



# PAPR Flow Tester

part no.  
488903

## instructions

### **⚠ WARNING**

This manual, including warnings and cautions inside, must be carefully read and followed by all persons who use or maintain the product, including those who have any responsibility involving its selection, application, service, or repair. This flow tester will perform as designed only if used and serviced according to the instructions. Otherwise, it could fail to perform as designed, and persons who rely on this product could sustain serious personal injury or death.

The warranties made by MSA with respect to the product are voided if the product is not installed, used, and serviced in accordance with the instructions in this manual. We encourage our customers to write or call for a demonstration of this equipment prior to use, or for any additional information relative to use or repairs. Call 1-800-MSA-2222 during regular working hours.

For More Information, call 1-800-MSA-2222 or Visit Our Website at [www.MSAnet.com](http://www.MSAnet.com)



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# Description and Installation

## DESCRIPTION

The PAPR Flow Tester measures the volumetric flow rate produced by a PAPR and indicates whether the respirator meets the minimum flow rates required by NIOSH:

- 4 cfm (115 lpm) for a tight-fitting facepiece
- 6 cfm (170 lpm) for a hood

The flow tester is a thin-plate orifice meter which uses a Magnahelic pressure gauge. The gauge reads "good" when the indicating needle is to the right of an adjustable signal flag. Because the gauge operates on barometric pressure, the signal flag must be calibrated to the approximate local altitude. A variation of 1" of Mercury (Hg) represents a change of approximately 1000 ft. in altitude. Such a change in barometric pressure will cause the meter to indicate a flow rate of change of 2 lpm.

The flow tester is housed in a painted steel case with a laminated glass cover.

## INSTALLATION

The flow tester must be mounted vertically, then calibrated. Mount the flow tester on a vertical surface. Use the holes in the mounting flanges at the top and bottom of the case to secure the unit.

### To calibrate the signal flag to the local altitude:

1. Remove the glass cover by unthreading and removing the two screws and the support bar at the base of the window (Figure 1). Slide the window out of the frame.



Figure 1

2. Set the signal flag:
  - a. Determine the local altitude. This may be found by using Figure 2, Barometric Pressure vs. Elevation, or from one of the following sources:
    - a local office of the National Weather Service
    - a topographical map
    - a local radio or television station
    - a local airport field elevation

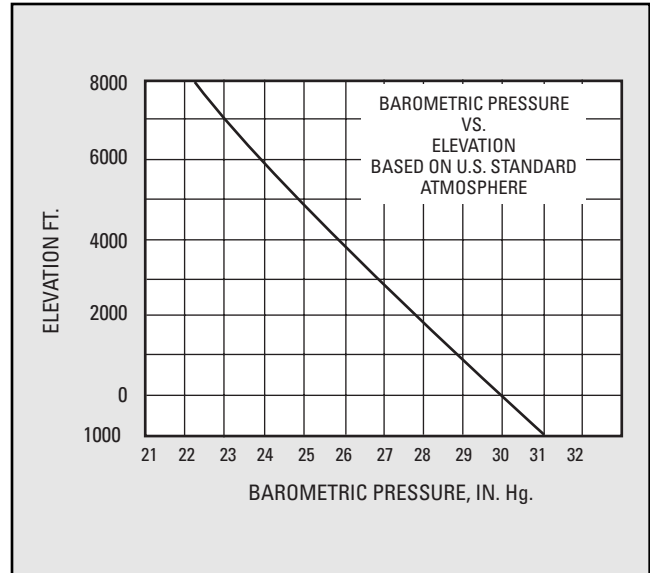


Figure 2

- b. Loosen the signal flag setscrew using a small flat-blade screwdriver (Figure 3).

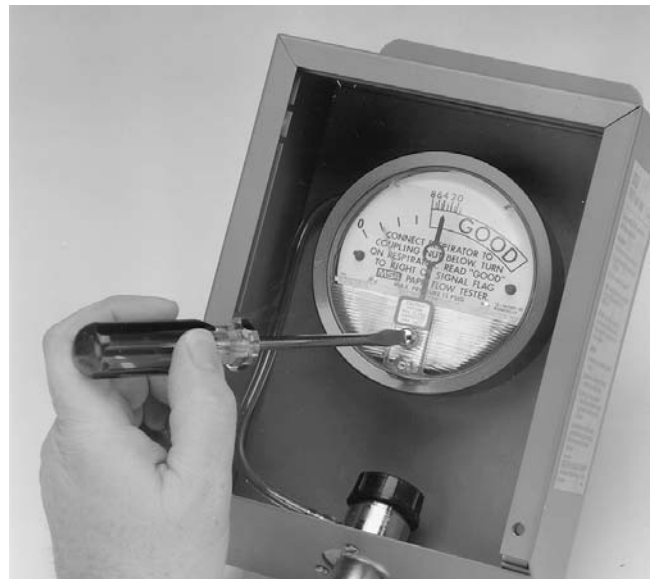


Figure 3

# Installation and Operation

- c. Turn the ring outside the setscrew until the signal flag points to the local altitude (Figure 4). Retighten the setscrew.



Figure 4

**Note:** The altitude scale appears above “GOOD” on the meter, and shows altitude in thousands of feet (eg., 2 stands for 2000 ft.). The line to the right of “0” stands for – 1000 ft.

3. To zero the gauge:
  - a. Locate the zero-adjust screw at the bottom of the gauge cover.
  - b. Using a small flatblade screwdriver, turn the set screw to position the flow rate indicator exactly on the zero mark (Figure 5).

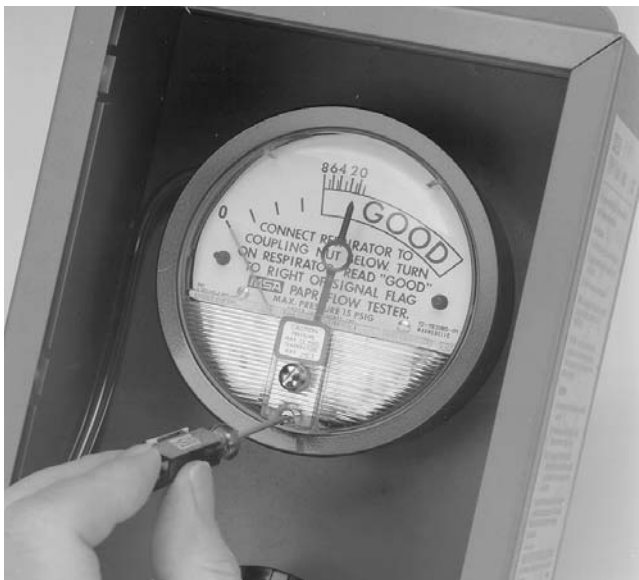


Figure 5

## ⚠ CAUTION

Turn the zero-adjusting screw to “zero” only. Do not force the screw in either direction. It will break.

4. Reassemble the glass cover and support bar and secure with the two screws.

## OPERATION

### To test the OptimAir® 6 & 6A PAPR with Hood:

1. Thread an OptimAir 6 or 6A adapter on the tester coupling nut if not installed. Unthread the hood coupling nut and remove the hood tube from the hood.
2. Connect the hood tube to the flow tester adapter coupling nut (Figure 6). Make sure that the tube remains straight and does not move. Any bends or movement of the tube will affect the accuracy of flow meter readings.



Figure 6

3. Turn the PAPR power switch ON and read the meter.
  - a. If the flow rate indicator is to the **right** of the signal flag, the respirator has adequate flow (greater than or equal to 6 cfm).
  - b. If the flow rate indicator points to the **left** of the signal flag, the respirator does not have adequate flow. Install new filters or a charged battery pack.

## ⚠ CAUTION

The gauge must read zero before the PAPR is turned on, as well as after the reading is taken. If the flow rate indicator does not read zero when the PAPR is turned off, the flow tester requires service and must be returned to the factory.

Do not use the flow tester to measure the flow in other respiratory protective devices.

### To test the OptimAir 6 & 6A PAPR equipped with a tight-fitting facepiece:

1. Unthread the facepiece coupling nut and remove the hood tube.
2. Remove the adapter coupling nut from the flow tester.

# Operation and Maintenance

3. Replace the 6 cfm orifice plate with a 4 cfm orifice plate:
  - a. Remove the glass cover (see page 2).
  - b. Remove the retaining cap from the top of the flow tube (Figure 7).



Figure 7

- c. Remove the 6 cfm orifice plate.
  - d. Re-install the gasket and the 4 cfm orifice plate included with the flow-tester (Figure 8).



Figure 8

- e. Re-install the retaining cap on the top of the flow tube.
  - f. Re-install the glass cover.
4. Connect the breathing tube to the coupling nut on the flow tester (Figure 9). Make sure that the breathing tube remains straight and does not move. Any bends or movement of the tube will affect the accuracy of flow meter readings.



Figure 9

5. Turn the PAPER switch ON and read the meter.
  - a. If the flow rate indicator is to the **right** of the signal flag, the respirator has adequate flow (greater than or equal to 4 cfm).
  - b. If the flow rate indicator points to the **left** of the signal flag, the respirator does not have adequate flow. Install new filters or a charged battery pack.

## To Test the OptimAir MM PAPER

1. Attach Mask Mounted Adapter P/N 491046 to the flow tester adapter tube (Figure 10).

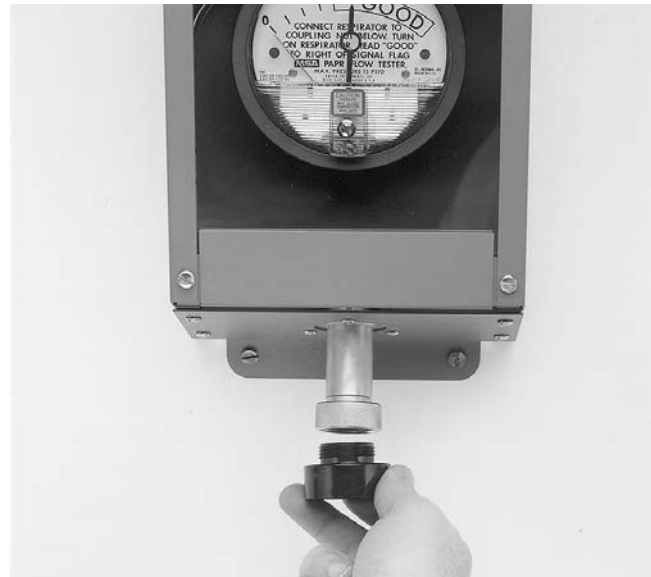


Figure 10

2. Remove the mask mounted motor blower module from the mask.

# Operation and Maintenance

3. Thread the motor blower module into the mask mounted adapter (Figure 11).



Figure 11

4. Turn the PAPR power switch on and read the meter.
  - a. If the flow indicator is to the right of the signal flag, the respirator has adequate flow (greater than or equal to 4 cfm).
  - b. If the flow indicator points to the left of the signal flag, the respirator does not have adequate flow. Install new filters or change battery pack.

## CAUTION

The gauge must read zero before the PAPR is turned on, as well as after the reading is taken. If the flow rate indicator does not read zero when the PAPR is turned off, the flow tester requires service and must be returned to the factory.

## MAINTENANCE

The orifice meter is an accurate, reliable, and relatively simple measuring device. To ensure that the instrument maintains its accuracy and reliability, inspect it periodically for any damage or defects. Clean the orifice, orifice plate, flow tube, and gasket regularly. The flow tester should be disassembled, cleaned, and calibrated at least once a year to be sure it is performing within acceptable limits. If heavy use or dirty conditions exist, cleaning will be required more frequently.

### Cleaning the Orifice Plate:

Be careful that you do not scratch, bend or otherwise damage the orifice plate. If damaged, the flow tester will not provide accurate flow readings. To clean the orifice plate:

1. Remove the support bar and glass cover (Figure 1).
2. Unscrew the retaining cap and remove the orifice plate and gasket (see figures 7 and 8).
3. Lay the orifice plate on a clean, flat surface that will prevent the plate from bending.
4. Remove dirt by gently burnishing the orifice plate.

## CAUTION

Do not pry, scrape, or mechanically abuse the orifice in any way. Do not use abrasives or scrape the orifice to clean it.

5. Clean the flow tube using a swab saturated with soap and water.
6. After cleaning the orifice plate, inspect it to see if all the dirt has been removed from the edge of the orifice (the hole through the center). Also look for burrs or nicks. These will affect the flow tester's accuracy.
7. When reassembling, note that the gasket is assembled to the end of the flow tube first, followed by the orifice plate and then the retaining nut.

## CALIBRATION TEST PROCEDURES

To maintain the accuracy of the Magnahelic gauge and the orifice plate, periodic calibration checks are recommended to ensure that these parts are maintained within acceptable limits.

### Equipment Required:

- a comparison gauge, such as an inclined manometer with a range of 0.10" to 1.0" H<sub>2</sub>O and minor scale divisions of 0.01" H<sub>2</sub>O (Dwyer Model 100.5 or equivalent is suggested)
- a PAPR with a fully-charged battery pack
- a tubing "Tee" connector and 1/8" ID vinyl (or rubber) tubing
- a hose clamp for 3/4" OD tubing
- a calibrated orifice (P/N 465989)

### Magnahelic Gauge Calibration:

1. Remove the glass cover from the flow tester case (Figure 1).
2. Connect the Magnahelic gauge and the test gauge together with two leads from the "Tee." Connect the tubing from the third leg of the "Tee" to the nipple on the flow tube assembly.
3. Make sure that the Magnahelic gauge is zeroed (see Installation, page 3).
4. Attach the PAPR breathing tube (or hood tube) to the motor-blower assembly.
5. Insert the PAPR breathing tube (or hood tube) into the hose clamp.
6. Thread the breathing tube (or hood tube) into the flow tester and hand-tighten the coupling nut.
7. Place the PAPR power switch ON.
8. Using the hose clamp, adjust the flow rate until the Magnahelic gauge flag is exactly on the number "4" of the altitude scale.

**Note:** Ensure there are no leaks in the system. Provide adequate time for the comparison gauge to equalize, since fluid drainage and dynamic characteristics can affect the reading.

9. The comparison gauge should read 0.44" H<sub>2</sub>O ( $\pm 0.05$ "). If the Magnahelic gauge does not fall within this range, return it to MSA for recalibration.

# Maintenance and Calibration Tests

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## Orifice Plate Calibration:

This is a simple field test to check orifice calibration.

1. Prepare the calibrated orifice:
  - a. Unscrew the retainer nut.
  - b. Remove the orifice plate.
  - c. Reassemble the calibrated orifice.
2. Turn the PAPR power switch ON and adjust the flow rate with the hose clamp so that the inclined manometer reads 0.50" H<sub>2</sub>O.

**Note:** Ensure there are no leaks in the system and allow time for the comparison gauge to equalize.

3. While the PAPR is running, remove the calibrated orifice by unscrewing the retainer nut.
4. Assemble the working orifice and watch the inclined manometer. It should read as follows:

4 cfm orifice	0.50" H <sub>2</sub> O (±0.01")
6 cfm orifice	0.60" H <sub>2</sub> O (±0.02")
5. If the inclined manometer does not agree with the values above, inspect and if necessary, clean the flow tube and orifice plate.
6. Re-test by performing steps 3 through 5.
7. If after cleaning, the working orifice plate does not produce a correct pressure drop, replace the working orifice.

A more precise method of checking the accuracy of the flow tester can be made using any purchased flow meter. The inclined manometer should have an accuracy of 1 percent or better and a pressure drop no greater than 1" H<sub>2</sub>O at 4 cfm.

## To check the accuracy of the flow meter using this method:

1. Connect an inclined manometer to the flow tester pressure gauge (see Magnahelic Gauge Calibration).
2. Connect the comparison flow meter between the PAPR and the flow tester.
3. If the local altitude is not known, use the local barometric pressure and find the corresponding U.S. Standard Altitude in Figure 2.
4. Place the PAPR power switch to ON and adjust the flow rate until the inclined manometer reads the correct pressure as determined in step 3.

**Note:** Ensure there are no leaks, and allow time for the test gauge to equalize.

5. Measuring the flow rate:
  - a. With the 4 cfm test orifice in place, check that the flow rate is between 112-120 lpm (3.95-4.24 cfm).
  - b. With the 6 cfm test orifice in place, check that the flow rate is between 140-150 lpm (4.94-5.29 cfm).

**Note:** The 6 cfm test orifice has been sized to compensate for decreased backpressure in the OptimAir 6 & 6A hood and breathing tube. This modification also permits the existing magnahelic gauge to be used. The flow rates listed above are extrapolated values which correspond to actual operational rates of 170 lpm (6 cfm).

6. If the flow tester is not within the appropriate range, inspect the instrument for damage, or clean the flow tube and orifice plate. Re-test following cleaning.
7. If the flow rate still does not fall within the appropriate range after cleaning, replace the orifice.

**Note:** Gaskets must be in place to obtain accurate flow readings.

## Part numbers for replacement orifices:

- 4 cfm: P/N 465989
- 6 cfm: P/N 10009720