repair shall be sent to Breathing Apparatus Technician.
6. No repairs are to be done by field personnel.
7. Do not mark, or engrave regulators.
8. Do not clean a regulator with alcohol.
9. Do not allow regulators to come in contact with hydrocarbons.
10. Do not submerse regulators in water.
11. Do not alter the regulator in any way.

B. The failure to ensure compliance with these measures may hamper the ability of the oxygen delivery equipment to work properly and, in some cases, may have the serious potential to cause a fire or explosion or deterioration of a patient's condition. Each member of the Department has a responsibility for understanding the proper utilization and hazards associated with using compressed oxygen.