MEDICAL EQUIPMENT REPAIR DIVISION

STANDARD OPERATING PROCEDURES

500 BED FLEET HOSPITAL

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STANDARD OPERATING PROCEDURES

MEDICAL EQUIPMENT REPAIR DIVISION

A. **MISSION:** Maintenance, repair, and installation of medical and dental equipment.

B. **FUNCTIONS:** Perform both preventive and corrective maintenance for all medical/dental equipment items. In addition, provides technical expertise/training on the operation of above items.

C. **PHYSICAL DESCRIPTION:**

1. Co-located within Fleet Hospital compound.
2. Sheltering is with one 2:1 hardwall shelter.
3. Materials provided:

IOLs	**0007:**	Work benches, basic tools
	0008:	Test equipment and repair kits
	MR3A, MR3B, MR3C:	ISO container
	MRTL:	Technical library

D. **WORKLOAD:**

All equipment shall be serviced and maintained IAW NAVMED P-5132, the BUMED Equipment Management Manual. Frequency of maintenance is based upon equipment class.

E. **SPECIAL CONSIDERATIONS:**

1. Repair limited to circuit board and assembly level replacement rather than component level repair.

2. Due to possible extreme environmental and climatic conditions, may require more frequent than minimum maintenance requirements.

3. Maintenance and repair of Oxygen generation systems will require additional watchstanding and technical expertise.

4. Possibility of remote location and resulting excessive lead-time in procurement of parts/supplies will require more diligent attention to prompt submission of requisitions.

F. **ORGANIZATION:**

HEAD, MATERIAL MANAGEMENT DEPARTMENT

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MEDICAL REPAIR SUPERVISOR (LCPO)

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LPO (1Advanced Tech)

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TECHNICIAN STAFF (8 Advanced, 3 Basic)

1. **Staffing**: Thirteen (13) total technicians, 10 NEC 8478, 3 NEC 8479.

Standards and Job Descriptions

Bio-Medical Equipment Technician, Advanced:

Maintains, repairs and installs mechanical, electromechanical, medical and surgical diagnostic and treatment apparatus, patient monitoring and recording systems.

Supervises and conducts preventive maintenance programs

Manages repair parts inventories.

Advises medical equipment and survey boards.

Coordinates medical equipment safety programs with safety officers and renders technical advice and assistance as required.

Acts as medical maintenance supervisor or inspector.

Bio-Medical Equipment Technician, Basic:

Maintains and repairs mechanical and electromechanical medical equipment under the supervision of an advanced BMET.

Participates in the medical equipment preventive maintenance and safety programs.

2. **Special Watches**: Support of Field Oxygen Generator(s) will require manpower and technical skills not typically required of the Biomedical Department. See appendix (a) for installation and start-up procedures.

G. **TASKS:**

1. Establish and maintain an inventory of all medical/dental equipment items.

2. Establish and maintain a preventive maintenance schedule.

3. Perform initial operational and safety checks of all medical/dental equipment items.

4. Distribution of medical equipment to all Functional Areas IAW IOL requirements.

5. Documentation of all preventive and corrective maintenance on both 6700/3 (hardcopy) and within available automated database (ie. Biofacs, DMILS). Printouts of automated data may be used as hardcopy backup if system is immediately available.

6. Identification and tagging of defective items prior to retrograde of Fleet Hospital.

H. **DOCUMENTATION:**

1. References

(a) Fleet Hospital Operational Support Manual
(b) NWP 4-02.4 PART A FLEET HOSPITALS
(c) NAVMED P-5132; BUMED Equipment Management Manual
(d) M1A/B Field Oxygen Generator Specialty Course Manual

2. Forms

Form #	Form Title
NAVMED 6700/3	Medical/Dental Equipment Maintenance Record
NAVMED 6700/4	Maintenance Work Order

DD Form 2164 X-Ray Verification/Certification Worksheet

FIELD OXYGEN GENERATOR INSTALLATION

1. The unit vents nearly pure Nitrogen during Oxygen production. Adequate ventilation must be provided to ensure normal operation and operator safety. A closed space would hamper the units effectiveness to maintain oxygen percentage and would eventually suffocate the operator.

2. There are two automatic drainage systems which blow off water collected in the compressed air. There should be allowances made for the runoff.

3. Adequate space should be provided to ensure free movement of cylinders to and from the fill manifold area, and to provide the operator clear access to all aspects of the unit.

4. Heating of the operating spaces in normal temperatures is not necessary. The heat given off from the air compressor is approximately 30,000 btu's. If the unit is going to be operated in temperatures below 45 degrees Fahrenheit, a space heater would be recommended during periods of non-operation. Start-up in cold temperatures is delayed due to the oil sump heater. It may take quite a long time for the unit's sump heater to bring the oil to a safe operating temperature. A space heater would eliminate this warm-up period.

5. The location of the unit should not be in an area where it is exposed to exhaust from other machinery or in an area frequented by motor vehicles. The units require fresh air and cannot produce oxygen from carbon monoxide.

6. If building power vs. portable generator power is to be used, protection should be provided to all computer-based items on the building power. The momentary current draw at start-up is approximately 560 amps at 230 volts, this sudden voltage drop interferes with unprotected equipment, therefore large portable generators are recommended.

7. The units are generally loud and should not be installed near offices, treatment or berthing areas.

APPENDIX (a)

M1-B PRE-OPERATION INSPECTION

1. A physical examination should be conducted prior to every start-up to verify all assemblies are physically intact and checked for damage.

2. Refer to appropriate diagrams for location and identification of assemblies, sub-assemblies and components.

3. Ensure that ball valves #2, 7, 8, 9, 10, 11, and 12 are closed.

4. Inspect the refrigeration analysis gauge on the first stage dryer to ensure that the unit has adequate refrigerant. Refrigerant analysis gauge should display >100psi. In cold temperatures, the gauge may display less than 100psi. This is acceptable. Attempting to run the 1st stage without adequate refrigerant may seriously damage the compressor.

5. Check the condition of the air compressor drive belt and the oil level.

6. Ensure that all switches on the control panel are in the OFF position with the exception of the "Alarm By-Pass" switch, which should be in the ON position.

7. If the unit has been in storage or has been shut down for several months, it will be necessary to manually lubricate the rotors. It should be noted that this procedure is only required at initial start or after several months of inactivity.

   a. Remove the air filter hose from the air inlet control valve and pour approximately ½ pint of authorized compressor oil directly into the control valve. Petroleum based oil should never be introduced into this unit!!
   b. Manually turn the rotors several times by utilizing the drive belt. **Ensure power to the unit is off to avoid accidental compressor start.**
   c. Replace the intake hose.

8. Ensure correct power is hooked up to the unit. The unit requires three hots and a ground. Incorrect configuration can damage the unit.

M1-B START-UP PROCEDURES

1. Turn power disconnect to “ON”.

    a. Control Panel power light will illuminate.
    b. Digital display should appear on the Oxygen Analyzer and Carbon Monoxide Monitors.
    c. If ambient temperature is low, the “oil sump heater” light will illuminate. If this occurs, proceed with step #2 and wait for light to go out before proceeding with step #3.

2. Calibrate Oxygen Analyzer and Carbon Monoxide Monitors.

    a. Remove cover plates from CO Monitors to expose “zero & span set screws.
    b. Zero CO monitors.
    c. Locate three-way ball valves in the control panel. Attach carbon monoxide calibration gas to the appropriate valve for each CO monitor and set span, normally 95 ppm.
    d. Attach nitrogen calibration gas to oxygen 3-way valve and zero the Oxygen Monitor.
    e. Attach oxygen calibration gas to oxygen 3-way and set the Oxygen Monitor span, normally 100%.
    f. Disconnect all cal gas bottles and return the 3-way valves to their correct positions.
    g. Set the Oxygen Monitor “Alarm level”.

        1) Press the orange alarm set button and hold it down.

        2) Gently turn the Alarm set dial until desired alarm trigger level is set.

        3) Release the orange button. Alarm level is now set.

3. Start the First Stage Dryer.

    a. Depress the 1st stage dryer start switch and hold for approximately 6 seconds.
    b. 1st stage dryer fans and compressor should start.
    c. Refrigeration analysis gauge should drop to approximately 55-65psi
    d. Let 1st stage dryer operate for a couple of minutes.

4. Start the Air Compressor ****Rotation is critical****

    a. “Bump” the compressor before starting to determine rotation.

b. Using a flashlight, look into the air compressor motor air grill. Notice the motor shaft. When bumping the compressor switch, the motor should rotate in the “clockwise” direction. If the shaft rotates in the wrong direction, **STOP!** Turn off power disconnect and incoming power breaker. Enter power panel and interchange L1 and L2. Repeat steps #1 and #3. Check rotation again.

c. If rotation is correct, start the compressor. If the compressor fails to start and shuts down the first stage dryer, check the compressor overload relay. If the relay is not tripped, start the 1st stage dryer again, simultaneously holding down the 1st stage dryer switch and starting the compressor. Once compressor starts, release 1st stage dryer switch.

d. Air pressure gauges on the control panel and 1st stage dryer panel should begin to rise.

5. Blow down auto drains on the first stage dryer and air receiver.

   a. Place 1st stage dryer auto drain switch in the manual position on units equipped with the 3-way switch. On units with the momentary on switch, depress and let all water drain out. Once water has drained, allow switch to return to automatic position.

   b. Locate the air receiver black test button. Depress it for approximately 3-4 seconds. Drain will close automatically. If drain fails to close after 10 seconds, depress the test button again.

6. Open supply valve to the 2nd stage dryer.

   a. Slowly open ball valve #2.
   b. Inlet pressure gauge on 2nd stage dryer will rise.

7. Turn on 2nd stage Dryer.

   a. Air pressure at the control panel gauge should be $\geq$ 100 psi.

   b. Turn the 2nd stage dryer switch to “on”.
   c. Observe 2nd stage dryer panel lights.
   d. Only three lights should illuminate:

      1) Power on
      2) Left or Right chamber
      3) Amloc or Fixed (Amloc for normal operation, Fixed is also acceptable.)

8. Open air side supply valves.

    a. Open ball valves (3) and (4).

9. Energize the Oxygen Sieve Module.

    a. Turn O2 module switch to “Hand”.

    b. After a short pause, the Amber O2 module light will illuminate indicating that the module is functional.

10. Open Oxygen side ball valves.

    a. Open ball valves (5), (6), and (7).

    b. Feel for oxygen flow at ball valve (7). If no oxygen is detected, check the air pressure gauge located on the front or back of the O2 sieve module. If no air pressure is detected, check the CO monitors in the control panel. One or both of them is probably reading above 008 ppm. Locate the 3-way valve in the control panel for the corresponding monitor and bleed air through the valve until the CO level drops below 008 ppm. The Servox valves should open and allow air for feed the sieve. After a minute or two, check for oxygen flow at ball valve (7).

11. Bleed Oxygen Receiver Tank.

    a. Let unit run for approximately 10 minutes with ball valve (7) completely open. This allows for atmospheric air in the tank to bleed off.

    b. Close valve (7) to approximately ½ open. This will allow oxygen pressure to build.

    c. Check Oxygen Analyzer for percentage. If percentage appears to stagnate, open valve (7) again. All air may not be purged. This procedure may be required several times before all air is purged.

12. Close Oxygen Receiver Drain Ball Valve.

    a. When oxygen percentage approaches approximately 90%, close ball valve (7). If O2 percentage begins to drop, slightly open ball valve (7). Once percentage stabilizes, valve (7) can be closed.

13. Activate Alarm System.

    a. Once oxygen percentage stabilizes at or above 93%, the alarm system can be activated.

    b. Place “Alarm By-Pass” switch located on the control panel to the “off” position.

    c. Depress arm switch for approximately six seconds. Once released, you will hear a “chirp” from the audible alarm.

14. Test the Mobile Alert Alarm System.

    a. Turn on the Mobile Alert Pocket Pager. Depress the reset button on the pager to stop the beeping.

    b. Locate the Mobile Alert Module above the CO Monitors.

    c. The selector switch should be in the “Both” position.

    d. Depress the reset button on the Mobile Alert Module. This should activate a green light on the module. After a few seconds, the pocket pager should begin to beep. The green light will stay illuminated for approximately 20-25 seconds. Once the light goes out, reset the pocket pager.

    e. To test the entire alarm system, close ball valve (6). The O2 percentage should fall and the alarm system should activate sounding the audible horn and then after several seconds the pocket pager should beep.

    f. To reset the system, open ball valve (6). Depress the alarm arm switch down for six seconds and release. The horn should “chirp”. Press the reset button on the pocket pager.

15. Test the Fill Manifold for leaks.

    a. Open manifold door and ensure that all valves are closed.

    b. Open the Air Boost Pump control valve. Observe the manifold pressure gauge. The boost pump should run until approximately 2200 psi, it should then stop. Close the control valve. Observe the gauge. It should remain at 2200 psi. Observe the pressure gauge at the boost pump. If either gauge drops, there is a leak somewhere in the piping.

c. Repeat the procedure for the Oxygen Boost Pump.

16. Cylinder Fill (Air)

a. The unit will fill Air cylinders and Oxygen cylinders at the same time, but it is not recommended.

b. If a large amount of air cylinders are desired, they should be filled first. The unit will fill air cylinders much faster than O2 cylinders.

c. Place the alarm by-pass switch to the “ON” position and depress the arm switch for six seconds. This will disable the O2 alarm system.

d. Turn the Oxygen Sieve Module to “Off”. This will stop air flow to the sieve and will allow more air to fill cylinders.

e. Locate the air fill hoses. Ensure that the Teflon washers at each end of the hose are in place. Without the washers, the hoses will not fit properly and will leak.

f. Connect the hose to an air port on the manifold. Connect the other end to the air cylinder. Open the air port valve on the manifold. Open the valve on the cylinder.

g. Open the Air Boost Pump Control Valve and regulate the boost pump to approximately 60 strokes/minute. If the system air pressure is maintained above 75 psi, you may increase the strokes/minute. Keep an eye on the system pressure. If it falls to around 50 psi you will have to slow the speed down. When the O2 Sieve is off, it is not taking air and should allow faster air cylinder fill times.

h. Once the cylinder is full, close the boost pump control valve.

i. Close the cylinder valve. You should remember that there is still 2200 psi in the hose! If only five or less cylinders are being filled, you can open the sixth air port valve to bleed the hoses before they are removed. If not, exercise caution during hose removal.

j. Once air cylinder fill is accomplished, turn the O2 Sieve to “Hand”. Wait for oxygen percentage to stabilize again at or above 93%. Activate the alarm system. You should now be ready for O2 cylinder fill.

17. Cylinder Fill (Oxygen)

    a. Filling the O2 cylinders will not be as fast as the air cylinders because of the quantity of air used by the sieve.

    b. Procedures for filling the O2 Cylinders are the same, as the air except the speed should not exceed 60 strokes/minute. The approximate speed for your machine will be a judgment call since all machines behave differently.

    c. When filling small cylinders, you can fill them quite rapidly. Use Caution! Filling these small cylinders at a fast pace tends to make them extremely hot.

M1-B SHUTDOWN PROCEDURES

1. Place the alarm by-pass switch in the "ON" position. Depress the arm switch for approximately six seconds.
2. Turn the O2 Sieve Module switch to "Off".
3. Turn off the 2nd Stage Dryer.
4. Turn off the Air Compressor.
5. Turn off the 1st Stage Dryer.
6. Ensure that hearing protection is in place for further procedures.
7. Close ball valves (4) and (6).
8. Open ball valves #7, 8, 9, 10, 11, and 12.
9. Blow down Air Receiver Auto Drain as described in Start-up instructions.
10. Place 1st Stage Dryer Auto Drain in the "Manual" position. Drain all water and then return the switch to "auto".
11. Turn off power disconnect.
12. Once all air and oxygen is drained, close ball valves 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12.
13. Shutdown is now complete.

I. RESPONSE TO DEPLOYMENT HAZARDS

1. FIRE PROCEDURES

- **Initially, attempt to extinguish a fire with a portable fire extinguisher ONLY IF THE FIRE IS CONTAINED.**

- Simultaneously, the Functional Area (FA) needs to **IMMEDIATELY** contact ADMIN either by phone or runner/messenger. **ADMIN WILL SOUND THE ALARM FOR FIRE**.

- Smoke boundaries need to be set by the FA staff by dropping the TEMPER liner flaps leading to the FA and vestibules(s). All flaps throughout the hospital need to be dropped to control the possible flow of smoke.

- The FA Leader will decide to evacuate the space if the fire is determined to be out of control.

- All O2 cylinders (on a cart) positioned in each appropriate FA need to be removed when the space is evacuated.

- A FA staff member should be assigned in each area to secure the electrical (C-panel) and HVAC units.

- A muster of all staff and patients within the affected FA needs to be taken immediately and sent to ADMIN by runner.

- The FA Leader needs to wait at the FA access point for the Fire Marshall and Fire Team to arrive in order to report: type of fire, volatile items in the space (O2 cylinders, HAZMAT) and any casualties known to be in the space.

- When assessing the intensity of the fire, the Fire Marshall WILL DECIDE WHETHER OR NOT THE ADJACENT FUNCTIONAL AREA (S) WILL EVACUATE. Therefore, **the FA on either side of the area of fire will wait for the word from the Fire Marshall before evacuating.**

- Once the fire is out, there will be an inspection of the damaged area by the Fire Marshall, FA Leader and other key personnel.

- The Fire Marshall will give an assessment report to the Commanding Officer describing damages sustained by the FA. Depending on the outcome of the fire, the FA may need to relocate somewhere else until it is

fully functional again. The FA Leader needs to await orders from the Command Staff before reentering the FA and returning to duty.

2. CHEMICAL/ BIOLOGICAL ATTACK

- The hospital ADMIN department will notify the hospital compound, via 1MC, if there is a possibility of a biological/chemical attack.

- **All areas of the compound must respond appropriately**

- Once the alarm has been sounded for biological/chemical attack, **THE INITIAL ACTION TAKEN IS TO DON AND CLEAR YOUR GAS MASK**. Since the fleet hospital is operational, sleeves should always be down. The donning and clearing of the gas mask should be accomplished in a total of **8 seconds**.

- If a MOPP level is required, the ADMIN department will announce that accordingly and everyone will proceed to MOPP Level 4. This task must be accomplished within **8 minutes**.

- Once Personal MOPP gear is on, place gas masks on your patients.

- One person from each FA should be assigned to secure the HVAC unit (to prevent gas from entering FA). DO NOT DROP THE FLAPS IN THE HOSPITAL! The designated person should NOT reenter the hospital but should proceed to the EOD/Decontamination bunker.

- **A muster of all FA staff and patients needs to be taken immediately and sent to ADMIN.**

- **Drink water!! Hydration, hydration, hydration**.

- The **ALL CLEAR** will be announced by ADMIN over the 1MC.

3. AIR RAID PROCEDURES

- Once the alarm has been sounded for air attack, **THE INITIAL ACTION TAKEN IS TO EVACUATE ALL FA STAFF AND PATIENTS TO THE BUNKERS**. The entire compound must evacuate to appropriate bunkers including living spaces/GPL's and the COMMZ

- **Conduct an accurate muster of all staff personnel and patients immediately and submit it to the ADMIN bunker.**

- Be sure to bring all gear including canteens since mustering may require everyone to be standing outside for long periods of time.

- It's not necessary to secure C-panel or HVAC during an air raid drill. **Evacuate to bunkers ASAP.**

- When announced over the 1MC, each FA must send in two junior personnel to search and sweep high, medium and low on both sides of the FA to check for bombs. All other personnel will stay outside in bunkers until area is cleared. **The All Clear will be announced over the 1MC.**

- **MISCELLANEOUS ITEMS**

- Each FA should denote a supply petty officer that is responsible for equipment inventory/high-tech gear checkout. If supplies are needed, submit a request to the student SK's/supply department for issue. The student SK's will request supplies from FHOTC supply if NIS.

- If trouble arises with HVAC or C-panel (electrical power), submit a work request to the student Public Works department. Both the HVAC and C-panel operations remain off-limits to students other than Seabees.

- Rear doors to FA are to be used only as evacuation routes or for patient flow during peak flow ONLY. There are only two ways to enter the hospital…either on foot by the ADMIN temper or through CAS REC via litter.

- Each FA needs to have a logbook or similar system in order to keep track of all staff and patients within the compound. Each time a staff member or patient leaves the FA, he/she must be logged out (time, location) and then logged back in when he/she returns. This will assist with accuracy when conducting musters.