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# **OCCUPATIONAL HEALTH DYNAMICS**

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*Operating Manual*

FitTester 3000

*Respirator Leak Rate Analyzer*

**FitTester 3000**  
**Quantitative Respirator FitTester**  
**Operating Manual**

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**OCCUPATIONAL HEALTH DYNAMICS**

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## Chapter

## 1

## General Information

*In this chapter you will learn how to use this manual, where to get help, and about the **FitTester 3000** features and specifications.*

### SAFETY CONSIDERATIONS

#### GENERAL

The instrument and related documentation must be reviewed for familiarization with safety markings and instructions before you operate the instrument.

#### WARNING

The WARNING! Sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING! Sign until the indicated conditions are fully understood and met.

#### CAUTION

The CAUTION Sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

#### MANUAL ADDENDA

Information concerning improvements or changes to the instrument that occur after the printing of this manual will be on an addendum sheet included with the manual. Be sure to review these changes before attempting to operate or service the instrument.

#### SAFETY INFORMATION

WARNING: There are internal fuses that are to be replaced by trained service personnel only.

### *The FitTester 3000 functions by...*

Creating and maintaining a negative pressure in the respirator mask. This process may last up to 8 seconds. Once the adapter valve is closed by squeezing and holding the attached bulb, sealing the respirator mask, the start key is pressed, allowing the *FitTester 3000* to remove air from the respirator mask until the challenge pressure is reached.

At this point, if there isn't a leak, the *FitTester 3000* doesn't remove any more air from the respirator mask. If there is a leak, air enters the respirator mask, and the pressure rises. The *FitTester 3000* then removes air from the respirator mask until the challenge pressure returns. This process continues for up to 8 seconds, and then the test ends. The individual under test releases his grip on the bulb and breathes normally.

During the fit test, the *FitTester 3000* measures exactly how much air it removed from the respirator mask after reaching the challenge pressure. This measurement is used by the *FitTester 3000* to calculate the leak rate.

The *FitTester 3000* has two types of protocols: Standard protocols with fixed challenge pressures and modeled breathing rates; and Custom protocols with challenge pressures and modeled breathing rates determined by user defined parameters, including work rate, mask cartridge type, mask size, and subject gender.

Challenge pressure, expressed in hundredths of inches of H<sub>2</sub>O, is the maximum partial vacuum created in a correctly fitting mask when the user is working at a typical rate. The modeled breathing rate is the calculated total inspiration for 1 minute.

The modeled breathing rate (in liters per minute [LPM]) is multiplied by 1000 to provide cubic centimeter and then divided by the leak rate (in cubic centimeters per minute [cc/min]) is the fit factor ratio. This is a ratio of the total air inhaled to the contaminated air inhaled.

## FitTester 3000 FEATURES

If you don't have a quantitative fit-testing program, the *FitTester 3000* helps you start one. Or, if you do have a quantitative fit-testing program, the *FitTester 3000* integrates easily into your present program.

*These features make the FitTester 3000 simple to use:*

- Doesn't require a computer.
- Eliminates the cumbersome booth, generator, and photometry equipment required for aerosol testing.
- Doesn't require an invasive probe.
- Doesn't use messy challenge agents or alcohol.
- Reduces test time compared to other quantitative fit-test systems. This will be especially true with the introduction of the *5-step protocol*.
- **Directly** measures leakage flow - the primary measure of respirator fit.
- Tests workers in the actual respirator masks they wear in the workplace.
- Displays individual test measurement results including Fit Factor, Leak Rate, Test Time, Test-Q (Test Quality), Challenge Pressure, Modeled Breathing Rate, and Minimum Passing Fit Factor.
- Displays and prints overall fit-test protocol results including Average Percent Leak, Equivalent Fit Factor, Test Date, Test Time, Test Parameter Values, and a step-by-step summary of the protocol.
- Meets OSHA fit-testing protocol requirements.
- Offers two custom protocols that can be created and stored in nonvolatile memory.
- Displays menu-selectable commands.
- Provides a comprehensive "Help" program that is available at the touch of a button.
- Outputs test results to the display (LCD display), an external printer, or a database.
- Minimizes cross-contamination (air extracted from the mask exits through the "EXHAUST" port, located on the back of the instrument).



## Installation

*In this chapter you will find information about keyboard controls and connections for the FitTester 3000.*

### FRONT PANEL CONTROLS

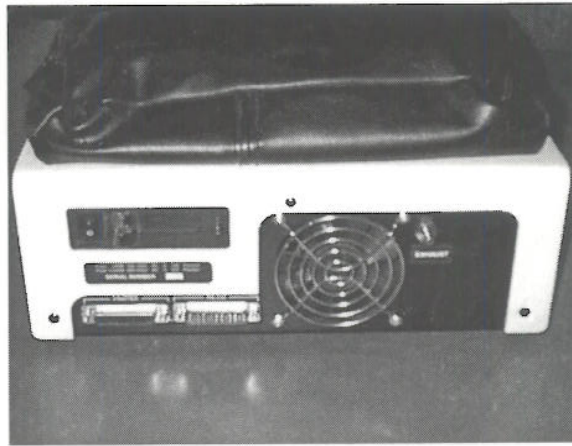


Front View of *FitTester 3000*

### Keyboard

KEY	DESCRIPTION
<Esc>	<b>Escape:</b> Exits a menu routine and returns to the previous screen,
<F1>, <F2>, <F3>, <F4>, and <F5>	<b>Function keys:</b> Executes function displayed above key when pressed.
<Ent>	<b>Enter:</b> Starts a menu routine or function.
<↑>, <↓>, <←>, and <→>	<b>Arrow keys:</b> Moves highlight bar through selections.

## FitTester 3000 CONNECTIONS



Rear view of *FitTester 3000*

### CONNECTING THE PRINTER

You can connect any Centronics or IBM PC compatible parallel printer\* to the *FitTester 3000*. OHD recommends that you use a standard IBM PC compatible parallel printer cable.

- ☐ Connect this cable to the PRINTER port, a 25-pin (DB25) female connector, on the rear panel of the *FitTester 3000*.

\* Compatible with Epson (standard) or PCL5 language

### CONNECTING TO COMPUTER (RS-232 Serial Port Setup)

The *FitTester 3000* has a remote control mode. The FitTrack software operates the *FitTester 3000* via the RS-232 serial port. (OHD recommends that you use the appropriate cable.)

- ☐ Connect the RS-232 cable (Part # 3010-0441) with the *FitTester 3000* and the computer.

#### NOTE:

If the computer's COMM port is other than a 9-pin connector, an adapter will be required to convert the 9-pin computer cable connection. **This adapter must NOT be a Null Adapter!** If an alternate cable (DB25 to DB25) is desired, please contact Customer Service.



## Operating Instructions

*In this chapter you will find information about menu options and preparing the **FitTester 3000** for testing.*

### Preparing the FitTester 3000 for testing

#### 1. LOCATION

- Use a room that permits spoken communication between the operator of the **FitTester 3000** and the test subject.
- Place the **FitTester 3000** on a table large enough to also accommodate a printer and accessories, while allowing room for two seated persons.

#### 2. PRINTER CONNECTION

- Turn the power off to both the printer and the **FitTester 3000**.
- Connect the printer to the **FitTester 3000** with a standard parallel printer cable. Plug this cable into the PRINTER port on the rear panel of the **FitTester 3000**.

#### NOTE:

Refer to Connecting the Printer for printer compatibility and connector specifications.

- Turn on the power to the **FitTester 3000**.
- Verify that the Printer is “available.” (Follow the Printer Verification Routine in the UTILITY MENU section of this chapter.)

## MECHANICAL INTERFACES

The test adapters provide mechanical connections between respirator masks and the squeeze-bulb assembly and/or the dual tube assembly. Three types of test adapters are used:

- ◆ Type “A” provides a mechanical connection to the squeeze-bulb assembly.
- ◆ Type “B” provides a mechanical connection to the dual tube assembly.
- ◆ Type “AB” provides a mechanical connection to the squeeze-bulb assembly and the dual tube assembly.

### NOTE:

For respirator masks with a single filter cartridge, use the type “AB” test adapter.

For masks with two filter cartridges, use one each of the type “A” test adapter and the type “B” test adapter.

A test subject holds his breath and closes the valve by squeezing the bulb. When the test finishes (in 8 seconds or less), the test subject releases the squeeze bulb, placing the valve in its normally open position, which creates a breathing path.

### Test-Adapter-Valve Operation

1. Connect the squeeze bulb assembly to the port on the test adapter.
2. Close the valve by squeezing the bulb. Do not apply excessive force. A firm squeeze is sufficient.

### NOTE:

Ensure that a constant force is maintained on the squeeze bulb assembly when the valve is closed. Have the test subject operate the squeeze bulb assembly during the fit test.

3. Open the valve by releasing grip on the bulb; this enables the air to flow.

## QUANTITATIVE FIT-TEST OVERVIEW

### Procedure

The *FitTester 3000* does not require an invasive probe in the respirator mask. In most cases, the test subject can be tested using the actual respirator mask that is worn in the workplace.

The respirator mask inlets are capped with one or two of the test adapters described in the previous section, and inhalation valves are removed or propped open. The test subject dons the respirator mask to perform the fit test. When the mask is properly positioned, the test subject takes a breath, holds the breath, and squeezes the bulb to close the adapter valve. The operator presses the start key to begin the fit test and that starts the piston moving within the cylinder inside the *FitTester 3000*. The piston movement within the cylinder removes air from the facepiece until a predetermined challenge pressure is reached (see *Challenge Pressure in Test Menu Chapter*). The fit test is completed in 8 seconds or less.

The *FitTester 3000* controls the piston movement to maintain the challenge pressure inside the facepiece. The piston speed required to maintain a constant pressure is directly related to the airflow. Since leakage is directly related to the fit of the respirator mask, the lower the leakage, the better the fit. The leak rate is reported in cubic centimeters per minute.

### Protocol

A *protocol* is a series of quantitative fit tests in various positions or a combination of fit tests and exercises. One quantitative fit test consists of the 8-second-or-less procedure explained above.

The protocol is a procedure followed by a company or institution as part of its respiratory protection program.

The user may tailor the protocol to meet his company's needs or may alternatively use the factory preset protocols and test values. These protocols and values are combined to provide a comprehensive test that determines accurately and completely the fit of a given respirator mask. Consistent fit-test results are achieved by using a protocol. (Note: Some regulatory agencies may require a specific protocol.)



## GETTING STARTED

### Preparing the Respirator for Fit-Testing

1. **SELECT** the size, brand, and style of respirator that best fits the test subject and is most suitable for the application.
2. **REMOVE OR PROP OPEN** respirator inhalation valve(s) carefully. Upon completion of the fit test, reinstall the respirator inhalation valve(s).
3. **REPLACE** filter cartridge(s) or regulator with test adapter(s).
4. **CONNECT** squeeze-bulb assembly (Part # 9503-0024) to type "A" or "AB" test adapter.
5. **CONNECT** dual tube assembly (Part # 9503-0069) to type "B" or "AB" test adapter.

#### NOTE:

Refer to the test-adapter illustrations on page 14.

### Instructing the Test Subject

Use the instructions below to teach the test subject the procedure for holding one's breath and the guidelines to follow during the fit test.

**Have the test subject practice the following steps a few times until comfortable with the procedure.**


- Take a breath and hold it, keeping mouth closed.
- Now look at a watch or any clock with a second hand. Continue holding breath for 8 seconds.
- After holding breath for 8 seconds, relax and breathe normally.

**Have the test subject follow these guidelines during a fit test.**

- Keep mouth closed (do not swallow or move mouth or tongue).
- Do not exhale any air through the nose.
- Do not make any head or facial movements. Sit or stand as still as possible in the position as instructed. Maintain this position for 8 seconds; then resume normal breathing.

- ❑ Press the → key again and the following appears:

TEST	EDIT PROTOCOL	SYSTEM	UTILITY
		Set Clock	Zero Pressure
		System Reset	Edit Name
		Dual Tube Cal	
Set system time and date			

- ❑ Press the ↑ or ↓ key to select “Set Clock,” “System Reset,” “Dual Tube Cal,” “Zero Pressure,” or “Edit Name.”
- ❑ Then press  key to continue. (For more information refer to the System Menu section.)
- **SET CLOCK** sets the system’s time and date.
  - **SYSTEM RESET** reloads all system variables to factory presets, removing all user-changed settings.
  - **DUAL TUBE CAL** calibrates the dual tube assembly.
  - **ZERO PRESSURE** removes the offset from the pressure transducer.
  - **EDIT NAME** edits stored operator’s name.
- ❑ Press the → key a final time and this display appears:

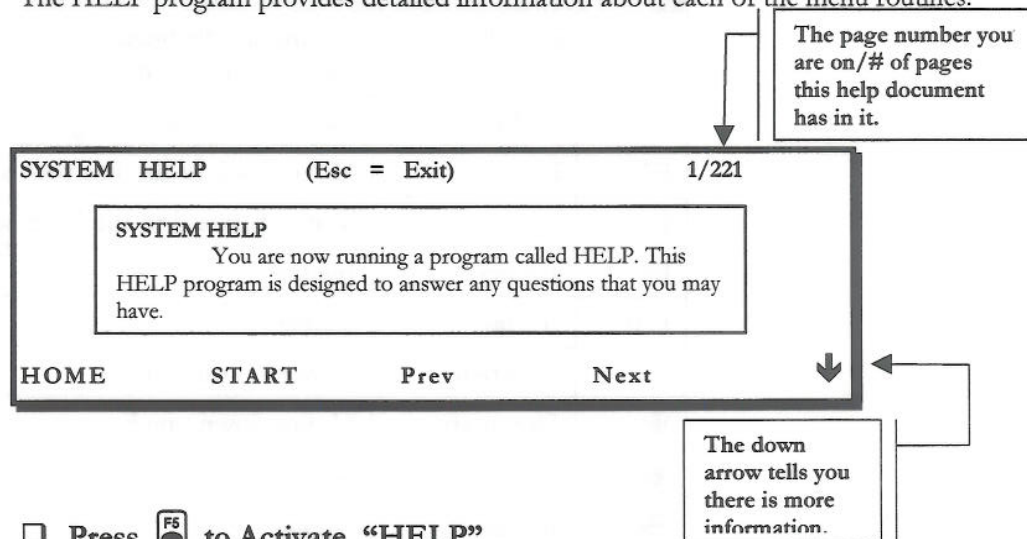
TEST	EDIT PROTOCOL	SYSTEM	UTILITY
			Printer
			Diagnostics
Install/uninstall Printer			

- **PRINTER** turns the printer port on or off.
- **DIAGNOSTICS** runs the *FitTester 3000* diagnostic routines, which are:
  - Speaker Test
  - Display Test
  - View Cycle Count
  - Keyboard Test
  - Printer Test
  - Factory Protocol

✓ Refer to the **UTILITY** menu for more information on Printer and Diagnostics.

## Help Program

The HELP program provides detailed information about each of the menu routines.



❑ Press **F5** to Activate "HELP"

- This can be done when any one of the menu routines is active. Instructions pertaining to the currently running menu routine then appear on the display. Scroll through the HELP program (line by line) using the **↑** or the **↓** key.

### NOTE:

The HELP program always goes to the top of the section for the active menu routine.



## TEST MENU

*In this chapter you will find information about the Testing Menu and Protocols.*

### PRE-TEST

#### Introduction

The pre-test can be used to familiarize the test subject with the fit test, to conduct donning exercises, and to let the test subject quickly see how donning affects fit factor. The pretest can also be used to “qualify” a mask before beginning a protocol. The *FitTester 3000* can quickly check fit factors on different sizes and models of masks to determine the best-fitting respirator.

This introductory section contains the following:

- Information shown on the display when running a pre-test. (*See instructions on running the pre-test.*)
- Challenge pressure and respirator mask pressure definitions.
- Explanations of the pre-test parameters: inspiratory work rate, respirator mask type, cartridge type, and test subject's gender. (*NOTE: The minimum passing fit factor is a parameter for protocols only; therefore, see the Parameters section for instructions on how to change the minimum passing fit factor.*)
- When the minimum passing fit factor is changed for protocols, it affects the pretest results. (See the *Pre-test Results* section.)

Follow the steps on page 24 to view the first three displays. The third display contains the challenge-pressure value and the respirator-mask-pressure value.

- ❑ From the **MAIN MENU**, select the **TEST MENU**. Press the **↑** or the **↓** key to highlight “Pre-Test” on the **TEST MENU**. The following display appears:

## Challenge Pressure

- For PRE-TEST, and CUSTOM 1 AND CUSTOM 2 PROTOCOLS the *FitTester 3000* calculates the negative pressure that would be produced in the respirator mask during inhalation, according to operator selected parameters.
- For the OSHA, REDON, MIL, and SCBA protocols, the challenge pressure is fixed and is not a factor of operator selected parameters.
- The challenge pressure is equal to the pressure produced in the respirator mask during inhalation, and it appears (in hundredths of an inch of water) in the upper left portion of the display during the pre-test.

### NOTE:

The challenge pressure is the pressure at which the leak rate measurement is made.

## Explanation of keys:



**WR:** The inspiratory work rate has the largest influence on internal respirator mask pressure. It is measured in units of kcal/hr (energy consumed).

When a person expends more energy (works harder), he breathes harder, causing greater airflow through the cartridge. This increased airflow results in a higher-pressure drop.

Make an estimate of the work rate that the test subject experiences under normal working conditions. Next, press <F2> to set the work rate accordingly.

100 kcal/hr	Light - standing still or sitting at ease.
200 kcal/hr	Moderate - walking (casual) without a load.
300 kcal/hr	Heavy - walking with or moving a light load.
350 kcal/hr	Extreme - walking with or moving a heavy load, climbing stairs, digging, etc.



**Msk:** The *FitTester 3000* tests two types of respirator masks.

- ◆ FF Full Face or Full Mask
- ◆ HM Half Mask

Because the full-face respirator mask has a CO<sub>2</sub> accumulation in the dead space, the test subject must take harder, deeper breaths to compensate for the lower oxygen content. Deeper breaths mean a higher instantaneous airflow rate through the filter cartridge.

Challenge pressure, the pressure differential across the filter cartridge, is directly proportional to the airflow rate through the cartridge.



**C:** The cartridges are classified into four categories:

Low	Dust/mist filter
Medium	Chemical or HEPA
High	Combination of chemical and HEPA
NA	Respirator masks that do not use cartridges; for example, SCBA and PAPR

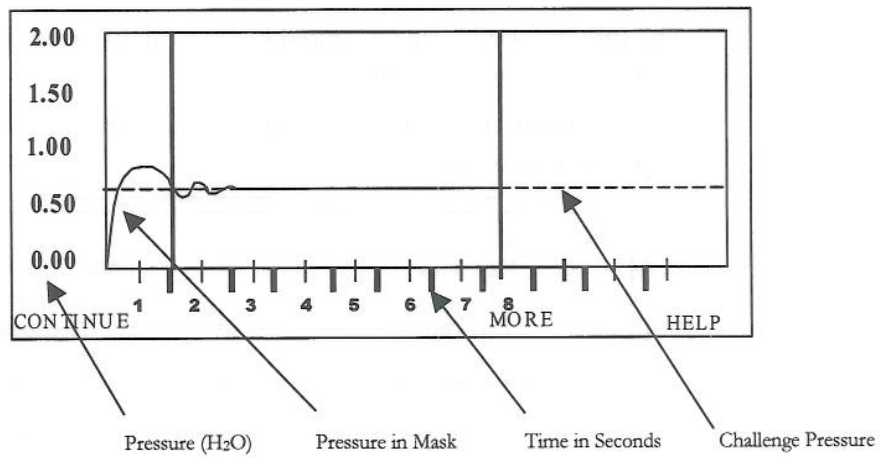
The pressure drop across the cartridge is a function of cartridge resistance and airflow rate; therefore, the higher-density (more resistive) cartridge causes a greater pressure drop across the face-to-facepiece seal.



**MALE/FEMALE** Men and women both breathe the same volume of air (for a given work rate). They do, however, have different inhalation rates. A male inhales faster, which causes a higher instantaneous flow rate to occur and results in a higher challenge pressure.



During the pre-test, a pressure trace appears as shown below:



**NOTE:**

Actual numbers depend on the challenge pressure.

The *FitTester 3000* measures respirator mask leakage after the pressure in the mask stabilizes at the challenge pressure.

The two beeps signify the following:

- ◆ The first beep (visually indicated by the first vertical line) signifies that the challenge pressure has been reached.
- ◆ The second beep (visually indicated by the second vertical line) signifies the end of the test.

## Repeat the Pre-Test

It is recommended that the user keep repeating the pre-test until successful test results are achieved, that is, a “GOOD Test-Q” and a passing fit factor.

☐ Press  (CONTINUE) to repeat the pre-test.

### NOTE:

It is not necessary to output the pre-test results to the printer.

## Fit Factor

The first test result is the calculated fit factor (FF), the ratio of the modeled breathing rate to the measured leak rate.

$$FF = \text{modeled breathing rate} \div \text{measured leak rate}$$

### NOTE:

The fit factor of the *FitTester 3000* is equivalent, by definition, to fit factors obtained by traditional quantitative fit-test methods (that is, aerosol methods). However, the *FitTester 3000* leak measurement doesn't use aerosols; therefore, it doesn't have the mixing problems associated with quantitative aerosol measurement methods.

The direct leakage measurement of the *FitTester 3000* is superior to the aerosol approximation methods because the leakage measurement isn't dependent on aerosol particle-size distribution.

Notice the word “PASS” or “FAIL” next to the fit factor:

- ◆ “FAIL” indicates that the calculated fit factor is less than the *Minimum Passing Fit Factor* (explained on next page).
- ◆ “PASS” indicates that the calculated fit factor is equal to or greater than the *Minimum Passing Fit Factor* (explained on next page).

## Minimum Passing Fit Factor

The minimum passing fit factor is the minimum fit factor required for a passing result. This parameter is operator-specified as explained in the *PARAMETERS, Editing Parameters* section and displayed here. The PASS/FAIL indication that appears next to the fit factor, is calculated based on this parameter number.

## PROTOCOLS

Now that you have completed several successful pre-tests, you are ready to begin running a protocol. The protocol is a comprehensive test that accurately measures the fit of a given respirator. Consistent fit-test results are achieved by using a protocol.

The protocol is a sequence of up to 18 fit tests or exercises. The *FitTester 3000* stores four standard and two custom protocols in nonvolatile memory. After all steps in a protocol have been completed, the fit-test results are combined to calculate an “average equivalent fit factor” for the protocol. The protocol results can be printed.

## Preprogrammed Protocols (4)

### OSHA

The OSHA protocol is a 17-step protocol created by OSHA (Dept. of Labor, 29 CFR 1910 and 1926, Respiratory Protection; Final Rule, January 8, 1998) for the *FitTester 3000*. It consists of eight exercises and nine test measurements, which follow the exercises. Due to the unique properties of the *FitTester 3000*, OSHA only required test measurements after the exercise periods. Therefore, no fit factors are created or reported for exercises listed. As specified by OSHA, two required values are preprogrammed and are as follows:

Challenge Pressure (0.58 in. H<sub>2</sub>O)  
Modeled Breathing Rate (53.8 l/min.)

### REDON

The REDON protocol comes from scientific peer-reviewed research into fit-testing of respirators. The protocol includes the significant factors that affect the fit of a respirator and provides a very conservative evaluation of the actual fit to the wearer. It is designed to be used in evaluating both Half-Face and Full-Face respirators. It uses the following values:

Challenge Pressure (0.58 in. H<sub>2</sub>O)  
Modeled Breathing Rate (53.8 l/min.)

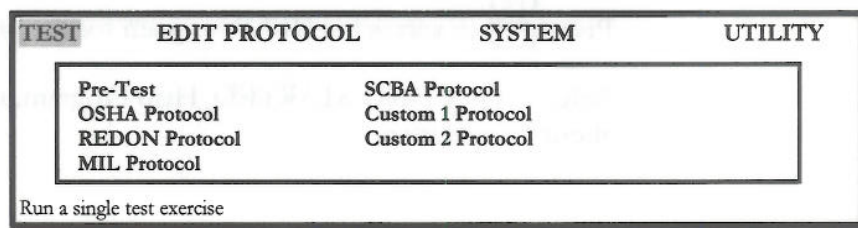


**Follow these steps to run a protocol:**

1. When running the OSHA, REDON, MIL, and SCBA protocols, only the gender and mask size parameters can be changed. However, changing these parameters will not affect challenge pressure and modeled breathing rate, as these are factory pre-set. The gender is printed on the protocol results report. Selecting full face or half mask does affect passing fit factor.

For Custom 1 and Custom 2 protocols, all four parameters (work rate, cartridge type, mask type, and gender) are available for modification, and they do affect challenge pressure and modeled breathing rate.

2. Review the breath-holding procedure with the test subject (see page 17).
3. Complete steps 1–4 in PREPARING THE FitTester 3000 FOR TESTING).
4. Complete steps 1–5 in GETTING STARTED, Preparing the Respirator for Fit-Testing.
5. View the protocol and ensure that it is correct. If the protocol is not correct, edit the protocol as described in the section Building and Editing a Protocol.
6. Make sure the test subject can perform the head positions required by the tests and the activities required by the exercises. Before each test or exercise, follow the on-screen prompts that instruct the test subject on which direction to face or which activity to perform.
7. From the Main Menu, select the Test Menu; then press the <↓> key to select the protocol to use.



- ☐ Press  and the following message appears:


**SELECT**-- toggles the highlighted field between the two parameters.

**CHANGE** - cycles through the available values for each parameter. **SAVE**

- places these parameter values in the volatile memory.

**NO-SAVE** -

exits without saving data.

- ☐ Press  (**TEST**) and the display shows:

Don the mask, adjust straps, and connect the Dual Tube Assembly.

Press any key when ready.

- ☐ Have the test subject don the mask. Press any key to continue. Instructions as to which exercise or test position to perform appears on the display.

**NOTE:**

For tests, it is recommended that the test subject or operator control the test adapter valve and, when ready, squeeze the bulb to close the valve.

58


0

START

TEST : Face Forward

Step # : 1

When ready, take a breath and hold. Seal the test valve and press START.

- ☐ Press  (**START**) to start the test or exercise.

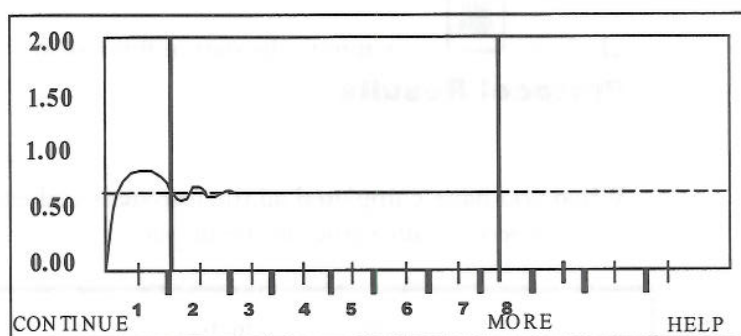
**NOTE:**

After completion of each fit test, you will be prompted to save, retry, or abort the fit test. See the next section, *TEST AND PROTOCOL RESULTS, Test Results*, for an explanation of these options.

- ☐ Press **F4** (MORE) and the display changes to this:

TEST RESULTS (continued)	
Challenge Pressure	=.58 (H <sub>2</sub> O)
Molded Breathing Rate	=53.8 (LPM)
Min Passing Fit Factor	=100
SAVE	RETRY      ABORT      MORE      HELP

- ☐ Press **F4** (MORE) again and the pressure trace from the fit test is shown again:



- ☐ Repeatedly press **F4** (MORE) to scroll through the above displays.



**NOTE:**

TEST RESULTS are explained in a previous section PRE-TEST, *Pre-Test Results*.


**You now have the following options:**

- ☐ Press **F1** (SAVE) to save this test-step's test results. The *FitTester 3000* automatically advances to the next protocol step.
- ☐ To retry this test-step, press **F2** (RETRY).






- ☐ Press  (NEXT) and the display looks similar to this or press  [PREV] to return to the previous display.

TEST PARAMETERS	
Work Rate	: 200 Kcal/Hr (moderate)
Cartridge Type	: Chemical/HEPA (medium)
Mask Type	: Half Face
Challenge Pres	: 0.58 (in. H <sub>2</sub> O)
Breathing Rate	: 53.80 (liters/min)
Subject Gender	: Male
NEXT PREVIOUS	

- ☐ Press  (NEXT) to view a step-by-step summary of the protocol and a summary of each step's test results.

STEP	TYPE	DESCRIPTION		
1	TEST	FACE FORWARD		
Leak Rate		Duration	FF	Q
597.60	(cc/m)	8.0 secs	177	Pass
NEXT PREVIOUS				

- ☐ Repeatedly press  (NEXT) to show each next step in the protocol.
- ☐ Repeatedly press  (PREVIOUS) to show each previous step in the protocol.
- ☐ Press  several times to return to the MAIN MENU.

## EDIT PROTOCOL MENU

### Introduction

This section contains instructions on how to use the EDIT PROTOCOL MENU to make adjustments to the protocol and parameters. Explanations are included on how to:

- View, Build, Edit, and Print a Protocol.
- View, Edit, and Print Parameters.


### Viewing a Protocol

To ensure that the protocol is correct, view each step in the protocol as follows:


- ☐ From the **MAIN MENU**, select the **EDIT PROTOCOL MENU**; then press the **↓** key to select the protocol to view.

TEST	EDIT PROTOCOL	SYSTEM	UTILITY
	OSHA Protocol REDON Protocol MIL Protocol SCBA Protocol	Custom 1 Protocol Custom 2 Protocol Parameters	

Edit, Prjint, or View Protocol 1

- ☐ Press  and the display changes to this:



*** OSHA PROTOCOL ***			
EDIT	PRINT	VIEW	HELP

- Press  (EDIT) and the display looks similar to this:

*** EDIT CUSTOM 1 PROTOCOL ***				
	<u>Step</u>	<u>Type</u>	<u>Description</u>	<u>Duration</u>
Current:	1	Clr	Clear	N/A
Edit:	1	Clr	Clear	N/A
ESC=Exit, ENT=Store			↔ Select, ↑ ↓ Modify	

**NOTE:**

Use the → and the ← keys to select the column: Step, Type, Description, or Duration. Then use the ↑ and the ↓ keys to scroll through the choices for the selected column. Refer to the next section, *Edit-Protocol Choices*, for a listing of the selections.

- When satisfied with the setting for a particular step, press the  key to save the step in nonvolatile memory. Select the next step and repeat the editing process.
- After all steps have been set and saved, enter an additional step\* and choose “Clr” in the “Type” column.
- Make sure to press the  key to save this step. (This additional step, with “Clr” in the “Type” column, is necessary because it signals the end of a protocol sequence\*.)
- The *FitTester 3000* is shipped with SCBA protocols factory pre-set. They may be modified (and restored through system reset). It is suggested that Custom 1 and Custom 2 protocols be used for user defined protocols.

*\*EXCEPTION: If all 18 steps are used, the additional step with “Clr” in the “Type” column is not necessary.*




## Printing a Protocol

Ensure that a printer is connected and that the *FitTester 3000* printer port is available as explained in *PREPARING THE FitTester 3000 FOR TESTING, 2. PRINTER CONNECTION*. Next, follow the instructions below to print a protocol.

- ❑ From the **MAIN MENU**, select the **EDIT PROTOCOL MENU**; then press the **↓** key to select the protocol to print. (*The FitTester 3000 prints a complete listing of the selected protocol.*)

TEST	EDIT PROTOCOL	SYSTEM	UTILITY
	<div> <div>OSHA Protocol</div> <div>REDON Protocol</div> <div>MIL Protocol</div> <div>SCBA Protocol</div> </div>	<div> <div>Custom 1 Protocol</div> <div>Custom 2 Protocol</div> <div>Parameters</div> </div>	
Edit, Print or View Protocol 1			

- ❑ Press  and the display changes to this:

*** OSHA PROTOCOL ***			
EDIT	PRINT	VIEW	HELP


- ❑ Finally, press  (**PRINT**) and the printer begins printing.

## PARAMETERS


### Viewing Parameters


- ❑ Select "Parameters" from the EDIT PROTOCOL MENU.

- ❑ Press  .

- ❑ Now press  (VIEW) and the display looks similar to this:



DEFAULT TEST PARAMETERS		
Mask Type	:	FULL FACE
Subject	:	MALE
HM Passing FF	:	100
FF Passing	:	500
ESC to exit		

- ❑ Press  to return to the previous screen, \*\*\*\*PARAMETERS\*\*\*\*.


- ☐ Press  (RECALL) to retrieve the previously saved value.

## Printing Parameters

Follow the instructions below to print a complete listing of the parameter values.

- ☐ Ensure that a printer is connected and that the *FitTester 3000* printer port is turned on as explained in *PREPARING THE FitTester 3000 FOR TESTING (2. PRINTER CONNECTION)*.
- ☐ Select "Parameters" from the EDIT PROTOCOL MENU.
- ☐ Press  .
- ☐ Next press  (PRINT).

### NOTE:

The "Printer Not Ready" message is an indication that there is a problem with the cable or the printer. Check both the cable and the printer before attempting a "Retry." Press  to retry.



## SYSTEM MENU

### Introduction

This section contains instructions on how to use the SYSTEM MENU to make adjustments to the system-level parameters. Explanations are included on how to:

- Set the clock.
- Reset protocols and parameters to the factory default values, and reset the piston in the cylinder to home position.
- Calibrate the dual tube assembly.
- Zero the pressure transducer.
- Add or edit operator name.

### Set Clock


“Set Clock” allows you to adjust the time and date of the battery-backed clock. All printed reports made by the *FitTester 3000* include a time and date stamp; therefore, it is important to adjust the battery-operated clock to the current time and date.

- ☐ Select “Set Clock” from the SYSTEM MENU as indicated in the following illustration:

TEST	EDIT PROTOCOL	SYSTEM	UTILITY
		Set Clock System Reset Dual Tube Cal	Zero Pressure Edit Name
Set system time and date.			

RESET REMOVES ALL EDITED PROTOCOLS,  
PRESS F3 TO PROCEED. "ESC" CANCELS.


**NOTE :**

Pressing  will return the *FitTester 3000* to the "Factory Defaults" and

**WILL OVERWRITE ALL USER PROGRAMMING!!!!\***

- ☐ If you do not wish to replace information and wish to escape, press ESC.

**NOTE:**

After pressing  , all system variables are now reset.

**Dual Tube Calibration**

To accurately measure respirator-mask-fit, the leakage attributed to the dual tube assembly leak orifice\* must be removed from the total measured fit-test leakage value. Calibrating the dual tube assembly accomplishes this.

The dual tube assembly is terminated with an airtight section of tubing. The *FitTester 3000* removes air at eight different flow rates. The pressure developed across the leak orifice is measured at each flow rate and stored in an array of calibration data.





To cancel the effect of orifice leakage during a fit test, an interpolating algorithm uses the array of calibration data to determine orifice leakage at the fit test's particular challenge pressure. This calculated-leakage value is subtracted from the measured-leakage value.

**\*NOTE:**

The leak orifice is the hole in the gray plastic in one of the female quick-disconnect adapters on the respirator-end of the dual tube assembly.

ERROR MESSAGE	ACTION TO TAKE
<b>ERROR</b> —Bypass orifice not within spec.	Replace the dual tube assembly.
<b>ERROR</b> —Check connections and repeat.	Reconnect quick-disconnect adapters and repeat this procedure.
<b>ERROR</b> —Check transducer calibration.	Go to the next diagnostic routine, “Zero Pressure,” and remove the offset from the pressure transducer.
<b>ERROR</b> —Replace orifice if necessary.	Replace the dual tube assembly.
Press any key to continue.	Press any key, returning to the SYSTEM MENU.

The *FitTester 3000* does not maintain long term internal storage of data. Therefore, to save a record of the data, printing out a copy of the data is required.

- ☐ After calibration finishes, press  (SAVE) to save the data to temporary memory, or
- ☐ Press  (NO-SAVE).
- ☐ To save a hard copy of the data, print it by pressing  (PRINT).
- ☐ Press  to return to the SYSTEM MENU.

**NOTE:**

*OHD* recommends a dual tube calibration before the beginning of a fit-test session, at the start of the day, or anytime a dual tube assembly is exchanged.



## Edit Name

“Edit Name” allows the operator to add his name to each report output.

- ☐ First select “Edit Name” from the SYSTEM MENU as indicated below.

TEST	EDIT PROTOCOL	SYSTEM	UTILITY
		<div style="border: 1px solid black; padding: 5px;"> Set Clock  System Reset  Dual Tube Cal </div>	Zero Pressure <u>Edit Name</u>

Edit operator's name.

- ☐ Press  .

- ☐ Screen below will appear.



-----

OP NAME

-----

\*

Edit operator's name  
Up and Down arrows EDIT  
ESC exits w/o save. Ent exits with save.

- ☐ Edit each letter space of the display with the arrows until the operator's name appears as desired.
- ☐ Press  to save. Saved name will remain until changed or removed.
- ☐ OR press  to exit *without* saving change.
- ☐ System returns to SYSTEM MENU.

## UTILITY MENU

### Introduction

This section contains instructions on how to use the UTILITY MENU to...

Turn on the *FitTester 3000* printer port using the printer installation routine.

Perform a diagnostic check of the *FitTester 3000* diagnostic routines listed below:

- Speaker Test
- Keyboard Test
- Display Test
- Printer Test
- View Cycle Count
- Factory Protocol
- Print Help File

### Printer Installation Routine

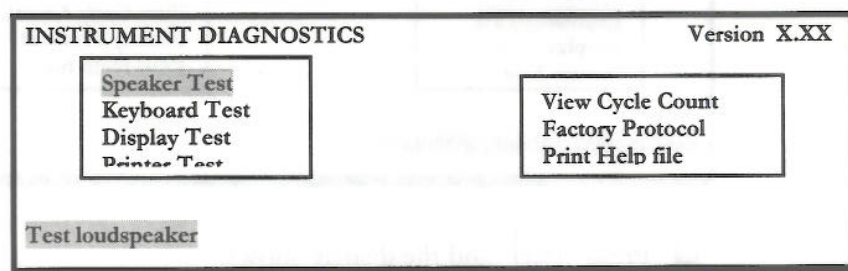
The printer installation routine turns the printer port on ("Available") or off ("Not Available").

- ☐ Select "Printer" from the UTILITY MENU as indicated below.

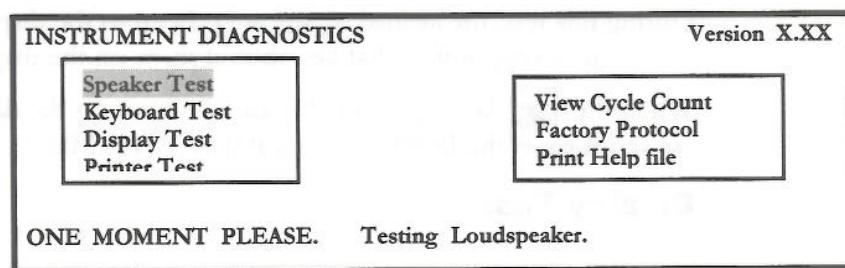
TEST	EDIT PROTOCOL	SYSTEM	UTILITY
			<div>Printer Diagnostics</div>
Install/Uninstall Printer.			

## Speaker Test

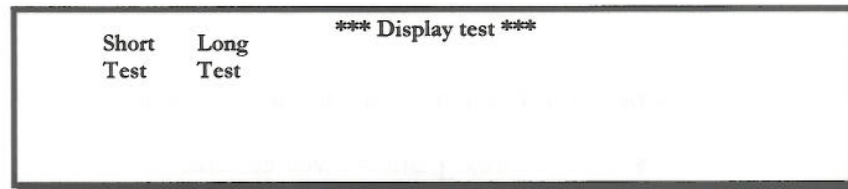
- From the INSTRUMENT DIAGNOSTICS MENU, select “SPEAKER TEST” using the ↑, ↓, ←, or → key if necessary to position the highlight bar over “SPEAKER TEST.”




- Press  then a series of tones is output and the display shows:

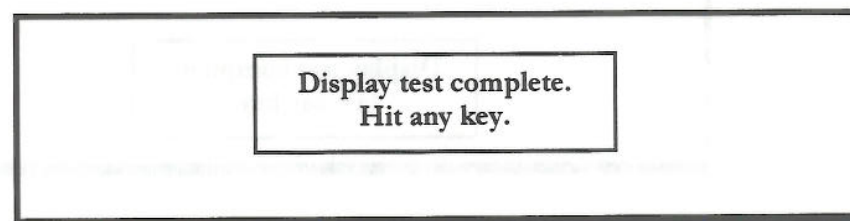
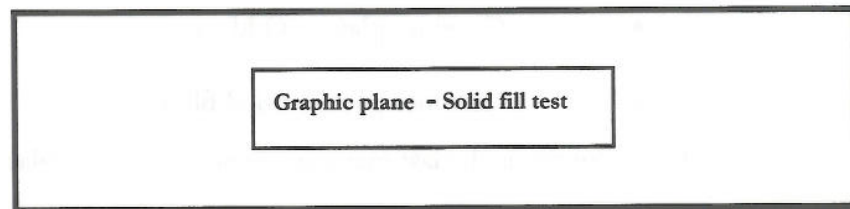
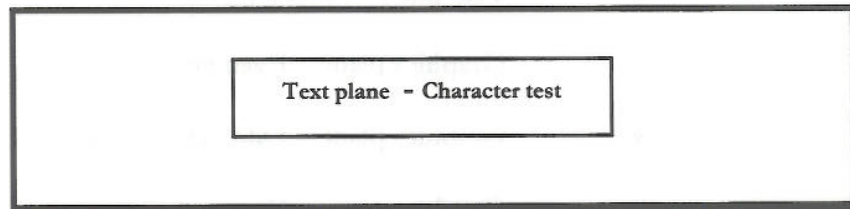




Use the “VOLUME” knob on the lower right front panel to adjust the volume.



- ☐ Next press  (**SHORT TEST**). First a text plane test, showing all text characters, is performed. Then a graphic plane test, showing a solid fill, is performed. At the end of the “Short Test,” press any key to return to the INSTRUMENT DIAGNOSTICS MENU.

*Following are the messages that show on the display during the “Short Test.”*

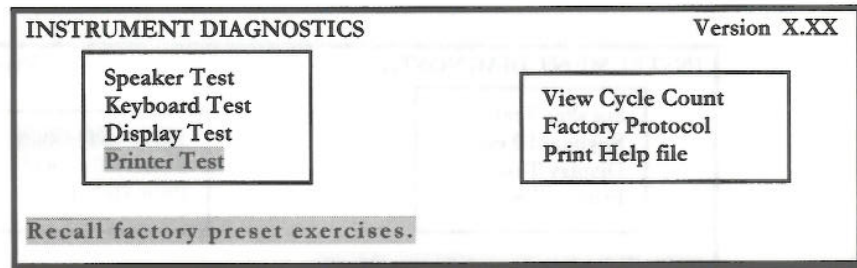



- ☐ Select “DISPLAY TEST” again from the INSTRUMENT DIAGNOSTICS MENU and press .
- ☐ Next, press  (**LONG TEST**). At the end of the “Long Test”, go to next step.



## Printer Test

- ☐ Select “PRINTER TEST” from the INSTRUMENT DIAGNOSTICS MENU.



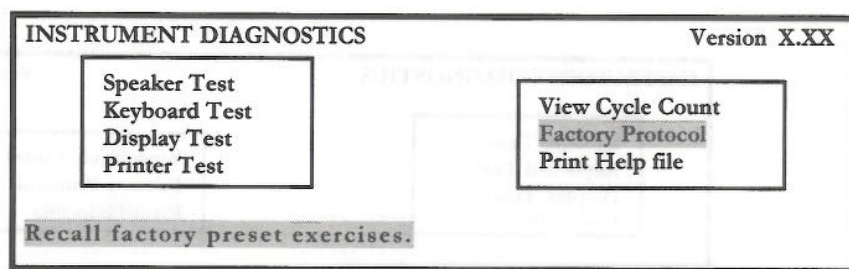
- ☐ Press . The *FitTester 3000* sends a short message to the printer.


### NOTE:

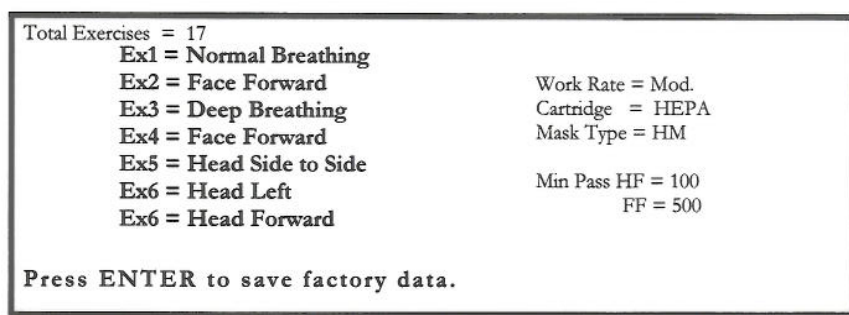
If the message “Printer Not Ready” shows on the display, ensure that the printer is turned on and that the cables are connected properly.



## Factory Protocol

- ❑ Select “FACTORY PROTOCOL” from the INSTRUMENT DIAGNOSTICS MENU.



- ❑ Press . The *FitTester 3000* reloads the factory protocol – Protocol #1 (the OSHA protocol).



- ❑ Press  to save the factory protocol and return to the INSTRUMENT DIAGNOSTICS MENU.
- ❑ Press  to return to the INSTRUMENT DIAGNOSTICS MENU without saving the factory protocol.

## Troubleshooting

*In this chapter you will find information about problems and possible solutions.*

### TEST MEASUREMENTS

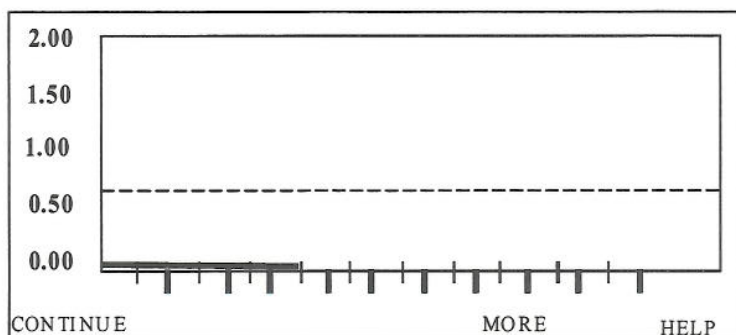
You may occasionally find a test measurement that is not as you expected. Descriptions of some of these common situations and possible solutions have been included to aid the user in obtaining more accurate measurements.

#### High Leakage

In many cases, the measured leakage exceeds the ability of the *FitTester 3000* to measure. Within the *FitTester 3000*, once the measuring cylinder reaches the maximum capacity, the cycle will immediately cease. This situation is accompanied by a high-pitched whine of the pump motor.

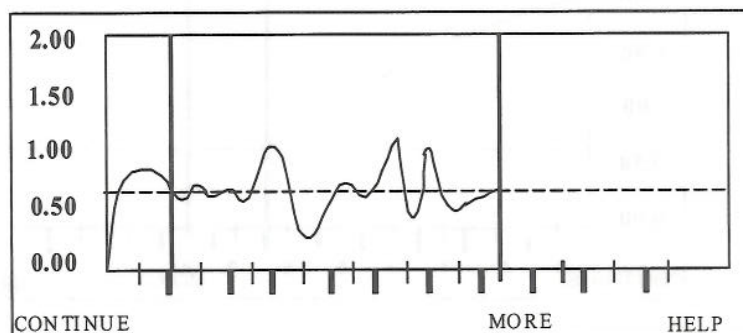
#### Massive Leak

The pump runs at a high pitch for about 4 seconds and stops abruptly. The *FitTester 3000* resets and reports a fit factor below 11. During the measurement the screen will look something like this:



### Erratic Mask Pressure

The *FitTester 3000* is very sensitive to pressure changes inside the mask. If the pump motor sound alternates between high- and low-pitched whines and the pressure tracing line, even after challenge pressure is attained, is erratic, the *FitTester 3000* is sensing variations in pressure. The graph can vary greatly and might look like this:



This tracing would give a **RETRY ADVISED** and be unacceptable as test measurement. You would need to rerun the measurement. There are a number of causes for this type of reading.

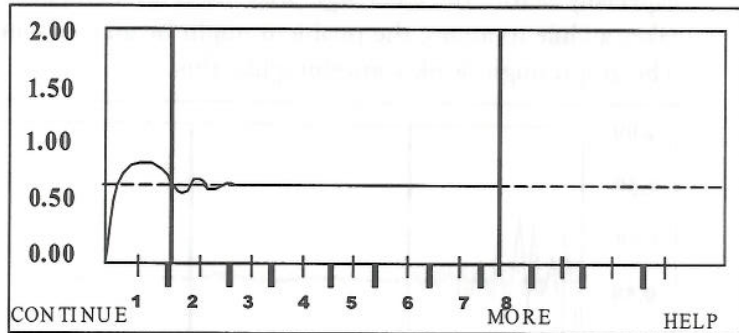
#### Possible Solutions

1. Movement by the person being tested needs to be minimized. Actions such as swallowing, opening the mouth, and moving the tongue can adversely affect the pressure sensor.
2. Air inhalation or exhalation, even slightly, creates dramatic changes within the mask. Re-instruct the test subject to maintain breath holding during the test measurement.
3. A test subject may be unable to stop the flow of air through the nose while holding his breath. A nose clip can assist the subject (be sure that the nose clip does not interfere with the fit of the respirator).



### Consistently Low Fit Factors

When you consistently get low fit factors, even when you know that a respirator should fit, and the pump motor is running slightly faster (at a higher pitch) than normal, the graph could look normal as this:



When the leak rate is high, the graph can still look somewhat normal. The *FitTester 3000* will often be able to keep up with the leak and give a good test result, regardless of the fact that the leak is too large to yield a passing fit factor.

### Possible Solutions

1. As in other leakage situations (see HIGH LEAKAGE), check all hose connections, adapters, and adapter connections to respirators.
2. Check for proper tension of respirator to face.
3. Try a different size or different respirator.
4. See SQUEEZE BULB page 78.
5. Have Adapter checked for leaks (call OHD for this service).

## OTHER PROBLEMS

### DUAL TUBE CALIBRATION

The Dual Tube Calibration normally functions to completion without any intervention by the user. Occasionally a problem may arise.

***Symptom:***

Dual Tube Calibration abruptly stops or will not continue after starting.

***Possible Problem:***

1. Something has blocked or partially obstructed the leak orifice on the Dual Tube Assembly and has rendered the tube out of tolerance.
2. Pressure in the transducer has not been zeroed.
3. The transducer needs factory calibration.

**Possible Solutions**

1. Turn *FitTester 3000* off at the power switch, wait 15 seconds, power on the *FitTester 3000*, zero pressure, and retry Dual Tube Calibration.
2. Replace Dual Tube Assembly.
3. Call OHD to evaluate problem or to arrange return for factory calibration.

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