

WP 12-ES1124

Revision 3

Operation of Breathing-Air Compressor, 45-G-621

Technical Procedure

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APPROVED FOR USE

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INTRODUCTION

This procedure provides information for step-by-step operation of the Mako High-Pressure Compressor and Purification System.

REFERENCES

BASELINE DOCUMENTS

- Mako Operations Manual
- National Fire Protection Association (NFPA) Standard 1989, Breathing Air Quality for Emergency Services Respiratory Protection
- NFPA 1404 Standard for Fire Service Respiratory Protection Training

PRECAUTIONS AND LIMITATIONS

- Only personnel currently qualified on Qualification Cards EST-01 or FPT-01 may operate this system without supervision.
- Compressors shall not be operated with any service indicator lamps on.
- Emergency Stop is primary emergency shutoff. Only Facility Operations will manipulate circuit breakers.
- The JOB HAZARDS CHECKLIST indicates types of hazards that may be present during the performance of this work. See the indicated section for precautions and mitigating actions.

JOB HAZARDS CHECKLIST

HAZARD	MITIGATED AT SECTION
PINCH POINT HAZARD	1.0, 2.0, 3.0
● DO NOT attempt to tighten a leaking fitting while under pressure.	
● Auto drain reservoir must be frequently drained.	
● Normal operating parameters are:	
- Air Pressure 1 st Stage	45 - 55 psig
- Air Pressure 2 nd Stage	230 - 300 psig
- Air Pressure 3 rd Stage	1050 - 1400 psig
- Air Pressure 4 th Stage	~2200 - 5100 psig
- Oil Pressure	40 - 85 psig

- The order of completion of this work may be modified, or sections may be performed in parallel as long as no precautionary actions associated with warning statements are bypassed.
- Compressor will start automatically when system pressure is decreased to less than 4650 psig.
- Troubleshooting, or other activities outside the scope of this procedure, may require the initiation of a work order as directed by the responsible engineer or Facility Shift Manager (FSM).

PREOPERATIONAL CHECKLIST

Perform the following preoperational checks on 45-G-621 Mako Breathing Air Compressor and/or Air Fill Station prior to use. Submit an Action Request for any discrepancies found.

Mako Compressor

- 1.0 Gas pressure hazards are mitigated by the following:
 - 1.1 Visually check Mako Compressor housing for loose or missing components.
 - 1.2 Check oil level (nominal level is between both black lines on sight glass).

NOTE

Any oil or air leaks must be rectified immediately before proceeding.

- 1.3 Check compressor for oil and air leaks after start-up.
- 1.4 Check compressor components for missing or broken parts.

WARNING

Pinch points exist. To prevent injury, fingers must be kept clear of latch mechanism and compartment door.

- 1.5 Check front access panel for proper latch operations.

Air Fill Station

NOTE

4th Stage: There will be no air release when 4th stage pressure is at \approx 2200 to 2400 psi, except through the bleed valve.

- 1.0 Verify that all gauges, except 4th stage, show that system has been bled off.
- 2.0 Ensure that all valves are closed.
- 3.0 Open and close front access door, and ensure proper latching of door.
- 4.0 Verify that Air Fill Station hoses, valves, and components are not damaged or missing.

PERFORMANCE

NOTE

The terms "cylinder" and "bottle" will refer to the same item(s).

- 1.0 CASCADE SYSTEM OPERATION (Filling cascade bottles)
 - 1.1 Ensure that all preoperational checks have been performed.
 - 1.2 Ensure that all panel valves are closed on Air Station.
 - 1.3 Press power button to start compressor.
 - 1.3.1 **IF** compressor does not start,
THEN press ▲ (up arrow) button on control panel.

CAUTION

To prevent an automatic compressor start signal from occurring when system pressure is less than, or drops below, ≈ 4650 psi, compressor must be turned **OFF**.

NOTE

Compressor operation will shut down when maximum set pressure of ≈ 5100 psi is reached.

- 1.4 To fill cascade system perform the following:
 - 1.4.1 Open all valves on storage bottles of cascade system (pressure on bottles will equalize).
 - 1.4.2 Verify 4th stage gauge pressure is equal to or greater than the cascade gauge pressure.
 - 1.4.3 Open "To Bank #1" Valve.
- 1.5 If system pressure above ≈ 4650 psi prevents a compressor start, **close** "To Bank #1" Valve, then drain excess pressure on Air Station by opening "Bypass" Valve and Fill Valve, in succession, until compressor starts.
 - 1.5.1 When compressor starts, immediately open "To Bank #1" Valve.
- 1.6 When compressor starts, close all valves listed in Step 1.5.
- 1.7 When completed, press compressor Power/Starter switch button to turn OFF compressor.
- 1.8 Close "To Bank #1" Valve when completed.
- 1.9 Close cascade cylinder valves.
- 1.10 Open Air Station door to cylinder rack area.
- 1.11 Open bleed valves on all fill hoses in cylinder rack.

WARNING

Pinch points exist. To prevent injury, fingers must be kept clear of latch mechanism and compartment door.

- 1.12 Close compartment door completely.

1.13 **IF** no further cascade filling operations are to be performed,
THEN GO TO Step 3.26.

2.0 SELF-CONTAINED BREATHING APPARATUS CYLINDER FILLING (Cascade Technique)

2.1 Ensure that all preoperational checks have been performed.

2.2 Ensure that all Air Station valves are closed.

2.3 Open Air Station door.

2.4 Pull out cylinder rack drawer.

2.5 Verify that all self-contained breathing apparatus (SCBA) cylinder-rated pressure capacities are the same.

2.6 Load SCBA cylinder(s) to be filled into drawer.

2.7 Connect fill hoses to SCBA cylinder(s) and hand tighten.

2.8 Ensure the following:

- Fill hose bleed valves are closed.
- Hose fill valves connected to SCBA cylinder(s) are open.
- All cylinders are properly seated in rack.

2.9 Open SCBA cylinder valves completely.

2.9.1 If any leaks are noticed, bleed pressure off of valves and tighten connections, or remove/replace cylinder before proceeding.

2.10 Push drawer rack in completely.

WARNING

Pinch points exist. To prevent injury, fingers must be kept clear of latch mechanism and compartment door.

2.11 Close compartment door completely.

2.12 Open and close each (one at a time) cascade storage bottle to compare pressures.

- 2.13 Open valve to cascade storage cylinder having the lowest pressure with pressure greater than the SCBA cylinder pressure.

NOTE

Banks #2 and #3 are **NOT** in operation and are **NOT** to be used.

- 2.14 Open "From Bank #1" valve on Air Station.
- 2.15 Regulate outlet pressure by turning the large regulator outlet valve clockwise to raise pressure, or counterclockwise to lower pressure.
- 4500 psi cylinders - 4050-4500 psi (4500 psi is optimal)

NOTE

The inlet pressure gauge will immediately read the same pressure as the "Bank #1" gauge, which reflects the pressure of the cascade cylinder in use (opened valve).

- 2.16 Open Fill Valve on Air Station panel until pressure is slowly transferred at a rate of approximately 100 psi every five to ten seconds.
- 2.17 When the cylinder being refilled is at the desired pressure or equalized, close Air Station panel Fill Valve.
- 2.18 Ensure all cascade cylinders are closed.
- 2.19 **IF** additional refilling is necessary, open valve to cascade cylinder having the next higher pressure **AND** **RETURN TO** Steps 2.13 through 2.18.
- 2.20 Open cylinder compartment door and pull out cylinder rack.
- 2.21 Close all SCBA cylinder valve(s).
- 2.22 Open fill hose bleed valve(s).
- 2.23 Disconnect fill hose connection from cylinder(s) and remove cylinder(s) from Air Station rack.
- 2.24 To refill additional cylinder(s), **GO TO** Step 2.5.
- 2.25 **IF** no further filling operations are to be performed, **THEN GO TO** Step 3.26.

3.0 DIRECT COMPRESSOR OPERATIONS

NOTE

Cylinder(s) are filled directly from the compressor.

- 3.1 Ensure that all preoperational checks have been performed.
- 3.2 Ensure that all Air Station valves are closed.
- 3.3 Open door to Air Station cylinder rack compartment.
- 3.4 Pull out cylinder rack drawer.
- 3.5 Verify that all SCBA cylinder-rated pressure capacities are the same.
- 3.6 Place SCBA cylinder(s) in rack.
- 3.7 Ensure fill hose connection(s) to cylinder(s) are hand tight.
- 3.8 Ensure the following:
 - Bleed valves are closed.
 - Hose valves attached to cylinders are opened.
- 3.9 Open SCBA cylinder(s) valves.
- 3.10 Push drawer rack in.

WARNING

Pinch points exist. To prevent injury, fingers must be kept clear of latch mechanism and compartment door.

- 3.11 Close compartment door completely.
- 3.12 Press power button to turn on compressor.
- 3.13 **IF** compressor does not start,
THEN press ▲ (up arrow) button on control panel.
- 3.14 Verify that compressor psi gauge reading is greater than Fill Valve gauge reading to prevent backflow to compressor.
- 3.15 Open Bypass Valve on Air Station panel.

- 3.16 Adjust regulator valve on Fill Station to proper pressure capacity of SCBA cylinder(s) being filled, as necessary.

NOTE

Compressor will automatically shut off when set pressure of \approx 5100 psi is reached on compressor.

- 3.17 Open Air Station panel Fill Valve.
- 3.18 Close Air Station panel Fill Valve, when compressor stops operating.
- 3.19 Open door to Air Station cylinder rack compartment.
- 3.20 Pull out cylinder rack drawer.
- 3.21 Close valve for all cylinders.
- 3.22 Bleed remaining pressure in Air Station by means of bleed valve.
- 3.23 Close valve on fill hose and remove from SCBA cylinder(s).
- 3.24 Remove cylinder(s) from rack.
- 3.25 **IF** filling more than one set of SCBA cylinders,
THEN repeat Steps 3.5 through 3.24.
- 3.26 Press compressor power/Starter switch button to turn compressor **OFF**.
- 3.27 Open valve on fill hose.
- 3.28 Push drawer rack in.

WARNING

Pinch points exist. To prevent injury, fingers must be kept clear of latch mechanism and compartment door.

- 3.29 Close compartment door completely.
- 3.30 Open Fill Valve on Air Station panel to slowly drain excess pressure on Air Station System.
- 3.31 Open Bypass Valve **AND** "From Bank #1" Valve.
- 3.32 If needed, open bleed valve behind compressor door to complete draining of excess pressure.

NOTE

Compressor fourth stage does not have to be bled off completely.

- 3.33 Verify that all gauges on Fill Station show that systems are bled off completely.
- 3.34 First, second, and third stage gauges will show all pressure is bled off and stage four gauge will bleed down to \approx 2200 to 2400 psi.
- 3.35 Ensure that all Air Station panel valves, hose fill valves, hose bleed valves and compressor bleed valves are in **CLOSED** position.
- 3.36 Close Air Station compartment door while keeping fingers clear of latch.

Attachment 1 - Basic Air Station Controls

