TME

WORKER ™

Leak Tester,
Leak and Flow Tester
or
Leak and Backpressure Occlusion Tester

Operator's Manual

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IMPORTANT INSTRUMENT SAFETY INFORMATION

This section of the ***WORKER*** Operator's Manual has been written to provide the operator with important safety information related to the installation, setup and operation of the instrument. It is important:

- to read this manual before installing, setting up or using this instrument to avoid personal injury and/or instrument damage,
- to follow the safety information included in this section to avoid personal injury and/or instrument damage,
- to keep this manual for future use, and
- to review and become familiar with all instrument safety labels and their meanings.

SAFETY LABEL DESIGN

Safety labels are designed and placed on the instrument to alert the user to both potential personal injury and property damage hazards. The ANSI/ISO harmonized safety labels consist of a Hazard Severity section, a Symbol panel, and a Word Message panel.

Hazard Severity Section

The hazard severity section of the label consists of the ISO "General Warning Symbol", a specific safety color, and the appropriate signal word to convey the seriousness of the hazard.

ISO General Warning Symbol

A black triangle with a black exclamation point on a yellow background is the ISO "General Warning Symbol". It is used to alert the user to a potential personal injury hazard. The general warning symbol can be used alone or in combination with a signal word to call attention to hazard information. Obey all safety messages that follow this symbol to avoid possible injury or death

Signal Word

The Signal Word that follows the General Warning Symbol, combined with a specific colored background, is used to convey the seriousness of the hazard.

DANGER is used to indicate an imminently hazardous situation, which, if not avoided will result in death or serious injury. The severity panel background is red for the Danger signal word.
WARNING indicates a potentially hazardous situation, which, if not avoided could result in death or serious injury. The severity panel background is orange for the Warning signal word.

CAUTION indicates a potentially hazardous situation, which, if not avoided may result in minor or moderate injury. **CAUTION** used **without** the General Warning Symbol indicates a potentially hazardous situation, which, if not avoided may result in property damage. The severity panel background is yellow for the Caution signal word.

Safety Symbol Panel

The symbol panel contains an ISO symbol chosen to convey the specific alerting message and supplement the word message.

Word Message Panel

The word message panel is designed to communicate the type of hazard, the consequence of interaction with the hazard and how to avoid the hazard.

INSTRUMENT SAFETY LABELS

The following Safety Labels have been placed on the instrument to alert the user to potential safety hazards.

Hazardous Voltage Warning

The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is Hazardous Voltage. This voltage is inside the instrument

The safety symbol conveys “shock” as the potential consequence of not avoiding the hazard.

The word message communicates to the operator that there is hazardous voltage that poses the potential for shock and communicates to the operator that there are **NO** user serviceable parts inside the instrument. The message directs the operator to contact the Manufacturer for Service/Repair as the means of avoiding the potential hazard.

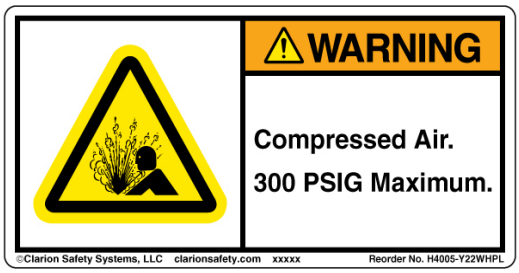
Compressed Air Warning-150 PSIG

The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is a compressed air input pressure above the instrument rated 150 PSIG Maximum.

The safety symbol conveys the explosion/release of pressure as the potential consequence of not avoiding the use of compressed air above 150 PSIG.

The word message on the label alerts the operator that the compressed air hazard is avoided by using a compressed air source that is rated for 150 PSIG Maximum. If maximum pressure is exceeded the release of pressure could result in death or serious injury to the user. Exceeding maximum input pressure will cause property damage to the instrument.

Compressed Air Warning-300 PSIG



The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is a compressed air input pressure above the instrument rated 300 PSIG Maximum.

The safety symbol conveys the explosion/release of pressure as the potential consequence of not avoiding the use of compressed air above 300 PSIG.

The word message on the label alerts the operator that the compressed air hazard is avoided by using a compressed air source that is rated for 300 PSIG Maximum. If maximum pressure is exceeded the release of pressure could result in death or serious injury to the user. Exceeding maximum input pressure will cause property damage to the instrument.

Custom Instrument Compressed Air Warning

Custom instruments designed to have a compressed air input pressure above 300 PSIG Maximum will carry a Compressed Air Warning with the Maximum Compressed Air input pressure handwritten on the label.

The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is a compressed air input pressure above the instrument rated Maximum PSIG indicated on the label.

The safety symbol conveys the explosion/release of pressure as the potential consequence of not avoiding the use of compressed air above 300 PSIG.

The word message on the label alerts the operator that the compressed air hazard is avoided by using a compressed air source that is rated for 300 PSIG Maximum. If maximum pressure is exceeded the release of pressure could result in death or serious injury to the user. Exceeding maximum input pressure will cause property damage to the instrument.

Fuse Safety Alert-Non-CE Configured Instruments

This ISO formatted label consists of the ISO “General Warning Symbol”, the fuse symbol and the required voltage and amperage rating of the instrument’s fuse.

This label is used to **CAUTION** service personnel that fuse replacement with an incorrectly rated fuse could result in minor or moderate injury or property damage to the instrument.

Fuse Safety Alert-CE Configured Instruments

The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is Hazardous Voltage. This voltage is inside the instrument

The safety symbol conveys “shock” as the potential consequence of not avoiding the hazard.

The word message panel is designed to provide service personnel with the replacement fuse characteristics including fuse type, size, voltage and amperage. The Dual Fuse symbol, below the safety symbol, indicates to service personnel that the instrument requires two fuses.

IMPORTANT LITERATURE ALERTS

The signal words "**WARNING!"** and "**CAUTION!"** are integrated into sections of this manual to alert the reader/operator to important literature that is included regarding potentially hazardous situations which, if not avoided may result in personal injury or property damage. These words appear in bold font and are embedded in the general text of the manual. Therefore, the information that follows these signal words should be read carefully to avoid personal injury and/or instrument damage.

RECOMMENDED SAFETY PRACTICES

Use of the *WORKER* in a manner not specified in this manual may impair the protection provided by the *WORKER* to other equipment.

DO NOT OPEN OR REMOVE THE INSTRUMENT COVER. There is hazardous voltage inside the instrument. Opening or removing the cover will expose the operator to a potential shock hazard and **WILL VOID THE WARRANTY**.

THERE ARE NO USER SERVICEABLE PARTS INSIDE THE INSTRUMENT. Refer all servicing to an authorized TM Electronics, Inc. Service Center.

The air or gas used for the instrument must be clean, dry, instrument quality air free of moisture, oil and dust. To ensure instrument quality air refer to Appendix F "Filter Drying System" or contact T.M. Electronics, Inc. for information on ordering a "Filter Drying System". The instrument Warranty does **not** cover instrument damage due to water, water vapor, oil vapor or oil damage to the instrument. It is the customer's responsibility to maintain dry, clean instrument quality air.

The air or gas used for the instrument must be at a recommended pressure between 90 and 150 PSIG MAX. A minimum of 60 PSIG must be supplied for proper instrument operation. For instrument models with a maximum test pressure higher than 50 PSIG, the inlet pressure must exceed the maximum test pressure by at least 10PSIG.

Do not exceed the Maximum Input Pressure of the instrument's Compressed Air Warning label as release of pressure may expose the operator to serious injury and cause instrument damage.

Do not position the instrument near water. Do not position the instrument where it can be splashed. Use caution when testing fluid filled products. Do not spill any liquids into the instrument. Do not allow the inside of the instrument to become wet. Contamination of the instrument with fluids voids the Warranty and requires extensive repairs.

Vacuum units require a filter at the input to prevent intake of dirty air.

Do not place this instrument on a sloping or unstable cart, stand or table as the instrument may fall, causing serious damage to it.

Do not place any heavy objects on the power cord. Damage to the cord may cause shock or fire.

Regularly inspect the instrument power cord, air supply hoses and hoses connected to test fixtures and replace if damaged.

Handle with care when transporting the instrument. Save packaging for transporting or return for recalibration or servicing.

Immediately unplug the instrument from the wall outlet and refer servicing to an authorized service center under the following conditions:

- If the power supply cord or plug is damaged.
- If liquid has been spilled into the instrument.
- If the inside of the instrument has been exposed to liquid during testing.
- If the instrument has been dropped or damaged.

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TME *WORKER* MODELS

Thank you for purchasing a TME *WORKER*. Please take the time to find and read the pertinent information contained in this manual for your specific model. This will help to ensure that you get the best possible service life from your instrument.

This manual covers the following models:

***WORKER* Leak Tester,**
***WORKER* Leak and Flow Tester,** and
***WORKER* Leak and Backpressure Occlusion Tester**.

Any reference in this manual to Flow testing is not applicable to an instrument purchased as a Leak Tester or a Leak and Backpressure Occlusion Tester.

The *WORKER* is available only as a single port instrument.

The Leak Tester and the Leak and Flow Tester are available as pressure or vacuum instruments. They are not available in a pressure and vacuum configuration.

The Leak and Backpressure Occlusion Tester is available only as a pressure instrument.

INTRODUCTION TO THE *WORKER*

The *WORKER* was designed as a single port test instrument and can be configured as a Leak Tester, a Leak and Flow Tester or a Leak and Backpressure Occlusion Tester.

The ***WORKER* Leak Tester** was designed as a single ended pressure decay system that monitors a gas pressurized part for a minute decrease (or decay) in pressure during the test period. The decay is attributed to a leak in the part. This configuration is available as a pressure or a vacuum instrument.

The ***WORKER* Leak and Flow Tester** was designed to test devices that pass liquid or gas at a required flow rate through an intended path. Examples of such devices include filters, tubing, valves and catheters. These types of devices generally require a two-part test. The device is first flow tested to verify that flow through the device is acceptable. Then a leak test is performed to verify that there is no leakage outside of the intended flow path.

The *WORKER* Leak and Flow Tester can be programmed to perform both a leak and flow test automatically in a single cycle. The tests can be done in either order: flow then leak or leak then flow. The tester can also be programmed to perform only a leak or a flow test.

For applications where occlusions or flow restrictions and leaks are of concern the ***WORKER* Leak and Backpressure Occlusion Tester** can be set-up to perform leak and backpressure occlusion tests, backpressure occlusion and leak tests, leak test only or backpressure occlusion test only.

At the completion of a test cycle, the *WORKER* display indicates whether the device met the preset test limits. A **P** for **PASS** on the display and the lit green ***ACCEPT*** light on the front panel indicate that the device met the test specifications. An **F** for **FAIL** on the display and the lit red ***REJECT*** light on the front panel indicate that the device did not meet the test specifications.

A Clamping option is available on all *WORKER* models. This option allows for the device under test to be held securely throughout the test cycle.

A Sealing device driver option is available on the Leak and Flow and Leak and Backpressure Occlusion *WORKER* models. These models are designed to perform both the leak and flow or backpressure occlusion tests in either order: leak and flow/backpressure occlusion, or flow/backpressure occlusion and leak. A leak test requires that all openings in the part be **closed**, a backpressure occlusion test requires only the intended air path in the part be **open** and a flow test requires that the flow path be open at one end. When the *WORKER* is configured with the optional sealing device driver, the open end(s) or openings of the test device can be sealed in an external sealing fixture. Once the seal is achieved, the leak or backpressure occlusion test can

be done. The sealing device driver is configured inside the *WORKER* case. The external sealing fixture must be ordered as a separate instrument option.

The *WORKER* Leak and Flow or Leak and Backpressure Occlusion models are available only as pressure instruments.

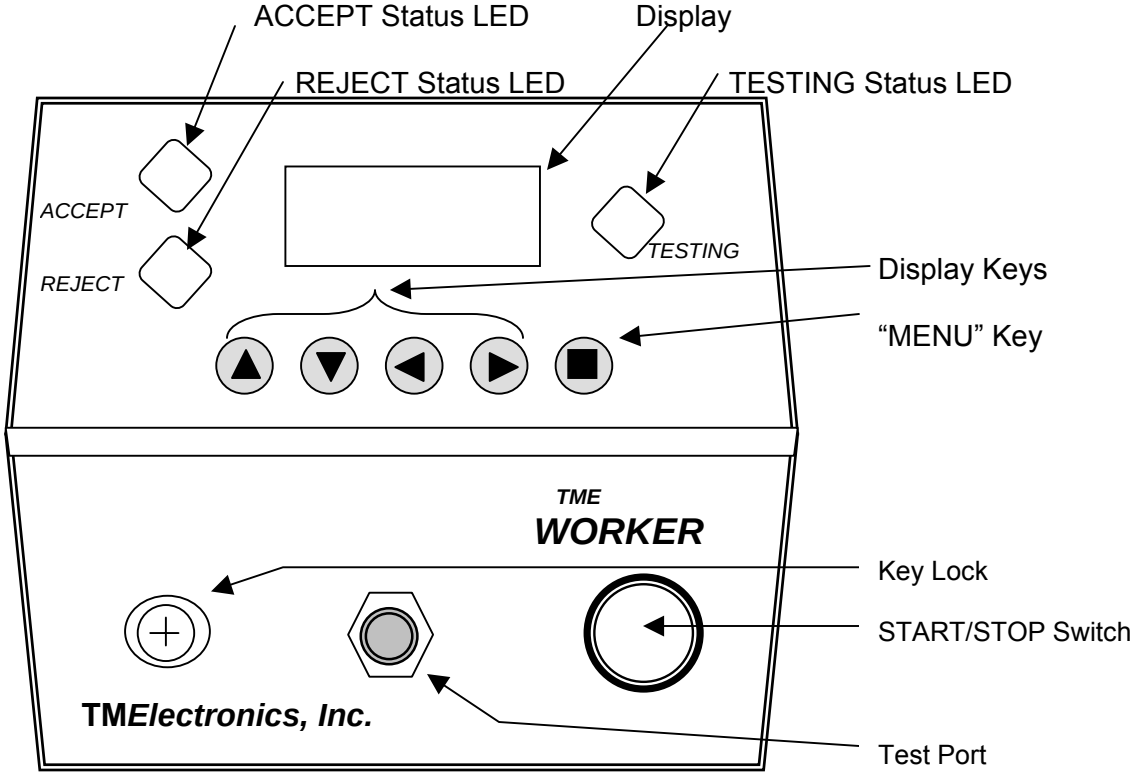
FEATURES OF THE *WORKER*

The *WORKER* contains several features that provide for the testing of a large variety of parts.

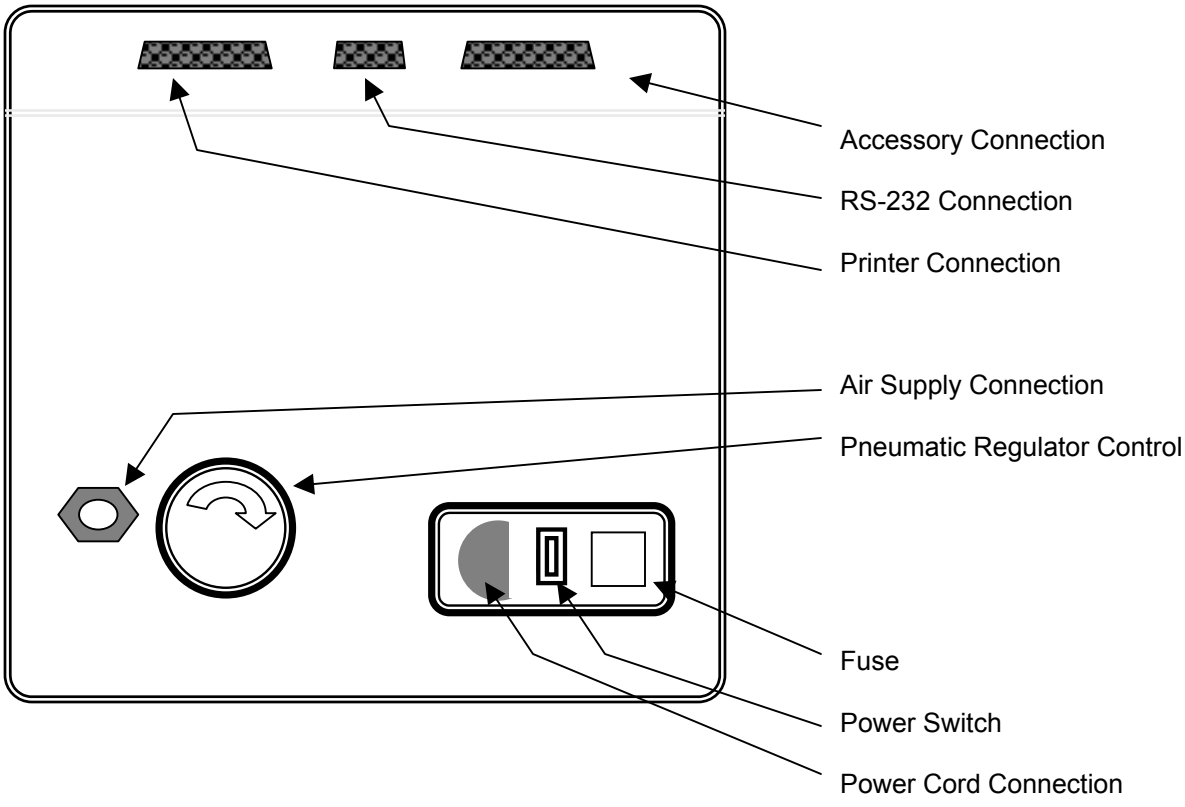
Flow Detection	The *WORKER* flow transducer has a typical sensitivity of 1 cc/min. A sensitivity of 0.1 cc/min is available in the instrument with a flow range of 10.0 to 500 CCM.
Leak Detection	The pressure transducer provides state-of-the-art sensitivity and temperature stability. Integrated with the system electronics the *WORKER* achieves resolution a low as 0.0001 PSIG (0.0069 mBar)
Self Diagnostics	Self-diagnostics are part of the *WORKER* start up program. This feature assures the operator that the instrument meets its own specifications when powered up.
Multiple Programs	The user is able to input up to one hundred (100) programs for individual test procedures. This feature allows for fast changeover of test programs.
Touch Keys	The touch keys allow the user to scroll through Menus, enter test parameters, select action items or return the display to Menu 1.
Key Lock	The Key Lockout function assures operation security. Once the key lock is activated neither test functions nor data can be altered.
Test Datalog	Test results are logged and retained in the Datalog Memory. The Datalog can store up to 5,000 test results. All stored results can be exported from the Datalog for easy viewing or storage.

Data Output/Export	The *WORKER* has multiple data output and data export modes. Test data is presented visually on the instrument panel with a P or F for PASS or FAIL, *ACCEPT* or *REJECT* LEDs and an audible alarm. Data export modes include Printer, and RS232C. The *WORKER* can also be equipped with Ethernet capability.
Clamp Valve (Option)	The Clamp Valve controls the pneumatic fixtures used to restrain the test device. When activated the clamp driver energizes an external valve or solenoid for the duration of the test cycle. The clamp delay time is the time allowed for the clamp to fully actuate on the test part before the instrument applies the test pressure.
Bleed Valve	All *WORKER* models contain a Bleed Valve Safety feature. This internal valve allows for air bleeding of a pressurized part prior to detaching the part from the test port. This safety feature prevents short bursts of air from escaping as a part is removed from the test port.
Seal Driver (Option)	The Sealing Driver controls an external fixture that is used to seal the open end of a test part. When activated the sealing driver activates the external sealing fixture on the test part and allows a leak or occlusion test to be run on the part.

INSTRUMENT CONTROL AND CONNECTION LOCATIONS



INSTRUMENT FRONT PANEL



INSTRUMENT CONTROLS

Refer to "INSTRUMENT CONTROL AND CONNECTION LOCATIONS" for location of the controls mentioned below.

POWER SWITCH	Turns instrument ON/OFF
PNEUMATIC REGULATOR	Controls the pressure or vacuum used in the test. Clockwise turn increases the pressure. Counterclockwise turn decreases it.
START/STOP SWITCH	Initiates the test sequence. Moves the instrument to the “Ready” Screen from a Menu Display. Stops a test or action that is in progress when held down for more than 2 seconds.
KEY LOCK	Locks the ▲▼ (UP/DN) keys to prevent program and/or test parameter changes. The ♦ Lock symbol on the display indicates the key is in the locked position and the ◊ symbol is used to indicate the key is in the unlocked position.
ACCEPT STATUS LED	Indicates a **PASS** test result with the letter **P** on the display.
REJECT STATUS LED	Indicates a **FAIL** test result with the letter **F** on the display.
TESTING STATUS LED	Indicates a test is in progress when lit.
MENU Key (■)	Returns the display to Menu #1.

◄ and ► Keys	Moves the display through Menu screens. ►moves Menu screen up to the next screen, ◄ moves Menu screen to the prior screen. Extended hold allows continuous movement of display up/down through all Menu screens.
▲ and ▼ Keys (UP/DN)	Executes/modifies the menu item being displayed One push changes a parameter set point by its smallest unit of measure. Holding the key for an extended time increases the rate of change of the set point and progress through the positions. A field pointer or arrow is displayed to indicate the position being changed. Activates Alarm and unit displays “=UNIT IS LOCKED!=” if operator tries to change a test parameter.

INSTRUMENT CONNECTIONS

Refer to "INSTRUMENT CONTROL AND CONNECTION LOCATIONS" for location of the connections mentioned below.

AIR SUPPLYCONNECTION (Pneumatic)	Compressed air inlet to the instrument. Instrument Connection Types: Quick disconnect or push fitting. Custom Instruments greater than 150 Psig to 300 Psig Maximum Input Pressure: Female Bulkhead fitting which will accept any male 1/8" NPT fitting or a standard 1/8" NPT male to 1/4" tube fitting. **CAUTION!** The air used for the WORKER must be clean, dry, instrument quality and at a recommended pressure between 90 and 150 PSIG MAX. A minimum of 60 PSIG must be supplied for proper operation. For models with a maximum test pressure higher than 50 PSIG, the inlet pressure must exceed the maximum test pressure by at least 10 PSIG. To ensure instrument quality air refer to Appendix D “Filter Drying System”.
TEST PORT CONNECTION (Pneumatic)	Test part connection to test port. Connection Type: Female Bulkhead 1/8" NPT that will accept the customer’s required fitting (see below-Bulkhead connections. **CAUTION!** Use caution when testing fluid filled products. Contamination of the instrument with fluids VOIDS the Warranty and requires extensive repairs. Vacuum units require a filter at the input to prevent intake of dirty air.
BULKHEAD CONNECTIONS	Common fittings that attach directly to the Female Bulkhead: Standard Connection: ¼” (6mm) Poly-tube to 1/8” NPT connection. Optional Connections: Quick Disconnect Small (1/8”) Male Colder. Quick Disconnect Small (1/8”) Female Colder. Male Luer Slip, Male Luer Lock, Female Luer Slip

PRINTER CONNECTION (Electrical)

Printer output connection:
Interface: Centronics
Connection Type: DB-25 Female
Printer cord:
DB25 Male/Centronics 36 (CN36), 25C Mold

RS232 CONNECTION (Electrical)

Serial port input/output connection:
Interface: RS232-C
Connection Type: DB-9 Female
RS232 Cord:
DB9 M/M Serial

ETHERNET CONNECTION (Optional)

RS-232/Ethernet Adapter required

ACCESSORY CONNECTION

Connection Type: DB-25 Male

FUSE

Non-CE Configured: 1.0 A @ 250 V, 72 Watts Max
Type: 5x20 mm Fast Acting Ceramic
Quantity Required-1

CE Configured: 1.0 A @ 250V, 72 Watts Max
Type: 5x20 mm Fast Acting Ceramic
Quantity Required-2

POWER SUPPLY

Universal: 95-250 Volts, 50-60 Hz
120 Volts, 50-60 Hz @ 0.6 Amps
240 Volts, 50-60 Hz @ 0.3 Amps

POWER CORD

Country	Plug	Connector	Cord	Approvals
US	NEMA 5-15P	IEC 60320 C-13	UL SJT E159216 VW-1 CSA SJT LL112007 VW-1	UL, CSA
England	Type G BS1363		HO5VV-F 250V/10A	N20050
European	Type E/F Hybrid CEE7/7		SHO55VV-F 250V/10A	UL, CSA N20050
Aus/NZ	3112 (AU1-10P)		HO5VV-F 250V/10A	Dept, of Fair Trading
China	CH1-10P		Temp Rated 70°C 250V/10A	CCC

POWER CORD ADAPTER

Receptacle side: CH1-10R Plug Side: Universal

INSTALLATION AND POWER UP INSTRUCTIONS

UNPACKING:
After taking the system out of its carton, make sure that the following parts are present:

WORKER Instrument,
Operator's Manual,
Air supply tube: ¼" NPT Male x ¼" PE tubing; tubing Length-6' minimum
2 Keys,
Calibration Report, and
Certificate of Inspection.

Contact the factory for missing or damaged parts.

Save all packing material for transport or return of instrument to a TM Authorized Service Center for service or recalibration.

INSTALLATION:
INSTRUMENT ENVIRONMENT
The *WORKER*™ should be installed in an environment with moderate temperature: 10-30ºC (50-90°F), and relative humidity less than 80%, non-condensing. Keep the instrument away from strong electromagnetic interference or machinery that generates large line voltage spikes.

Position the instrument so that the mains power switch is easily accessible to allow the unit to be switched off.

Do not position the instrument near water or where it can be splashed.

CONNECTIONS:
Connect the power cord into a properly grounded (Earthed) mains outlet socket.

US Units: Three pronged 120 Volt AC outlet socket

Worldwide Units: 110-240 Volt AC outlet socket

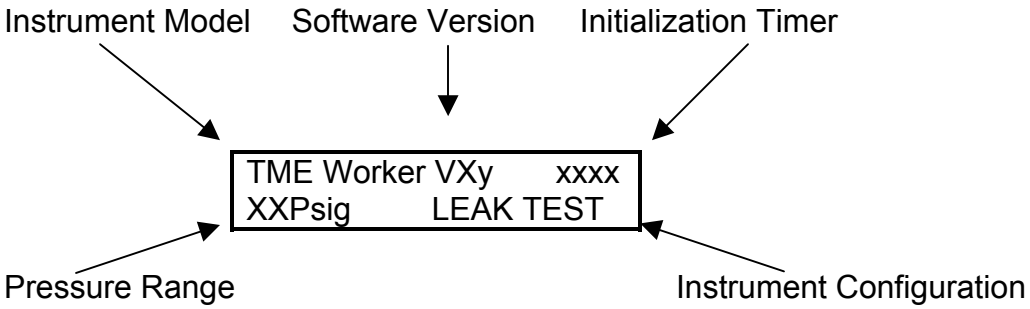
Connect the air hose from the "AIR SUPPLY" port to a compressed air outlet.

CAUTION! Do not exceed the Maximum Input Pressure indicated on the instrument's Compressed Air Warning label. Standard unit Maximum Input Pressure is 150 PSIG. A Custom unit's Maximum Input Pressure is above 150 PSIG as indicated on the Compressed Air Warning label.

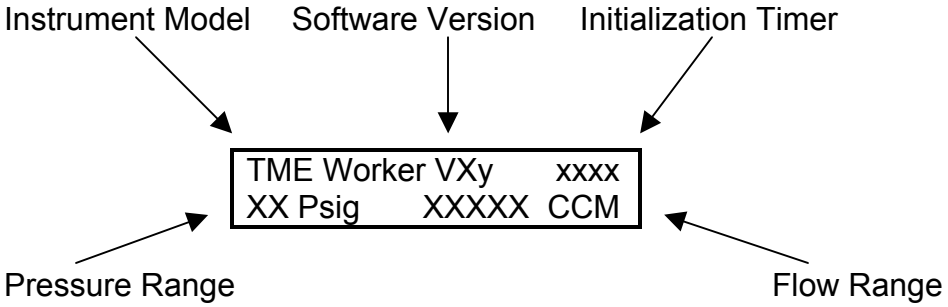
CAUTION! The air must be free of moisture, oil and dust and at a standard pressure between 90 and 150 PSIG. Other pressures may be required based on customer's special requests.

POWER UP:
Turn on the *WORKER* by using the power switch in the back of the instrument. On start up the instrument runs an automatic self-diagnostic test. During this test the instrument display appears as shown below for each of the *WORKER* Models.

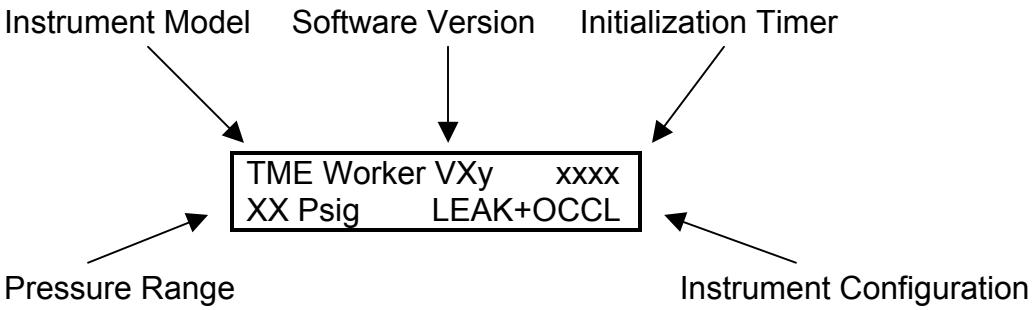
LEAK TEST MODEL



LEAK AND FLOW TEST MODEL



LEAK AND BACKPRESSURE OCCLUSION MODEL



The display shows the Instrument Model Name, the Software Version, the Initialization timer countdown, the instrument Pressure Range and where applicable the Flow Range. The ***ACCEPT***, ***REJECT*** and ***TESTING*** LED's are lit during the initialization period.

The Initialization Timer counts down from 1000 to 0 in the Leak Tester.

The Initialization Timer counts down from 3000 to 0 in the Leak and Flow and Leak and Backpressure Occlusion Testers.

The software version of the instrument is displayed as "VXy" where:

- "V" stands for "Version",
- "X" is a numeric designator starting at "1" and represents the software version, and
- "y" is an alpha designator beginning with "a" indicating the revision of the software version represented by the "X".

The full Initialization Time must be completed to ensure accuracy of all measurements. Once the self-diagnostic tests are completed the Ready Screen is displayed.

Ready	XX.XX Psig
LEAK	◊ P1

The above screen indicates that the following:

- LEAK indicates the instrument is in the Leak Test Mode,
- the ◊ indicates the Key lock status is **OFF**,
- P1 indicates Program 1, and
- XX.XX indicates the current pressure regulator setting and pressure units.

Note: The LEAK Test Mode displayed above may be replaced with one of the following test modes depending on instrument model and last test run prior to instrument shut down:

- FLOW indicating Flow Test Mode,
- LK+FW indicating Leak + Flow Test Mode,
- FW + LK indicating Flow + Leak Test Mode,
- OCC indicating Backpressure Occlusion Test Mode,
- OCC + LK indicating Backpressure Occlusion + Leak Test Mode, or
- LK + OCC indicating Leak + Backpressure Occlusion Test Mode.

MENU SCREENS

From the Ready screen the use of ◄ or ► key allows the operator to scroll to a higher or lower numbered Menu screen. The use of the ▲ or ▼ key allows the operator to execute or modify the menu item displayed.

The following table details the display associated with each Menu in the *WORKER* and the resulting item that may be executed or modified.

MENU SCREEN #-Title	**PRESS ▲▼ RESULTING ACTION**
#1-Program Number	Select desired Program Number Range: 1 - 100
#2-Test Mode	Select desired Test Mode Leak, Leak + Flow, Flow + Leak, Flow, Leak + Occlusion, Occlusion + Leak
#3- Pressure Spec.	Set Leak Specified Test Pressure
#4-Pressure Tolerance	Set Leak test Test Pressure Tolerance Range: -100.0-1000.0%
#5-Pressure Units	Select Psig, kPa, Bar, mBar, InH_2O, Kg/cm^2, cmH_2O, mmH_2O, InHg, mmHg
#6-Charge Timer	Set Leak test Charge time Range: 0.1 to 1000.0 sec. Smallest Increment: 0.1 sec.
#7-Settle Timer	Set Leak test Settle time Range: 0.1 to 1000.0 sec. Smallest Increment: 0.1 sec.
#8-Test Timer	Set Leak test Test time Range: 0.1 to 1000.0 sec. Smallest Increment: 0.1 sec.
#9-Decay Maximum	Set Leak Test Maximum Decay Limit Range: 0.0001 to 3.0000 Psig Smallest Increment: Varies based on instrument resolution. See Instrument Specifications Appendix E. See “Establishing Leak Test Parameters” in Chapter 2 LEAK TEST MODE

MENU SCREEN #/Title	RESULTING ACTION PRESS ▲▼
#10-Decay Units	Select Psig, kPa, Bar, mBar, InH_2O, Kg/cm^2, cmH_2O, mmH_2O, InHg, mmHg
#11-Clamp Timer	Set desired Clamp Delay time. Range: 0.0 to 100.0 Sec. Smallest Increment: 0.1 Sec.
#12-Bleed Timer	Set desired Bleed or Exhaust Time Range: 0.0 to 100.0 Sec. Smallest Increment: 0.1 Sec.
#13-Pause Timer	Set desired Pause time Range: 0.0 to 100.0 Smallest Increment: 0.1 Sec.
#14-Seal Timer	Set the desired Fill time Range: 0.0 to 100.0 Sec. Smallest Increment: 0.1 Sec.
#15-Alarm Mode	Select **ON** or **OFF**. With Alarm Mode **ON** the Failure Alarm sounds after each failed test.
#16-P, F, Tests	View Part Counters **P**-Number of **PASS** Results, **F**-Number of **FAIL** Results, **Tests**-Total number of Tests
#17-Send Datalog # n	Sends Datalog to external output Displays number of tests in Datalog
#18-Clear Datalog	Moves display to “Clear Datalog?” decision screen. Press START button for NO, Press UP/DN for YES.
#19-Datalog Warning	Disables “Clear Datalog?” warning. **ON** ensures that each time there is an attempt to change test parameters the “Clear Datalog” Warning is displayed and a decision is required. **OFF** disables the WARNING and automatically clears the Datalog every time a change is made without asking for confirmation.

MENU SCREEN #-Title	RESULTING ACTION PRESS ▲▼
#20-Calibration Mode	Moves display to transducer calibration check screen. See Chapter 8 Calibration Check.
#21-Set Time/Date	▲▼ keys adjust time and date. ◄► keys change the field being changed –i.e.: Hrs., Min. ■ returns display to Menu 21 after clock is updated.
#22-Print Last Test	Prints last test result.
#23-Print Program	Prints Program test parameters.
#24-Print Datalog	Prints all test results stored in Datalog.
#25-Printer Type	Allows printer selection from: TEXT, HP, EPSON, or CONT.
#26-Flow Maximum	Set Flow Test Maximum flow value Smallest Increment: Varies with instrument range. See Instrument Specifications Appendix F.
#27-Flow Minimum	Set Flow Test Minimum flow value. Smallest Increment: Varies with instrument range. See Instrument Specifications Appendix F.
#28-Flow Timer	Set Flow Test time. Range: 0-1000.0 sec. Step: 0.1 sec.
#29-Flow Units	Set Flow Test units-CCM or LPM.

CHAPTER 3 LEAK TEST MODE PAGE

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Establishing Test Specifications 31
Establishing Leak Test Parameters 32
WORKER Normal Leak Test Cycle 33
Programming a Normal Leak Test (Vacuum or Pressure) 35
Running a Leak Test 40

INTRODUCTION TO LEAK TESTING

Leaks can be detected in several different ways. Test methods range all the way from looking for a bubble (Bubble Testing) to testing for a few molecules of a tracer gas (Mass Spectrometer testing). The Bubble Test method seems efficient at first but its faults of high per unit cost due to handling, potential bacterial contamination of product, and operator "judgment" calls soon become apparent. The Mass Spectrometer Test method, on the other hand, carries a very high price tag as well as a high per unit cost. This method is more useful in testing for permeability than actual leaks.

A third test method known as the Pressure Decay Test method provides sensitive testing with simplified methods. A Pressure Decay Tester is must less costly than a Mass Spectrometer and has a lower per unit cost when compared to both the Bubble Test and the Mass Spectrometer Test. Pressure Decay testers monitor a gas pressurized part, or parts, for a decrease (or decay) in pressure during the test period. This decay is attributed to a leak in the part.

There are two types of pressure decay testers-the Differential Pressure Decay tester and the Single Ended Pressure Decay tester. As the term Differential implies, the Differential Pressure Decay test is looking for a difference in pressure decay between at least two volumes. One of these volumes should be a reference-a known no leak sample. If there is no known leak-free volume, it is difficult to determine if both units are leaking, with one leaking more than the other, or if only one unit is leaking. The Single End Tester is engineered to avoid the problems associated with reference part quality. Its simple air handling system pressurizes one unit and watches for a decay in the test pressure.

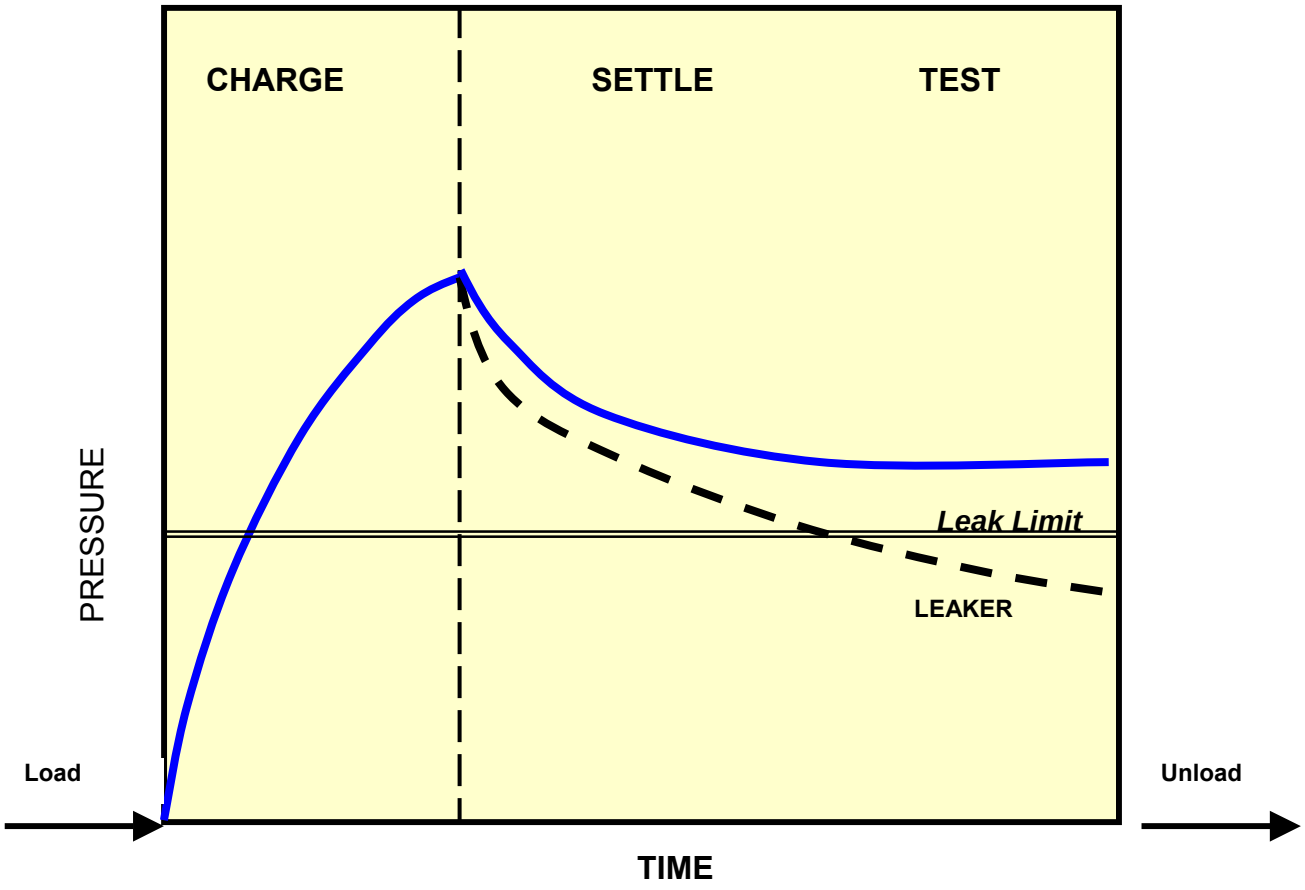
Both of these testers pressurize a gas and must deal with the physical effects of gas pressurization. When a gas is pressurized its temperature increases. This is known as "Adiabatic Heating". As this heat dissipates, the gas temperature and pressure decrease. Additionally, if the item being tested is flexible, its walls will expand during and immediately after pressurization. This expansion will also cause a pressure decrease.

The Differential Pressure Decay tester tests two or more units at the same time in order to cancel out the non-leak decay. The Single Ended tester will either compensate for the decay, (using mechanical, electrical or mathematical compensation), or incorporate the decay into the test by utilizing long stabilization periods or curve memorization-"ΔP". "ΔP" is equivalent to "Delta P" or DP and refers to changes in pressure.

The *WORKER* is a single end pressure decay system. As the term "pressure decay" implies, the tester is looking for a minute decrease (decay) in pressure in the tested part. The *WORKER*'s air handling system pressurizes the test volume and monitors this pressure over time. Any decrease in the monitored pressure is known as "Pressure Decay" and is attributed to a leak.

Since the *WORKER* pressurizes a gas to perform the test, it must deal with pressure decay due to “Adiabatic Heating” and test part flexibility. The *WORKER* uses a “Settle” or equilibration period to accommodate the cooling and expansion of the gas and the test part. After the “Settle” period is completed the test cycle begins and the instrument monitors pressure changes due to leakage from the test part.

Typical Decay Curve



ESTABLISHING TEST SPECIFICATIONS

Prior to setting the *WORKER* controls the following information needs to be established for the item to be tested.

Product Description
The following items will influence the design of the test program.
How will the item be used? Will it contain air or liquid? What pressures will the item be subjected and for what period of time? What is the elasticity of the item? What are the heat absorption properties of the item - material, temperature, volume?

Production Requirements
What test time will fit with the production process? What is the desired sampling rate or frequency?

Define the Leak Test Specifications
In determining the test specifications consider the system's internal volume, the test temperature, the test time and the density of air versus liquid. Establish the minimum leak rate to be detected by the test.

Establish Test Parameters
Identify the test time and test pressure that will detect leaks that correlate with the results of previous test methods.

ESTABLISHING LEAK TEST PARAMETERS

CHARGE TIME

The Charge time controls the amount of time used to pressurize the test part. Allow sufficient time for the pressure inside the part to reach the required test pressure. Use short charge times for small parts/volumes and long charge times for larger parts/volume items.

SETTLE TIME

The Settle time controls the amount of time allotted for the part to stabilize after pressurization. When setting this timer set sufficient time for the pressurized part to stabilize (equilibrate) to account for adiabatic cooling and elastic expansion.

Metallic devices, devices with large surface areas or devices that are colder than normal tend to absorb large amounts of heat from the pressurizing gas. The heat loss due to dissipation of heat to the walls of the device will show up as pressure decay during test.

Soft, flexible or otherwise compliant devices will expand when pressurized increasing the volume of the part. This volume increase will also show up as pressure decay during test. Some devices are so flexible that restraining by means of a fixture may be necessary to stop the expansion.

The Settle time should be set long enough to allow the part to reach 90 to 100% of its equilibrium state. The equilibrium state is reached when the part no longer expands and the temperature of the device is the same as that of the test gas. There is no universal Settle time that can be used since the time required to reach equilibrium depends on the volume of the part, its material of construction, its thickness, the test pressure and the test temperature. Settle time can only be determined through actual tests.

TEST TIME

The Test timer controls the amount of time used to monitor the decay of the test device. The Test timer should be set for the time required to detect a leak. Set a short test time when detecting large leaks and a long test time to detect small leaks. To increase reliability the Test timer should be set for the time required to see a minimum difference of 3 to 4 decay steps between good and bad parts. Five or more decay steps are most desirable. A “Decay Step” is the smallest amount of pressure decay that the instrument can detect, i.e.: resolution of the instrument.

PRESSURE SPECIFICATION

Pressure specification is the pressure to be used during testing. It is also known as the Test Pressure. This specified pressure is entered in Menu 3 and the pressure is set by manually turning the regulator knob at the back of the instrument until the desired pressure is displayed on the Ready Screen.

PRESSURE TOLERANCE (± % OF PRESSURE SPECIFICATION)
The selected test Pressure Tolerance is the amount that the regulator can vary and not stop a test. If the pressure of the regulator varies outside of the tolerance range, the instrument will not allow the test to begin.

DECAY MAXIMUM
The Decay Maximum is the pressure decay threshold used to determine a REJECT or FAILURE. Typically, the Decay Maximum is set 3 to 5 decay steps above the maximum decay of an acceptable part. For example, if the maximum decay of an acceptable part is 1.0 InH_2O at a resolution of 0.2 InH_2O, the Decay Maximum must be set at least at 1.6 or 2.0 InH_2O in order to allow a clear distinction between acceptable part and a reject part.

NOTE: Settings of below 3 decay steps are not recommended unless the leaks are large.

WORKER NORMAL LEAK TEST CYCLE

The WORKER Leak Test consists of three periods: CHARGE, SETTLE and TEST. The leak test begins when the START button is pressed. The part is pressurized to the specified pressure. This part of the cycle is called the CHARGE portion of the cycle or pressurization period.

The SETTLE portion of the cycle allows the part to expand and cool before it goes into the TEST portion of the cycle.

During the TEST portion of the cycle the pressure decay of the part is monitored and compared to the preset Decay Limit. If the decay is less than the Decay Maximum limit the part is accepted, the result displayed on the screen is a **P** for **PASS**, the green *ACCEPT* LED is lit and the pressure decay is display.

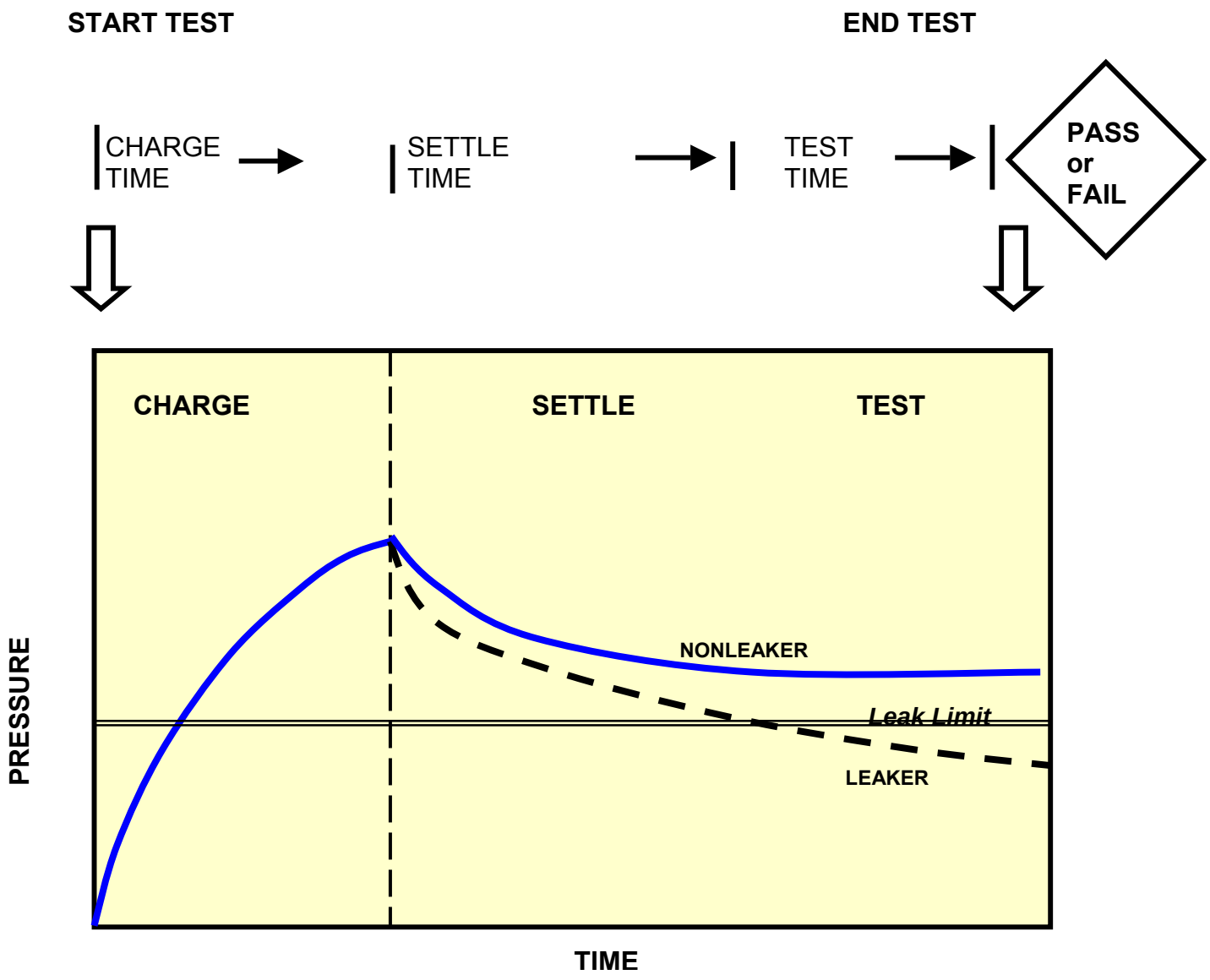
If the Decay reaches the preset Decay Maximum limit but the decay is less than the test Pressure Tolerance then the device is a reject and the result displayed on the screen is an **F** for **FAIL**, the red *REJECT* LED is lit, the audible alarm sounds (if ON) and the pressure decay is displayed.

If at the end of the TEST portion of the cycle the pressure decay exceeds the preset Decay Limit and the decay is greater than the set point of the Pressure Tolerance then the device being tested is considered a Gross leak failure and the display shows "3.0000* G" for gross leak, the red *REJECT* LED is lit and the audible alarm sounds (if ON). **NOTE:** The Pressure Tolerance should be set high enough so that good parts are not rejected due to their normal expansion and cooling.

If the instrument senses a pressure above its actual pressure tolerance range the display will indicate "Overpressure" as shown below:

The audible alarm will sound and the test will STOP at this point. Adjust the pressure to the Test Set Pressure to shut off the alarm. The test will need to be restarted.

WORKER NORMAL LEAK TEST CYCLE



PROGRAMMING A NORMAL LEAK TEST (VACUUM OR PRESSURE)

The following example details the steps to follow in programming the *WORKER* to run a Normal Pressure Decay Leak Test. It is designed to familiarize the operator with the Leak Test Menus, the display associated with each Menu, the keys used for setting flow test parameters and the display appearance during at the completion of the test.

NOTE: The settings to be entered will vary from those indicated below based on the instrument purchased. Review the Certificate of Inspection to determine instrument accuracy and range.

NOTE: The *WORKER* must be a pressure instrument to program a pressure decay leak test. If the instrument's configuration is a vacuum instrument, then a vacuum decay leak test must be programmed. A vacuum instrument will display the test pressure in the negative number format (i.e.: -10.00 Psig). The vacuum pressure specification and vacuum pressure decay are entered in the positive number format to allow for intuitive used of the ▲▼ (UP/DN) keys. The Vacuum pressure decay is displayed in the positive number format.

PROGRAM OVERVIEW

Program 1 will be programmed to test a part at 10.0 Psig ± 10% for 4 seconds with a Charge time of 2 seconds allowing 3 seconds for Settle, and having a Decay Maximum of 0.5 Psig.

SET TEST PARAMETERS

In the following example use the◄► keys to move to the indicated Menu display, use the ▲▼ keys to set the indicated test parameters.

NOTE: When setting test parameters those parameters to related to the test should be reviewed, cleared and set to 0.0 (or Off) to prevent the instrument from accidentally activating an unrelated test parameter.

Press	Resulting Action
■	Move from Ready screen to Menu 1
▲▼	Select Program 1
►	Move to Menu 2
▲▼	Select LEAK TEST Mode
►	Move to Menu 3
▲▼	Set Specified Pressure at 10.00 Psig
►	Move to Menu 4

Press	Resulting Action
▲▼	Set Pressure Tolerance at ±10.0%
►	Move to Menu 5
▲▼	Select Pressure Units-[Psig]
►	Move to Menu 6
▲▼	Set Charge Timer at 2.0 Sec.
►	Move to Menu 7
▲▼	Set Settle Timer at 3.0 Sec.
►	Move to Menu 8
▲▼	Set Test Timer at 4.0 Sec.
►	Move to Menu 9
▲▼	Set Decay Maximum at 0.5000 Psig for both pressure and vacuum test (Resolution based on instrument specification)
►	Move to Menu 10
▲▼	Select Decay Units [Psig]
►	Move to Menu 11
▲▼	Set Clamp Timer at 0.0 Sec.
►	Move to Menu 12
▲▼	Set Bleed Timer at 0.0 Sec.
►	Move to Menu 13
▲▼	Set Pause Timer at 0.0 Sec.
►	Move to Menu 14
▲▼	Set Seal Timer at 0.0 Sec.
►	Move to Menu 15

Press	Resulting Action
▲▼	Set Alarm Mode [**ON**]
►	Move to Menu 26
▲▼	Set Occlusion Maximum at 0.00
►	Move to Menu 27
▲▼	Set Occlusion Minimum at 0.00
►	Move to Menu 28
▲▼	Set Occlusion Timer at 2.0
►	Move to Menu 29
▲▼	Set Occlusion Units-[Psig]
●	Press START button to return to Ready display.

Adjust Pressure Regulator to the programmed Specified Pressure of 10.00 Psig for a pressure unit and –10.00 Psig for a vacuum unit.

RUN A LEAK TEST

See the section entitled “RUNNING A LEAK TEST”.

RUNNING A LEAK TEST

The following example explains the procedure for running a Normal Leak Test and continues with the example detailed in the section entitled “Programming a Normal Leak Test”.

PROCEDURE OVERVIEW

1.) Put the instrument in Ready Mode.
2.) Connect part to be tested.
3.) Run the Test.
4.) Read the result.

STEP 1-Put Instrument in Ready Mode

With the instrument in the Ready mode the instrument displays the following:

Ready	10.00 Psig
LEAK	P1

The display indicates the instrument is prepared to run a Leak Test per the parameters set in Program 1 (P1) at a test pressure of 10.00 Psig.

If the regulator pressure is outside the Test Pressure Tolerance Range and the START button is pressed the display will appear as shown below:

Ready?	XX.XXPsig
LEAK	◊ P1

The pressure regulator must be adjusted to the preset Test Pressure and the Ready screen will be displayed.

If the START button is pressed prior to the pressure being adjusted the following will be displayed:

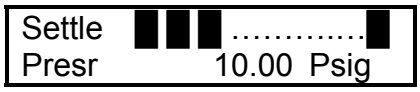
Prs=>	XX.XXPsig
Adjust	Prs. Regulator

The audible alarm sounds and the yellow ***TESTING*** LED is lit. Press the START button to move to the Ready display, silence the alarm and adjust the pressure to the preset Test pressure. The Ready screen will be displayed.

STEP 2-Connect the Test Part

For this example the part to be tested is a stopcock in its “OFF” position.
Connect the part to the test port.

Step 3-Run the Test
Press the "START" Button.
As the test is run the progress of the Charge, Settle and Test portions of the cycle is monitored on the display, along with the test pressure and the yellow ***TESTING*** LED is lit.



STEP 4-Read the Result
At the completion of the test the measured Decay is displayed along with the status of the part. The Accept, Reject and Gross Leak displays are shown below.

A **PASS** result is displayed when the observed pressure decay is less than the Decay maximum set point.

The observed pressure decay is shown in Psig with a **P** for **PASS**. The green ***ACCEPT*** LED is lit.

A **FAIL** result is displayed if the pressure decay reached the Decay maximum set point.

The observed decay is shown in Psig with an **F** for **FAIL**. The red ***REJECT*** LED is lit and the Alarm* sounds.

*** NOTE**: When the audible Alarm is set to **OFF** no alarm sounds when the result is a Reject.

A **GROSS LEAK** result is displayed when the observed pressure is outside the test specification tolerance range. Gross leaks are assigned a Decay Value of 3.000 Psig (or equivalent) with the over range symbol "*" to indicate the result status.

DP 3.0000* Psig G

The "3.0000*" and the G indicate a Gross Leak. The red ***REJECT*** LED is lit and the Alarm* sounds. To clear a result, press the Menu key to return to the Ready screen. To run a new test, simply press the START button from the result screen to begin a new test cycle. It is not necessary to go the Ready screen to start the next test.

- **NOTE**: When the audible Alarm is set to **OFF** no alarm sounds when the result is a Reject or a Gross Leak.

CHAPTER 4	FLOW TEST MODE	PAGE
	Leak and Flow Test Model Only	

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Establishing Flow Test Parameters 45
Programming a Normal Flow Test 46
Running a Flow Test 49

FLOW TESTING IN THE TME *WORKER* LEAK AND FLOW TESTER

In manufacturing and quality control, one of the most important parameters to be measured is flow. The airflow through a part can indicate whether the part is within the acceptable dimensional, seal or density tolerances.

For example, a smaller than normal flow rate in a particular section of tubing might indicate a reduction in the Internal Diameter (I.D.) of the tubing. An unusually high flow rate in a filter element might indicate lower fiber density or membrane perforation. In the extreme case, a very low or zero flow rate would indicate a partial or total occlusion of the part which might be the result of manufacturing flaws or poor bonding - welding, assembly operations, etc.

The *WORKER* uses a mass flow meter that is the state of the art in flow measurement technology to perform its flow tests. This allows accurate measurement of the flow through a part regardless of pressure or temperature.

ESTABLISHING FLOW TEST PARAMETERS

The flow test, as performed by the *WORKER*, requires the setting of the maximum and minimum acceptable flow rate limits.

- The Maximum Flow Rate limit is highest flow rate that the instrument will consider acceptable. If a part has a flow rate higher than this limit a FAIL result is displayed.

- The Minimum Flow Rate limit is lowest flow rate that the instrument will consider acceptable. If a part has a flow rate lower than this limit a FAIL result is displayed.

- The Flow Timer is used to control the duration of the flow test. Typically, the flow rate value settles to 98% of its final value in 6 seconds. However, if the flow meter is exposed to flow rates beyond its full scale, longer settle times are required to allow the flow meter to recover.

Once the flow rate of a particular part is known, the ***WORKER*** compares the measured value to limit set points. If the measured flow rate is within the acceptable range, the part will PASS the flow test. If the measured flow rate is outside the acceptable tolerance range the part will FAIL the test. For example, if a part is tested using a Minimum Flow Rate of 750 CCM and a Maximum Flow Rate of 1250 CCM, then parts with flow rates BETWEEN 750 and 1250 CCM would PASS the test while parts with flow rates below 750 CCM or above 1250 CCM would FAIL the test.

PROGRAMMING A NORMAL FLOW TEST

The following example details the steps to follow in programming the *WORKER* to run a Normal Flow Test. It is designed to familiarize the operator with the Flow Test Menus, the display associated with each Menu, the keys used for setting flow test parameters and the display appearance during and at the completion of the test.

NOTE-The settings to be entered will vary from those indicated below based on the instrument purchased. Review the Certificate of Inspection to determine instrument accuracy and range.

PROGRAM OVERVIEW

Program 1 will be programmed to test a part with a flow range of 450-1250 CCM. The Specified Test Pressure will be 1.00 Psig to produce a flow of approximately 900 CCM. The Test Pressure Tolerance will be ±2%. The Flow Test Time will be 6.0 seconds.

SET TEST PARAMETERS

In the following example use the ◄► keys to move to the indicated Menu display, use the ▲▼ keys to set the indicated test parameters.

NOTE: When setting test parameters those parameters not related to the test should be reviewed, cleared and set to 0.0 (of Off) to prevent the instrument from accidentally activating an unrelated test parameter.

Press	Resulting Action
■	Move from Ready screen to Menu 1
▲▼	Select Program 1
►	Move to Menu 2
▲▼	Select FLOW TEST
►	Move to Menu 3
▲▼	Set Specified Pressure at 1.00
►	Move to Menu 4
▲▼	Set Pressure Tolerance at 2.0%
►	Move to Menu 5
▲▼	Select Pressure Units-[Psig]
►	Move to Menu 6

Press	Resulting Action
▲▼	Set Charge Timer at 0.0
►	Move to Menu 7
▲▼	Set Settle Timer at 0.0
►	Move to Menu 8
▲▼	Set Test Timer at 0.0
►	Move to Menu 9
▲▼	Set Decay Maximum at 0.0000Psig
►	Move to Menu 10
▲▼	Set Decay Units-[Psig]
►	Move to Menu 11
▲▼	Set Clamp Timer at 0.0
►	Move to Menu 12
▲▼	Set Bleed Timer at 0.0
►	Move to Menu 13
▲▼	Set Pause Timer at 0.0
►	Move to Menu 14
▲▼	Set Seal Timer at 0.0
►	Move to Menu 15
▲▼	Set Alarm Mode [ON]
◄	Move to Menu 26
▲▼	Set Flow Maximum at 1250
►	Move to Menu 27
▲▼	Set Flow Minimum at 450

Press	Resulting Action
►	Move to Menu 28
▲▼	Set Flow Timer at 6.0
►	Move to Menu 29
▲▼	Set Flow Units-[CCM]
●	Press START button to return to Ready display

Adjust Pressure Regulator to the programmed Specified Test Pressure 1.00 Psig.

RUN A FLOW TEST
See the section entitled “Running A Flow Test”

RUNNING A FLOW TEST

The following example explains the procedure for running a Normal Flow Test and continues with the example detailed in the section entitled “Programming a Normal Flow Test”.

PROCEDURE OVERVIEW:

1.) Put the instrument in the Ready Mode.
2.) Connect the part to be tested.
3.) Run the Test.
4.) Read the Results.

STEP 1-Put the Instrument in Ready Mode

After programming the Flow Test as Program Number 1 and with the instrument in the Ready Mode the instrument displays the following:

Ready	X.XX	Psig
FLOW		◊ P1

NOTE: If the display indicates any other program then move to the Menu 1 display and select Program Number 1 by using the ▲ or ▼ key. Once Program Number 1 has been selected push the START button to move to the Ready display.

If the regulator pressure is outside the Test Pressure Tolerance Range and the START button is pressed the display will appear as shown below:

Ready?	XX.XXPsig
LEAK	◊ P1

The pressure regulator must be adjusted to the preset Test Pressure and the Ready screen will be displayed.

If the START button is pressed prior to the pressure being adjusted the following will be displayed:

Prs=>	XX.XXPsig
Adjust	Prs. Regulator

The audible alarm sounds and the yellow ***TESTING*** LED is lit. Press the START button to move to the Ready display, silence the alarm and adjust the pressure to the preset Test pressure. The Ready screen will be displayed.

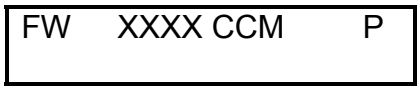
STEP 2-Connect the Test Part

Connect the part to the test port.

STEP 3-Run the Test
Press the START Button.
As the test is run the display monitors the progress of the test and appears as shown below.

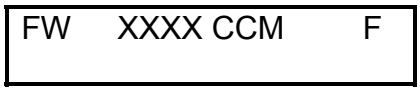
Step 4-Read the Results
At the completion of the test the measured Flow is displayed along with the status of the part. The Accept and Reject and Over/Under Range displays are shown below.

A **PASS** result is displayed if the measured flow is less than or equal to the Flow Maximum and greater than or equal to the Flow Minimum set points.



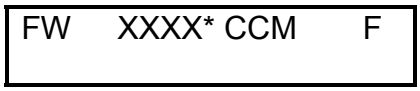
The observed flow is shown in CCM with a **P** for **PASS**. The green ***ACCEPT*** LED is lit.

A **FAIL** result is displayed if the measured flow is less than the Flow Minimum and greater than the Flow Maximum set points.



The observed flow is shown in CCM with an **F** for **FAIL**. The red ***REJECT*** LED is lit and the ALARM* sounds. To clear the result, press the Menu key to return to the Ready screen. To run a new test, simply press the START button from the result screen to begin a new test cycle. It is not necessary to go to the Ready screen to start the next test.

An **Over/Under-range** result is displayed when the measured flow is outside the flow meter range. The Over/Under-range symbol "*"is displayed with the reading as shown below:



A flow value is shown in CCM with an **F** for **FAIL**. The red ***REJECT*** LED is lit and the ALARM* sounds. A flow value of zero with an Over/Under-range symbol (0.00*) is used to indicate that the observed flow is below the lower limit of the flow meter range. **Any flow value with the Over/Under-range symbol is not accurate because the**

reported result is outside the flow meter range. To clear the result, press the Menu key to return to the Ready display. To run a new test, simply press the START button from the result display to begin a new test cycle. It is not necessary to go to the Ready display to start the next test.

***NOTE:** When the audible Alarm is set to **OFF** no alarm sounds when the result is a Reject or Over/under Range.

CHAPTER 5 BACKPRESSURE OCCLUSION TEST MODE PAGE
Leak and Backpressure Occlusion Test Model Only

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Programming an Backpressure Occlusion Test 55
Running a Backpressure Occlusion Test 58

INTRODUCTION TO BACKPRESSURE OCCLUSION TESTING

A backpressure occlusion test measures the backpressure created when air is allowed to flow through a test part. This is a measure of the resistance to airflow in the air path. When an occlusion occurs, a higher backpressure will be measured as compared to a good part. Knowing an acceptable range for backpressure allows good and bad parts to be identified by measuring a part's backpressure.

An acceptable backpressure range must be established on a group of known good parts. This range provides the maximum and minimum pressure limits to use for a backpressure test of the part.

During a backpressure occlusion test, the instrument opens the test port, air flows through the test part, creating a backpressure that the instrument measures. Once the backpressure range for known good parts is established a part's status can be identified by its measured backpressure. All parts that fall within the maximum and minimum pressure limits are considered ACCEPTED and parts above or below these limits are considered REJECTED.

ESTABLISHING BACKPRESSURE OCCLUSION TEST PARAMETERS

The backpressure occlusion test, as performed by the *WORKER*, requires the setting of the maximum and minimum acceptable backpressure occlusion limits.

The Maximum Occlusion limit is upper limit of backpressure that the instrument will consider acceptable. If a part measures a higher backpressure than this value the part is considered occluded and FAIL result is displayed.

The Minimum Occlusion limit is lower limit of backpressure that the instrument will consider acceptable. If a part has a lower backpressure than this limit a FAIL result is displayed.

The Occlusion Timer is used to control the length of the occlusion test. The timer should be set to a value that allows the Occlusion measurement to stabilize during the test cycle.

The Specified Pressure is the pressure setting to be used during the test.

The Pressure Tolerance is acceptable range for the specified test pressure

Establishing an acceptable backpressure range on a group of known good parts provides the maximum and minimum occlusion limits for the test. Once the backpressure range of a particular part is established, the *WORKER* can compare the measured backpressure of a part to the occlusion limit set points. If the measured backpressure is within the acceptable range, the part will PASS the backpressure occlusion test. If the measured backpressure is outside the acceptable tolerance range the part will FAIL the test. For example, if a part is considered to have an acceptable backpressure range of 2.00 to 4.80 Psig then parts with backpressures between 2.00 and 4.80 Psig would PASS the test while parts with backpressures below 2.00 Psig or above 4.80 Psig would FAIL the test and would be considered occluded.

PROGRAMMING A BACKPRESSURE OCCLUSION TEST

The following example details the steps to follow in programming the *WORKER* to run a Backpressure Occlusion Test. It is designed to familiarize the operator with the Occlusion Test Menus, Menu displays, the keys used to set Backpressure Occlusion test parameters and the display appearance during and at the completion of the test.

NOTE-Accuracy of the settings to be entered will vary from those indicated below based on the instrument purchased. Review the Certificate of Inspection to determine instrument accuracy and range.

PROGRAM OVERVIEW-PARAMETERS

Program 1 will be programmed to test a part with a known acceptable backpressure occlusion pressure range of 2.00 to 4.80 Psig when tested at a Test Pressure of 5.00±10.0% Psig for a test time of 2.0 seconds.

SET TEST PARAMETERS

In the following example use the ◄► keys to move to the indicated Menu display, use the ▲▼ keys to set the indicated test parameters.

NOTE: When setting test parameters those parameters not related to the test should be reviewed, cleared and set to 0.0 (or Off) to prevent the instrument from accidentally activating an unrelated test parameter.

Press	Resulting Action
■	Move from Ready display to Menu 1
▲▼	Select Program 1
►	Move to Menu 2
▲▼	Select OCCLUSION TEST
►	Move to Menu 3
▲▼	Set Specified Pressure at 5.00 Psig
►	Move to Menu 4
▲▼	Set Pressure Tolerance at 10.0%
►	Move to Menu 5
▲▼	Select Pressure Units-[Psig]
►	Move to Menu 6

Press	Resulting Action
▲▼	Set Charge Timer at 0.0
►	Move to Menu 7
▲▼	Set Settle Timer at 0.0
►	Move to Menu 8
▲▼	Set Test Timer at 0.0
►	Move to Menu 9
▲▼	Set Decay Maximum at 0.0000 Psig
►	Move to Menu 10
▲▼	Set Decay Units-[Psig]
►	Move to Menu 11
▲▼	Set Clamp Timer at 0.0
►	Move to Menu 12
▲▼	Set Bleed Timer at 0.0
►	Move to Menu 13
▲▼	Set Pause Timer at 0.0
►	Move to Menu 14
▲▼	Set Seal Timer at 0.0
►	Move to Menu 15
▲▼	Set Alarm Mode [ON]
► or ◄	Move to Menu 26
▲▼	Set Occlusion Maximum at 4.80
►	Move to Menu 27

Press	Resulting Action
▲▼	Set Occlusion Minimum at 2.00
►	Move to Menu 28
▲▼	Set Occlusion Timer at 2.0
►	Move to Menu 29
▲▼	Set Occlusion Units-[Psig]
●	Press START button to return to Ready display

Adjust Pressure Regulator to the programmed Specified Test Pressure 5.00 Psig.

RUN A BACKPRESSURE OCCLUSION TEST

See the section entitled “Running A Backpressure Occlusion Test”

RUNNING A BACKPRESSURE OCCLUSION TEST

The following example explains the procedure for running a Normal Backpressure Occlusion Test and continues with the example detailed in the section entitled "Programming a Normal Backpressure Occlusion Test".

Procedure Overview:
Put the instrument in the "Ready" Mode.
Connect the part to be tested.
Run the test.
Read the results.

STEP 1-Put the Instrument in Ready Mode
After programming the Backpressure Occlusion Test as Program Number 1 and with the instrument in the Ready Mode the instrument displays the following:

Ready	X.XX	Psig
Occls		◊P1

NOTE- If the display indicates any other program then move to the Menu 1 display and select Program Number 1 by using the ▲ or ▼ key. Once Program Number 1 has been selected push the START button to move to the Ready display.

If the regulator pressure is outside the Test Pressure Tolerance Range and the START button is pressed the display will appear as shown below:

Ready?	XX.XX	Psig
LEAK	◊	P1

The pressure regulator must be adjusted to the preset Test Pressure and the Ready screen will be displayed.

If the START button is pressed prior to the pressure being adjusted the following will be displayed:

Prs=>	XX.XXPsig
Adjust	Prs. Regulator

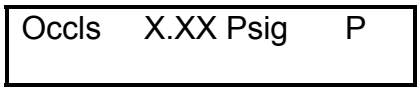
The audible alarm sounds and the yellow *TESTING* LED is lit. Press the START button to move to the Ready display, silence the alarm and adjust the pressure to the preset Test pressure. The Ready screen will be displayed.

STEP 2-Connect the Test Part.
Connect the part to the test port.

STEP 3-Run the Test
Press the START Button.
As the test is run the display monitors the progress of the test and displays the Backpressure measured at the transducer inside the unit. The display appears as shown below.

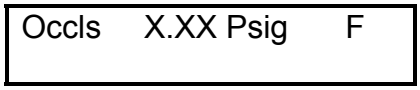
Step 4-Read the Results
At the completion of the test the measured Backpressure is displayed along with the status of the part. The Accept and Reject Displays are shown below.

A **PASS** result is displayed if the measured flow is less than or equal to the Occls Maximum and greater than or equal to the Occls Minimum set points.



The observed flow is shown in Psig with a **P** for **PASS**. The green ***ACCEPT*** LED is lit.

A **FAIL** result is displayed if the measured flow is less than the Occls Minimium set point or greater than the Occls Maximum and greater than or equal to the Flow Minimum set points.



The observed flow is shown in Psig with an **F** for **FAIL**. The red REJECT LED is lit and the ALARM* sounds. Press the Menu Key to stop the alarm and move to the Ready display.

To clear the result, press the Menu key to return to the Ready display.

To run a new test, simply press the START button from the result display to begin a new test cycle. It is not necessary to go to the Ready display to start the next test.

***NOTE:** When the audible Alarm is set to **OFF** no alarm sounds when the result is a Reject.

CHAPTER 5	TWO-PART TEST MODES IN THE *WORKER* Leak and Flow/Leak and Backpressure Occlusion Test Models Only	PAGE

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LEAK AND FLOW TESTING IN THE LEAK AND FLOW TEST MODEL

The *WORKER* Leak and Flow Test Model is able run any of the following tests:

- Leak Test,
- Flow Test,
- Leak and Flow Test, or
- Flow and Leak Test.

The setting of test parameters for an individual leak or flow test is detailed in earlier chapters. This information should be reviewed prior to setting the test parameters for a Leak + Flow or Flow + Leak Test.

There is no functional difference in the Leak + Flow or Flow + Leak test modes. The two modes have been provided to accommodate special test fixtures that may require a particular test sequence. For example, when programming a test involving a sealing device the Flow + Leak Mode should be used because the leak test requires the part be sealed. The sealing of the part deforms it and a flow test is not appropriate after sealing has altered the part.

When running a two part test the instrument the instrument can be set to pause between the tests to allow for sealing of the device. After the pause time the instrument will proceed through the second test. The Pause Timer (Menu 13) must be set to the desired time when setting the test set up parameters.

After the completion of the two tests both test results will be displayed. If the first test is a failure/reject the test sequence will be terminated. The second test will not be run and the failure of the first test will be displayed.

LEAK AND BACKPRESSURE OCCLUSION TESTING IN THE LEAK AND BACKPRESSURE OCCLUSION TEST MODEL

The *WORKER* Leak and Backpressure Occlusion Test Model is able run any of the following tests:

- Leak Test,
- Backpressure Occlusion Test,
- Leak and Backpressure Occlusion Test, or
- Backpressure Occlusion and Leak Test.

The setting of test parameters for an individual leak or backpressure occlusion test is detailed in earlier chapters. This information should be reviewed prior to setting the test parameters for a Leak + Backpressure Occlusion Test or Backpressure Occlusion + Leak Test.

There is no functional difference in the Leak + Backpressure Occlusion or Backpressure Occlusion + Leak test modes. The two modes have been provided to accommodate special test fixtures that may require a particular test sequence. For example, when programming a combination test consideration must be given to the fact that the leak test requires all openings in the part be **sealed or closed** during the leak test and the intended air path in the part must be **open** during the backpressure occlusion test. A Pause Timer is provided to control the time between the two tests and aid in the opening and closing of sealing device(s). The Pause Timer (Menu 13) must be set to the desired time when setting the test set up parameters.

After the completion of the two tests both test results will be displayed. If the first test is a failure/reject the test sequence will be terminated. The second test will not be run and the failure of the first test will be displayed.

ESTABLISHING TEST PARAMETERS FOR TWO-PART TESTS

Recommendations for establishing individual test parameters in the different models of the *WORKER* are detailed in earlier chapters of this manual. These recommendations also apply to two part tests and should be reviewed prior to programming a two-part test.

There are additional requirements that **must** be taken into consideration when establishing test parameters for a two-part test.

1. Both tests of a two-part test must have the same test set points for:
    - Specified Pressure,
    - Pressure Tolerance, and
    - Pressure Units.

2. If needed, the Pause timer must be set to allow sufficient time between tests to manually open and close the leak and flow/backpressure occlusion path.

PROGRAMMING A TWO-PART LEAK AND FLOW TEST

The following example details the steps to follow in programming the WORKER to run two-part test. This example consists of a Leak Test followed by a Flow Test with a Pause time in between the two tests and assumes that the reader has reviewed earlier chapters that detail the programming of individual tests.

NOTE: Accuracy of the settings to be entered will vary from those indicated below based on the instrument purchased. Review the Certificate of Inspection to determine instrument range and accuracy.

PROGRAM OVERVIEW

Program 1 will be programmed to Leak and Flow test a part. The part will be leak tested at 1.00 Psig ±2.0 % for 4.0 seconds with a Charge time of 2.0 seconds allowing 3 seconds for Settle having a Decay Maximum of 0.5 Psig. The same part has a flow of approximately 900 CCM with a flow minimum set point of 450 and a flow maximum set point of 1250 CCM when tested for 2.0 seconds. The Pause time required between tests will be 10.0 seconds.

SET TEST PARAMETERS

In the following example use the◄► keys to move to the indicated Menu display, use the ▲▼ keys to set the indicated test parameters.

NOTE: When setting test parameters those parameters not related to the test should be reviewed, cleared and set to 0.0 (or Off) to prevent the instrument from accidentally activating an unrelated test parameter.

Press	**Resulting Action**
■	Move from Ready screen to Menu 1
▲▼	Select Program 1
►	Move to Menu 2
▲▼	Select LEAK + FLOW TEST
►	Move to Menu 3
▲▼	Set Specified Pressure at 1.00 Psig
►	Move to Menu 4
▲▼	Set Pressure Tolerance at ±2.0%
►	Move to Menu 5

Press	Resulting Action
▲▼	Select Pressure Units-[Psig]
►	Move to Menu 6
▲▼	Set Charge Timer at 2.0 Sec.
►	Move to Menu 7
▲▼	Set Settle Timer at 3.0 Sec.
►	Move to Menu 8
▲▼	Set Test Timer at 4.0 Sec.
►	Move to Menu 9
▲▼	Set Decay Maximum at 0.5000 Psig (Resolution varies based on instrument specification)
►	Move to Menu 10
▲▼	Select Decay Units [Psig]
►	Move to Menu 11
▲▼	Set Clamp Timer at 0.0 Sec.
►	Move to Menu 12
▲▼	Set Bleed Timer at 0.0 Sec.
►	Move to Menu 13
▲▼	Set Pause Timer at 10.0 Sec.
►	Move to Menu 14
▲▼	Set Seal Timer at 0.0 Sec.
►	Move to Menu 15
▲▼	Set Alarm Mode [**ON**]
► or ►	Move to Menu 26

Press	Resulting Action
▲▼	Set Flow Maximum at 1250
►	Move to Menu 27
▲▼	Set Flow Minimum at 450
►	Move to Menu 28
▲▼	Set Flow Timer at 2.0
►	Move to Menu 29
▲▼	Set Flow Units-[CCM]
●	Press START button to return to Ready display

Adjust Pressure Regulator to the programmed Specified Test Pressure 1.00 Psig.

RUNNING A TWO PART LEAK + FLOW TEST

See the section entitled “RUNNING A TWO-PART LEAK + FLOW TEST”.

RUNNING A TWO-PART LEAK AND FLOW TEST

The following example explains the procedure for running a two part Leak + Flow Test and continues with the example detailed in the section entitled “Programming a Two Part Leak And Flow Test”.

PROCEDURE OVERVIEW
Put the instrument in Ready Mode.
Connect part to be tested.
Run the Test.
Read the result.

STEP 1-Put Instrument in Ready Mode
With the instrument in the “Ready” mode the instrument displays the following:

Ready	1.00	Psig
LK+FW		◊P1

The display indicates the instrument is prepared to run a Leak + Flow Test per the parameters set in Program 1 (P1) at a test pressure of 1.00 Psig.

If the regulator pressure is outside the Test Pressure Tolerance Range and the START button is pressed the display will appear as shown below:

Ready?	XX.XXPsig
LK+FW	◊P1

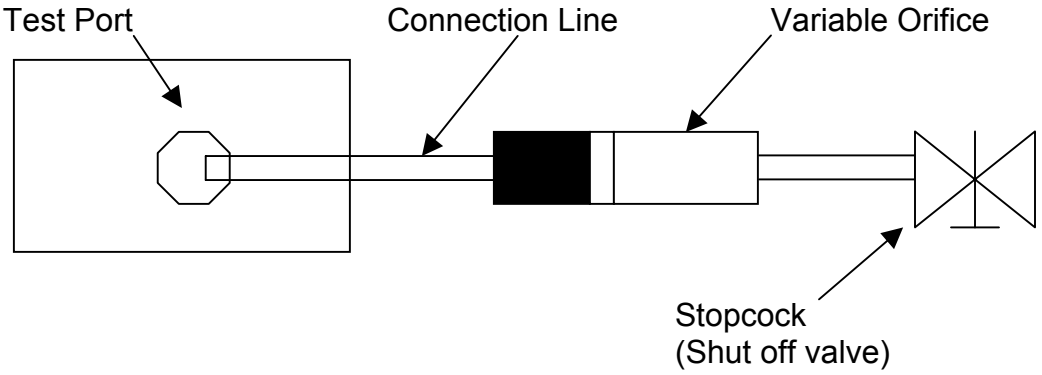
The pressure regulator must be adjusted to the preset Test Pressure and the Ready screen will be displayed.

If the START button is pressed prior to the pressure being adjusted the following will be displayed:

Prs=>	XX.XXPsig
Adjust	Prs. Regulator

The audible alarm sounds and the yellow ***TESTING*** LED is lit. Press the START button to move to the Ready display, silence the alarm and adjust the pressure to the preset Test pressure. The Ready screen will be displayed.

STEP 2-Connect the Test Part
For this example the part to be tested is a variable flow orifice in series with a stopcock (or shut off valve). The variable flow orifice must be adjusted to the desired flow of approximately 900 CCM. The positioning of the part to the instrument is shown below.



Connect the part to the test port. Verify that the stopcock is in the **closed** position.

Step 3-Run the Test
Press the "START" Button.
As the Leak test is run the progress of the Charge, Settle and Test portions of the cycle is monitored on the display, along with the test pressure and the yellow ***TESTING*** LED is lit.

If the part passes the Leak test the instrument will move to the Pause portion of the test cycle and the display will monitor the Pause Time as shown below.

In this example the operator must manually **open** the stopcock within the Pause time period. The yellow ***TESTING*** LED remains lit during the Pause time. After the Pause time is complete the instrument runs the Flow test and the display appears as shown below.

The yellow *TESTING* **LED remains lit throughout the flow test.**

Step 4-Read the Results
At the completion of the Flow test both the Leak and Flow results are displayed.

At the completion of both tests **PASS** results are displayed when the observed pressure decay is less than the Decay Maximum set point and the measured flow is within the 450 to 1250 CCM range.

The observed pressure decay is shown in Psig, the measure flow is shown in CCM and both results include a **P** for **PASS.** The green ***ACCEPT*** LED is lit.

A **PASS** Leak result and a **FAIL** Flow result are displayed when the observed pressure decay is less than the Decay Maximum set point and the measured flow is outside the acceptable flow range of 450 to 1250 CCM.

The observed decay is shown in Psig with a **P** for **PASS**. The observed flow is shown in CCM with an **F** for **FAIL**. The red ***REJECT*** LED is lit and the Alarm* sounds to indicate that the Flow test failure.

A **PASS** Leak result and an **Over Range** Flow result are displayed when the observed pressure decay is less than the Decay Maximum set point and the measured flow is outside the acceptable flow range of 450 to 1250 CCM the flow meter range. The over range symbol "*"is displayed with the reading as shown below:

The observed decay is shown in Psig with a **P** for **PASS**. The flow value is shown in CCM with the over range symbol "*" with an **F** for **FAIL**. The red ***REJECT*** LED is lit and the ALARM* sounds.

*** NOTE**: When the audible Alarm is set to **OFF** no alarm sounds when the result is a Reject.

If the **first test result** of a two-part test is a reject the instrument stops and does not run the second test. In this example if the Leak Test result is a **FAIL** the instrument does not start the Flow test. A **FAIL** result is displayed if the pressure decay exceeded the Decay Maximum set point.

DP X.XXXX Psig F

The observed decay is shown in Psig with an **F** for **FAIL**. The red ***REJECT*** LED is lit and the Alarm* sounds.

A **GROSS LEAK** result is displayed when the observed pressure is outside the test specification tolerance range. Gross leaks are assigned a Decay Value of 3.000 Psig (or equivalent) with the over range symbol "*" to indicate the result status.

DP 3.0000* Psig G

The "3.0000*" and the G indicate a Gross Leak. The red ***REJECT*** LED is lit and the Alarm* sounds. Press the Menu Key to stop the alarm and move to the Ready display. To clear a result, press the Menu key to return to the Ready screen. To run a new test, simply press the START button from the result screen to begin a new test cycle. It is not necessary to go the Ready screen to start the next test.

***NOTE:** When the audible Alarm is set to **OFF** no alarm sounds when the result is a Gross Leak.

See Chapter 3 for Reject and Over/Under-range Flow test result displays when running a Flow + Leak Test.

PROGRAMMING A TWO-PART LEAK AND BACKPRESSURE OCCLUSION TEST

The following example details the steps to follow in programming the WORKER to run two-part test. This example consists of a Leak Test followed by a Backpressure Occlusion Test with a Pause time in between the two tests and assumes that the reader has reviewed earlier chapters that detail the programming of individual tests.

NOTE: Accuracy of the settings to be entered will vary from those indicated below based on the instrument purchased. Review the Certificate of Inspection to determine instrument range and accuracy.

PROGRAM OVERVIEW

Program 1 will be programmed to run a Leak and a Backpressure Occlusion test on a part. The part will be leak tested at 5.00 Psig ±10.0 % for 4.0 seconds with a Charge time of 2.0 seconds allowing 3.0 seconds for Settle having a Decay Maximum of 0.5000 Psig. The same part has a backpressure occlusion of approximately 5.00 Psig with an Occlusion Minimum set point of 3.00 and an Occlusion Maximum set point of 6.00 Psig when tested for 1.6 seconds. The Pause time required between tests will be 10.0 seconds.

SET TEST PARAMETERS

In the following example use the◄► keys to move to the indicated Menu display, use the ▲▼ keys to set the indicated test parameters.

NOTE: When setting test parameters those parameters not related to the test should be reviewed, cleared and set to 0.0 (or Off) to prevent the instrument from accidentally activating an unrelated test parameter.

Press	**Resulting Action**
■	Move from Ready screen to Menu 1
▲▼	Select Program 1
►	Move to Menu 2
▲▼	Select LEAK + OCCLUSION
►	Move to Menu 3
▲▼	Set Specified Pressure at 5.00 Psig
►	Move to Menu 4
▲▼	Set Pressure Tolerance at ±10.0%
►	Move to Menu 5

Press	Resulting Action
▲▼	Select Pressure Units - [Psig]
►	Move to Menu 6
▲▼	Set Charge Timer at 2.0 Sec.
►	Move to Menu 7
▲▼	Set Settle Timer at 3.0 Sec.
►	Move to Menu 8
▲▼	Set Test Timer at 4.0 Sec.
►	Move to Menu 9
▲▼	Set Decay Maximum at 0.5000 Psig (Resolution varies based on instrument specification)
►	Move to Menu 10
▲▼	Select Decay Units [Psig]
►	Move to Menu 11
▲▼	Set Clamp Timer at 0.0 Sec.
►	Move to Menu 12
▲▼	Set Bleed Timer at 0.0 Sec.
►	Move to Menu 13
▲▼	Set Pause Timer at 10.0 Sec.
►	Move to Menu 14
▲▼	Set Seal Timer at 0.0 Sec.
►	Move to Menu 15
▲▼	Set Alarm Mode [**ON**]
► or ◄	Move to Menu 26

Press	Resulting Action
▲▼	Set Occls Maximum at 6.00
►	Move to Menu 27
▲▼	Set Occls Minimum at 3.00
►	Move to Menu 28
▲▼	Set Flow Timer at 1.6
►	Move to Menu 29
▲▼	Set Flow Units-[Psig]
●	Press START button to return to Ready display

Adjust Pressure Regulator to the programmed Specified Test Pressure 1.00 Psig.

RUNNING A TWO PART LEAK + BACKPRESSURE OCCLUSION TEST
See the section entitled “RUNNING A TWO-PART LEAK + BACKPRESSURE OCCLUSION TEST”.

RUNNING A TWO-PART LEAK AND BACKPRESSURE OCCLUSION TEST

The following example explains the procedure for running a two part Leak + Backpressure Occlusion Test and continues with the example detailed in the section entitled “Programming a Two Part Leak And Backpressure Occlusion Test”.

PROCEDURE OVERVIEW
Put the instrument in Ready Mode.
Connect part to be tested.
Run the Test.
Read the result.

STEP 1-Put Instrument in Ready Mode
With the instrument in the “Ready” mode the instrument displays the following:

Ready	1.00	Psig
LK+OCCL		◊P1

The display indicates the instrument is prepared to run a Leak and Backpressure Occlusion Test per the parameters set in Program 1 (P1) at a test pressure of 1.00 Psig.

If the regulator pressure is outside the Test Pressure Tolerance Range and the START button is pressed the display will appear as shown below:

Ready?	XX.XXPsig
LK+OCCL	◊P1

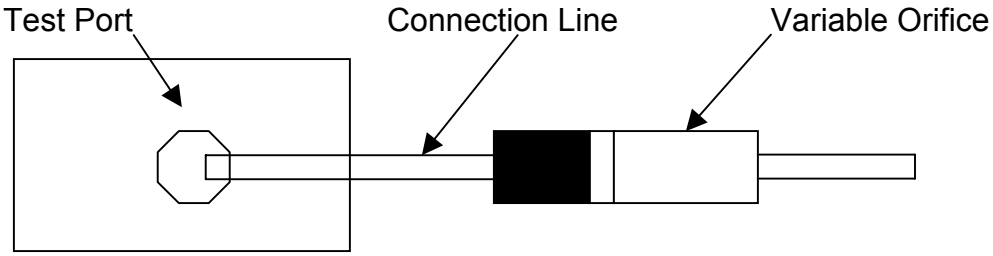
The pressure regulator must be adjusted to the preset Test Pressure and the Ready screen will be displayed.

If the START button is pressed prior to the pressure being adjusted the following will be displayed:

Prs=>	XX.XXPsig
Adjust	Prs. Regulator

The audible alarm sounds and the yellow ***TESTING*** LED is lit. Press the START button to move to the Ready display, silence the alarm and adjust the pressure to the preset Test pressure. The Ready screen will be displayed.

STEP 2-Connect the Test Part
For this example the part to be tested is a variable leak orifice. The orifice must be in the closed position for the leak test and in an open position for the backpressure occlusion test. The positioning of the part to the instrument is shown below.



Connect the part to the test port. Verify that the leak orifice is in the **closed** position.

Step 3-Run the Test
Press the "START" Button.
As the Leak test is run the progress of the Charge, Settle and Test portions of the cycle is monitored on the display, along with the test pressure and the yellow ***TESTING*** LED is lit.

If the part passes the Leak test the instrument will move to the Pause portion of the test cycle and the display will monitor the Pause Time as shown below.

In this example the operator must manually **open** the leak orifice within the Pause time period. The yellow ***TESTING*** LED remains lit during the Pause time. After the Pause time is complete the instrument runs the Flow test and the display appears as shown below.

The yellow ***TESTING*** LED remains lit throughout the flow test.

Step 4-Read the Results
At the completion of the Backpressure Occlusion test both results are displayed.

At the completion of both tests **PASS** results are displayed when the observed pressure decay is less than the Decay Maximum set point and the measured backpressure is within the 3.00 to 6.00 Psig range.

The observed pressure decay and Backpressure are shown in Psig and both results include a **P** for **PASS.** The green ***ACCEPT*** LED is lit.

A **PASS** Leak result and a **FAIL** Backpressure result are displayed when the observed pressure decay is less than the Decay Maximum set point and the measured backpressure is outside the acceptable backpressure range of 3.00 to 6.00 Psig.

The observed decay is shown in Psig with a **P** for **PASS**. The observed backpressure is shown in Psig with an **F** for **FAIL**. The red ***REJECT*** LED is lit and the Alarm* sounds to indicate that the Backpressure test failure.

*** NOTE**: When the audible Alarm is set to **OFF** no alarm sounds when the result is a Reject.

If the **first test result** of a two-part test is a reject the instrument stops and does not run the second test. In this example if the Leak Test result is a REJECT the instrument does not start the Backpressure Occlusion test. A **FAIL** result is displayed if the pressure decay exceeded the Decay Maximum set point.

DP X.XXXX Psig F

The observed decay is shown in Psig with an **F** for **FAIL**. The red ***REJECT*** LED is lit and the Alarm* sounds.

A **GROSS LEAK** result is displayed when the observed pressure is outside the test specification tolerance range. Gross leaks are assigned a Decay Value of 3.000 Psig (or equivalent) with the over range symbol "*" to indicate the result status.

DP 3.0000* Psig G

The "3.0000*" and the G indicate a Gross Leak. The red ***REJECT*** LED is lit and the Alarm* sounds. Press the Menu Key to stop the alarm and move to the Ready display. To clear a result, press the Menu key to return to the Ready screen. To run a new test, simply press the START button from the result screen to begin a new test cycle. It is not necessary to go the Ready screen to start the next test.

***NOTE:** When the audible Alarm is set to **OFF** no alarm sounds when the result is a Gross Leak.

CHAPTER 7 CLAMP DRIVER, BLEED CYCLE, SEAL AND PAUSE TIMERS PAGE

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CLAMP DRIVER OPTION

NOTE: The Clamp Driver is a separate option, which is ordered at the time of purchase.

Clamp delay is the time from the beginning of the test that the instrument allows for the holding clamp (or fixture) to actuate fully on the test part before applying the test pressure. The clamp driver is a feature that allows the *WORKER* to control pneumatic fixtures that are used to restrain or seal the device being tested. When enabled the clamp driver energizes an external low power valve or solenoid for the duration of the test cycle. After the test is over the valve remains de-energized until the next test.

To enable the clamp driver, set the Clamp Timer to a value higher than zero, typically between 0.5 and 1.0 seconds. The Clamp Timer address appears in Menu 11.

BLEED CYCLE

The Bleed Cycle is a function of the *WORKER* that allows the release of the pressure inside the device under test after the test is done. Bleed time is useful when parts are tested at high pressures and/or restrained by a fixture. In these cases the part will be difficult or dangerous to remove from the fixture unless the pressure is exhausted or bled internally in the instrument.

In order to enable the Bleed Cycle set the BLEED TIMER to a value higher than zero typically between 0.5 and 1.0 seconds for small parts. The BLEED TIMER is Menu 12.

A typical *WORKER* Clamp + Bleed Test Cycle is diagrammed below:

NOTE: When the bleed function is used the air inside the part flows back into the instrument carrying any loose debris or dust from inside the part. To prevent contamination of the internal pneumatics of the *WORKER* the use of a filter at the front port is recommended.

SEAL TIMER

NOTE: A Sealing device is a separate external option, which is ordered at the time of purchase.

Sealing time is the time during the test that the instrument allows for an external sealing fixture to actuate fully on the test part before applying the test pressure. A sealing fixture may be designed to restrain or seal a device being tested. For example a sealing fixture:

- may close off or dead end an open tube prior to leak testing
- may hold a tube in place while the instrument applies air to a dead ended part, or
- may hold a vent valve in line for flow testing.

To activate an external sealing device, set the Seal Timer to a value higher than zero, typically between 0.5 and 1.0 seconds. The Seal valve will automatically open to allow a Flow Test. The Seal Timer address appears in Menu 14.

PAUSE TIMER

The Pause Timer is a user-adjustable timer that controls the time between the individual tests in a Two Part Test. This timer aids in the timing of the opening and closing of sealing devices required when a two part test is performed of a part. The Pause Time must be set when setting test set up parameters and is accessed through Menu 13.

CHAPTER 8 CALIBRATION CHECK PAGE

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PRESSURE CALIBRATION CHECK PROCEDURE

The following details the procedure for checking the calibration of the instrument's pressure transducer.

PROCEDURE OVERVIEW
Put the instrument in the Calibration Mode Menu Screen #20
Attach Standard Pressure Gauge
Check Zero
Verify Supply is "ON"
Attach standard pressure gauge
Check Full Scale Pressure
Check Pressure Set Points
Verify Pressure Calibration is within specification
Exit Pressure Calibration Check mode

STEP1-Put the Instrument in the Calibration Mode
With the instrument powered up attach the air (vacuum) supply line to the instrument. Turn air (vacuum) supply on.

To display the Calibration Screen press the ►key until Menu Screen #20-Calibration Mode is displayed.

Calibration Mode #20

STEP 2-Attach Standard Pressure Gauge
Attach a standard pressure gauge to the front port of the instrument.

STEP 3-Check Zero
Press the ▼key and verify that with the Bleed valve "ON" the standard pressure gauge reads 0.00 Psig. Verify that the instrument displays a pressure of 0.00 ± 0.5% Psig of the instrument's maximum pressure range (full scale) on the display.

P: (Max Pressure Range) 0.00 Psig **Bleed: ON**

STEP 4-Verify Supply is "ON"
Press the ▲key to display the following screen and verify the Supply is "ON".

P: (Max. Pressure Range) 0.00Psig **Supply: ON**

STEP 5-Check Full Scale
Adjust the regulator handle until the standard pressure gauge reads 100% full scale or the Maximum Pressure Range of the instrument. Record the pressure displayed on the instrument screen.

STEP 6-Check Set Points
Repeat the above step with the standard pressure gauge set at 75%, 50% and 25% of the instrument's full scale or its maximum pressure range. Record the pressure displayed on the instrument screen for each gauge setting.

STEP 7-Verify Calibration is within Specification
Compare the standard pressure gauge set points to the pressure displayed by the instrument at each set point. All results should be within ±0.5% of the instrument's full scale or maximum pressure range.

If any of the readings do not meet the instrument specification the instrument should be returned to the factory for calibration.

STEP 8-Exit Pressure Calibration Check Mode
If the instrument is a Pressure and Flow instrument proceed to the Flow Calibration Check Procedure.

If the instrument is a pressure instrument **ONLY** press the green Start Button to return to Calibration Mode Menu Screen #20. Press the ► or ◄ to move to another Menu Screen.

FLOW CALIBRATION CHECK PROCEDURE

The following details the procedure for checking the flow calibration of the instrument's flow transducer. This procedure is applicable only instruments configured to do both pressure and flow testing. This procedure is NOT applicable to pressure instruments.

PROCEDURE OVERVIEW
Complete Steps 1through 7 of the Pressure Calibration Check Procedure
Verify Supply is "OFF"
Check Zero
Check Full Scale
Check Set Points
Verify Calibration is within specification
Exit Flow Calibration Check Mode

STEP 1-Complete Steps 1- 7 of the Pressure Calibration Check Procedure

STEP 2-Verify Supply is "OFF"
Once the pressure calibration check has been completed press the ▲ key to display the following screen and verify that the Supply is "OFF".

FLOW: (Max Flow Rate) CCM
Supply: OFF 0.0

STEP 3-Check Zero
Attach a flow limiter to the front port of the instrument. Attach a standard flow gauge to the flow limiter. Verify that the standard flow gauge reads 0.0 and that the displayed flow reads 0.0 ±2% Maximum Flow Rate of the instrument.

STEP 4-Check Full Scale
Press the ▲key and display the following screen and verify that the Supply is "ON".

FLOW: (Max Flow Rate) CCM
Supply: ON 0.0

Turn regulator knob until the standard flow gauge reads 100% full scale or the maximum flow rate of the instrument. Record the flow displayed on the instrument screen.

STEP 5-Check Set Points
Repeat the above step with the standard flow gauge set at 75%, 50% and 25% of the instrument's full scale or its maximum flow rate. Record the flow displayed on the instrument screen for each gauge setting.

STEP 6-Verify Calibration is within Specification
Compare the standard flow gauge set points to the pressure displayed by the instrument at each set point. All results should be within ±2% of the maximum flow rate of the instrument (±2% Full Scale Deflection).
If any of the readings do not meet the instrument specification the instrument should be returned to the factory for calibration.

STEP 7-Exit to Calibration Check Mode
Press the Start button to return to the Calibration Mode Menu Screen# 20. Press the ► or ◄ to move to another Menu Screen.

CHAPTER 9 PRINTER FORMATS PAGE

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Printer Type Selection 91

PRINTED REPORTS

The *WORKER* provides the following printed reports:

Print Last Test Results Report,
Print Parameters Report, and
Print Datalog Report.

PRINTED REPORT FORMATS

Each of the three reports provide specific test information in a specific report format.

The Print Last Test Results Report provides the following information on the last test run on a part:

Program #,
Cycle #,
Accept/Reject Result,
Test #,
Test Mode,
Measured Data,
Measurement Units, and
Test Pass/Fail Result.

The printed report is in a one line format and appears as shown below:

Program #1 #00003 ACCEPT T1 DECAY 0.0000 PSIG PASS

The Print Datalog Report provides a print out of every test result for a specific program. This report contains a header which includes the Program # and the Datalog start time and date. In addition to the information provided in the Print Last Test Result Report the Print Datalog Report includes a Test Time stamp. The report is formatted a shown below:

Program # 1 Start 12:00 am 1/01/00
#1 ACCEPT 12:00 T1 DECAY 0.0000 PSIG PASS
#2 ACCEPT 12:01 T1 DECAY 0.0001 PSIG PASS
#3 ACCEPT 12:02 T1 DECAY 0.0002 PSIG PASS

The Print Last Test Result and the Print Datalog Reports will include multiple test results if the *WORKER* is configured as a Leak and Flow or Leak and Back Pressure Occlusion Tester and both tests are run on a test part.

As an example, the Print Last Test Result Report for a Leak and Flow instrument will be a two line report and will include both the decay and flow results on the test part. The report format is shown below.

Program #1 #00003 ACCEPT T1 DECAY 0.0000 PSIG PASS
ACCEPT T2 FLOW 150 CCM PASS

The Print Datalog Report format for Leak and Flow instrument will include two lines for each test cycle run. The first line for the decay test result and the second for the flow test result. The format is shown below.

Program # 1 Start 12:00 am 1/01/00
#1 ACCEPT 12:00 T1 DECAY 0.0000 PSIG PASS
ACCEPT 12:00 T2 FLOW 150 CCM PASS
#2 ACCEPT 12:01 T1 DECAY 0.0001 PSIG PASS
ACCEPT 12:01 T2 FLOW 155 CCM PASS
#3 ACCEPT 12:02 T1 DECAY 0.0002 PSIG PASS
ACCEPT 12:02 T2 FLOW 150 CCM PASS

The Print Parameters Report provides the following information on a specific program in the report format shown below.

Program # 1
Test: LEAK
Charge timer 1.0 sec.
Settle timer 1.0 sec.
Test timer 1.0 sec.
Decay max. 1.00 psig
Presr Spec. 15.00 psig
Presr. Tol. 25 %
Clamp timer 1.0 sec.
Bleed timer 1.0 sec.
Pause timer 1.0 sec.

AUTO PRINT FUNCTIONS

The *WORKER* will automatically print the test result at the end of each test if a ready-printer is detected by the instrument. The report format is identical the Print Last Test Report.

PRINTER TYPE SELECTION

The *WORKER* offers the choice of three printer drivers to accommodate various types of printers. These drivers include:

- Text for generic text printers,
- HP for various Hewlett-Packard DeskJet printers, and
- Epson for Epson compatible printers.

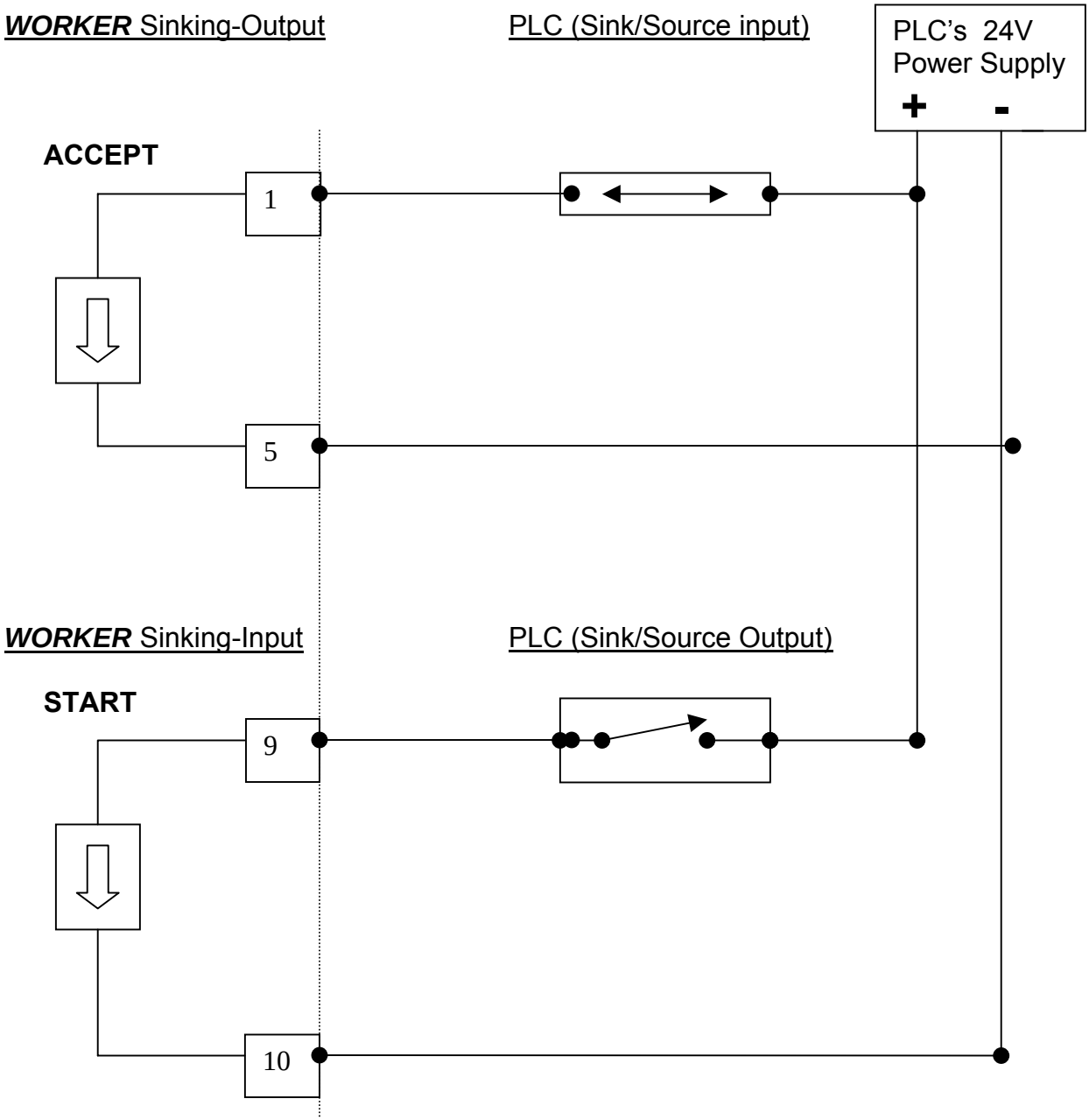
Contact your TM sales representative for information on availability of other printer driver options that may come available in the *WORKER*.

APPENDIX A: *WORKER* PLC INTERFACE

The PLC Signals provided by the ***WORKER*** are tabulated below.

ACC Pin #	Type	Signal Name	Description
1	Output-Sinking	CYCLE-ACEPT Output	Active when ALL tests PASS
2	Output-Sinking	CYCLE-REJECT Output	Active when ANY test FAILs
3	Output-Sinking	TEST Output	Active during the test cycle.
4	Output-Sinking	NEXT Output	Active dring the second test of a two-part test
5	Common Input	Common for Sinking Outputs	Should be connected to the PLC's 24V GND (-)
9	Input-Sinking	START test input	Actuate to START a test (t>0.25s)
6	Input-Sinking	RESET test input	Actuate to RESET a test (t>0.25s)
10	Common-Inputs	Common for Sinking Inputs	Should be connected to the PLC's 24V GND (-)

- Sinking Inputs are rated for 30V Max/20mA
- Sinking Outputs are rated for 30V Max/20mA



APPENDIX B: WORKER RS232/ETHERNET CONNECTION

WORKER V1a RS-232 Input/Output Functions

The RS-232 port of the WORKER is configured with the following parameters.

ITEM	SETTING	REMARKS
Baud	9600	Not adjustable
Bits	8N1	8 data, No parity, 1 stop
Handshake	Null modem	No flow control

INPUT COMMANDS

The RS-232 input commands are tabulated below.

ITEM	CODE	REMARKS
Start	'S'	Starts a test
Reset	'R'	Reset the current test
Program	'P'	Sends the current program settings
Datalog	'D'	Sends the contents of the Datalog
Select Program #	ASCII: 97-197 ASCII: 'A' to '┼' 'a-z { | } ~	Selects the program #1-100 Redraws the screen to show new # Keyboard codes: correspond to programs 1-30

PROGRAM SELECTION

This feature allows selection of programs using the RS232 port. The *WORKER* programs are assigned to ASCII codes #97-#197. Program #1 is assigned to character '**a**' (ASCII #97), Program #2 is assigned to character '**b**' (ASCII #98) and so on. Only programs 1-30 can be selected directly from a PC-keyboard (keys: 'a'~'z', { , | , } , ~), however, the *WORKER* will respond to the full 100 code range.

To select a program, the corresponding ASCII code is send to the *WORKER* which translates it to a program number.

OUTPUT DATA

Test/Datalog Output	Data Fields: Comma delimited, <CR> ended
Cycle#	0-1000000
Cycle result	ACCEPT, REJECT
Test Number	T1=Leak, T2=Flow
Test Name	DP=Leak, FW=Flow
Test Data	0.0001
Test Units	Psig
Test Result	PASS, FAIL
Test time	12:34pm
Test Date	11/22/00

APPENDIX B; WORKER RS232/ETHRENET CONNECTION (continued)

WORKER ETHERNET CONNECTION

To configure the *WORKER* for Ethernet connection requires the purchase of a special adapter that is plugged into the RS232 port prior to any other communications connections being made. This adapter may be purchased through T.M. Electronics, Inc.

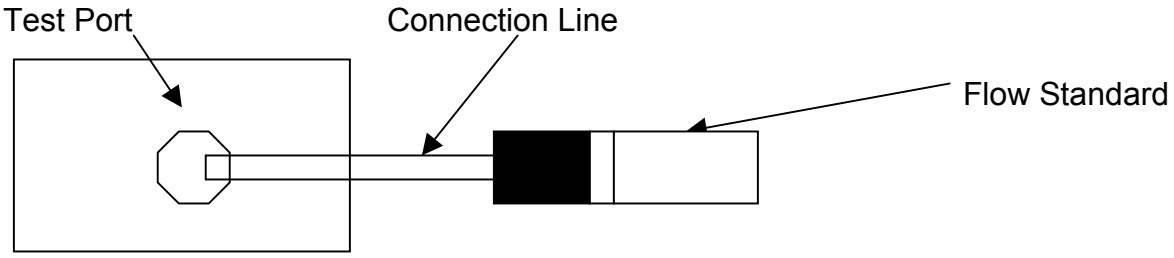
APPENDIX C: USE OF FLOW STANDARD

The Flow Standard or Leak Orifice may be used to perform a functional test of a leak or flow instrument or simulate a leak in a known good part.

The following instructions assume that test parameters for the orifice being used have been programmed into the instrument.

Instrument Functional Check
These instructions assume that test parameters have been established on known good and bad parts and that these parameters have been programmed into the instrument

Remove all fixture and test lines and items attached to the instrument. Attach the orifice to the instrument with its connector line or quick disconnect fitting. Be sure nothing blocks the flow standard. Run the test.



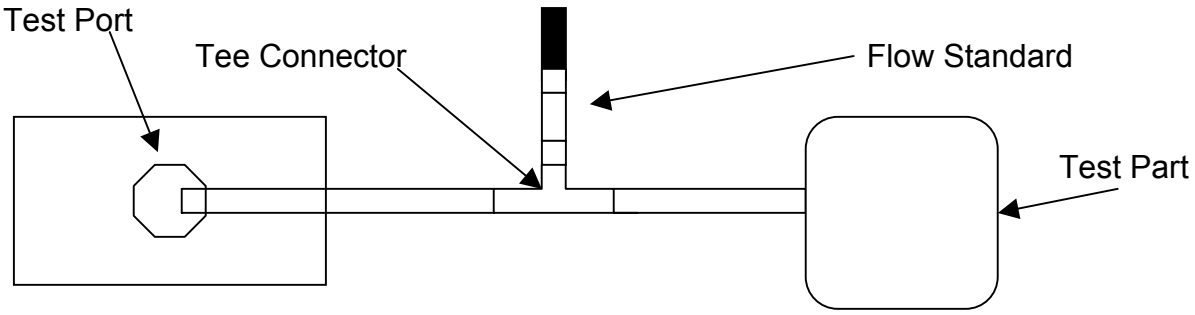
A Flow Reading will be displayed for instruments with Mass Flow Meters. Consult the Test Report for the expected flow reading.

The Flow Standard can also yield a specific Pressure Decay result related to instrument test parameters and the flow specifications of the flow standard. Consult TM Electronics for the expected Pressure Decay Reading.

Leak Simulation

These instructions assume that test parameters have been established on known good and bad parts and that these parameters have been programmed into the instrument

To simulate a leak in a known good part, the leak orifice must “Tee” into the pneumatic test circuit. This configuration will simulate the volume leak of a complete system, which includes the test part, the instrument and all connection lines. Install a “Tee” fitting on the instrument Test Port. Connect the orifice to one of the “Tee” connections and a known good test part to the other connection. Run the test.



The test result will be a leak result on a known good part with a simulated leak rate equivalent to that of the orifice. Consult the Test Report for the indicated leak rate.

APPENDIX D: FILTER DRYING SYSTEM

A Filter Drying System is recommended to ensure that only instrument quality air is used in the TME *WORKER*. An LA-05, Filter Drying System may be purchased directly from TM Electronics, Inc. and consists of the following components:

- Coalescing Filter - 16 CFM, 150 Psig maximum at 125° F or Wilkerson M16-02-000 or ASCO #34203468,
- Desiccant Drying Filter – 10 CFM at 100 Psig; 150 Psig maximum at 125° F, or Wilkerson X03-02-000, and
- After Filter – 40 CFM, 5μ, 150 Psig maximum at 125° F or Wilkerson F08-02-SK00 or ASCO #34204018.

Installation Responsibility and Recommendations

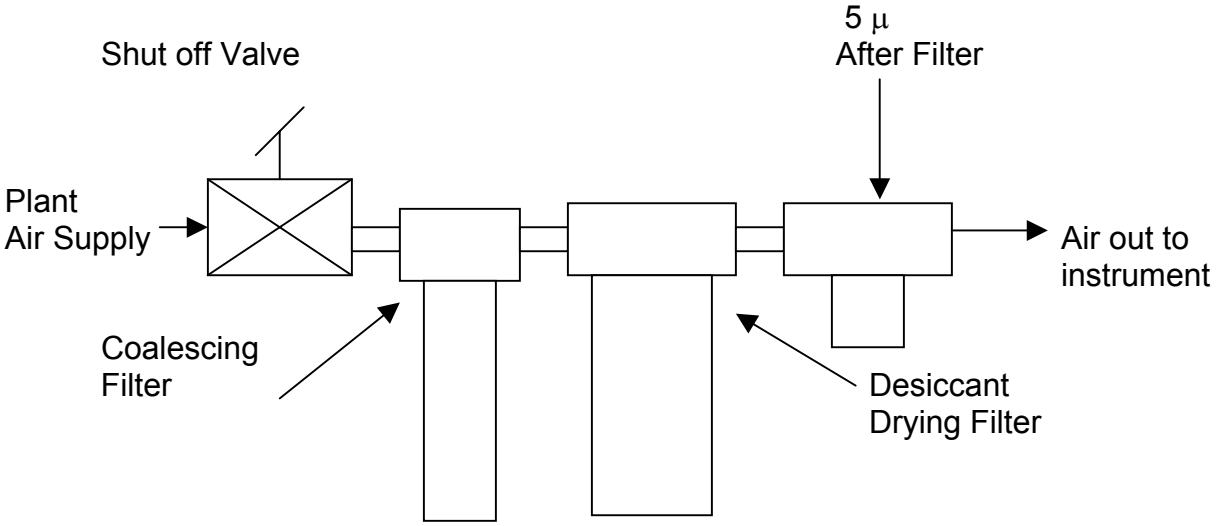
The customer is responsible for properly mounting the components to a wall or an adjacent surface.

It is recommended that the filter assembly be mounted within 10 feet from the instrument location.

It is recommended that a shut off valve be placed in line between the main air supply and the coalescing filter.

Installation

Connect the three (3) components as shown in the drawing below. Use the ¼" NPT fittings supplied with the system.



After connecting the components, mount the filter assembly in its permanent position.

Open the desiccant filter bowl and fill it with silica gel supplied with the system. Fill the filter bowl with silica gel up to 1/8" below the bowl's inner shoulder. Shake and/or tap the bowl while filling to settle the gel.

Connect the plant air supply line to the input side of the shut off valve. Connect a line from the output side of the shut off valve to the input side of the coalescing filter. If there is no shut off valve, connect the plant air supply line to the input side of the coalescing filter.

Connect an air line from the outlet of the 5 μ After Filter to the air supply connection on the back of the instrument.

Maintenance

CAUTION! The instrument Warranty does not cover water, water vapor, oil vapor or oil damage to the instrument. It is the customer's responsibility to maintain dry, clean instrument quality air.

The filter assembly should be checked on a periodic basis to assure that no water is found in the drain bowls of in any of the components. Frequency of checks should be based on the air supply quality and the frequency of use.

The coalescing filter prevents oil vapors from contaminating the desiccant drying resin. Oil contamination of the resin decreases its absorption capacity. The coalescing filter should be replaced when it appears gray, damp from contamination or when the indicator requires.

The desiccant drying material is silica gel with an indicating color. When the color is PINK the silica gel must be replaced or recharged. See the manufacturer's instructions on the insert provided for recharging directions.

The After Filter is a 5μ particulate filter that prevents dust from the desiccant drying cartridge from entering the instrument. The filter should be monitored for discoloration or visible particulate. The 5μ filter element can be washed and blown dry and reused.

Order/Reorder Numbers for Filter Drying System Components

Filter Type	ASCO	Wilkerson
Coalescing Filter	34203468	M16-02-000
Coalescing Filter Replacement	97801005	MTP95548
Desiccant Drying Filter	N/A	X03-02-000
Desiccant Drying Filter Replacement	N/A	DRP-85-059 (2 packs/unit)
5μ After Filter	34204018	F08-02-SK00
5μ After Filter Replacement Element	97802070	FRP96729

APPENDIX E: TME *WORKER* SPECIFICATIONS

Dimensions	…..……8.7” H x 13.7” D x 8,0: W
Power	……Universal 90-240 V @ 50-60 Hz 0.6/0.3 Amps
Storage /Operating Environments	……..…10-30ºC (50-90ºF)<80% RH, non-condensing
Controls	……..……...5-switch keypad ▲,▼,◄,►, ■(Menu), Key Lock Power ON/OFF Switch, Green Stop/Start Switch
Test Channels	……Single Channel
Display	……..…20x2 Line Vacuum Fluorescent display ……..Software auto-dimming after 5 minutes
Pressure Units	……Psig, kPa, Bar, mBar, InH_2O, Kg/cm^2 cmH_2O ,mmH_2O, InHg, mmHg
Flow Units	……..CCM, LPM
DATALOG Memory	……Up to 5000 Tests
PROGRAM Memory	……..…Up to 100 Programs
Manual Output	…..……Test Result, Program Parameters, Datalog
Automatic Output	……Current Test Result(s) to Printer & RS232
Auxiliary Output	……24 V Opto Isolated PLC Interface
Communications Port	…….RS232 Connector, Program Input/Data Output Ethernet Capability
Calibration	…..……NIST Traceable
Timer Ranges	…..……0.0 to 1000.0 Seconds ……Smallest increment: 0.1 Seconds
Cleaning	…….Soft cloth wetted with a glass cleaner such as Windex®

Models	**Leak**	**Leak +Flow**	**Leak + Occlusion**
Test Modes by Model Software Vers: V1a	Leak only	Leak; Flow Leak + Flow Flow + Leak	Leak; Occlusion Leak + Occlusion Occlusion + Leak

Pressure Specifications	**LEAK AND BACKPRESSURE OCCLUSION* MODELS**						
Range (Psig)	-13.5 - -0.5	0.5 - 5	0.5 -15	1.0 -50	2 -100	2 -150	5 - 300
Resolution (Psig)	0.0005	0.0001	0.0001	0.0005	0.001	0.002	0.005
Accuracy ±0.5% FSD	±0.068	±0.025	±0.075	±0.25	±0.50	±0.75	±1.50

*Backpressure Occlusion available in pressure instruments only

Flow Specifications	**FLOW MODELS ONLY**			
Flow Ranges (CCM)	10.0-500	20-1000	100-5,000	200-10,000
Accuracy±2% FSD	±10.0	±20.0	±100	±200
Resolution (CCM)	0.1	1	1	1

INSTRUMENT MAINTENANCE

CAUTION! There are no user serviceable parts inside the instrument. Opening or removing the cover **WILL VOID THE WARRANTY**.

INSTRUMENT MAINTENANCE

Note Cautions and Warnings detailed throughout this manual to prevent any damage to the instrument.

Use only a soft cloth wetted with a glass cleaner such as Windex® to clean the outside of the instrument. Do not allow the inside of the instrument to become wet.

INSTRUMENT SERVICE

TM Electronics, Inc. recommends that the ***WORKER*** be recalibrated at least annually. The customer should establish an appropriate recalibration interval for the instrument. The following are some of the factors to consider when establishing a recalibration interval:

- characteristics, specifications and tolerances of the product being tested,
- frequency of use of the ***WORKER***, and
- work environment.

Before returning any ***WORKER*** to the TM Electronics, Inc. for Service or Calibration contact TM's Customer Service Department at 1-508-869-6400 to obtain a Return Material Authorization Number.

WARRANTY

TM Electronics, Inc. warrants to the original use purchaser that it will repair or replace, at its option, any product under normal use and service that proves defective in material or workmanship, as determined by TM Electronics' inspection, within one year from the date of purchase when promptly returned to the TM Electronics factory. This warranty does not extend to damage caused by dirty air, water or water vapor, oil or oil vapor intrusion from the air supply source or from the product tested.

If TM Electronics' inspection discloses no defect in material or workmanship, repair or replacement will be made at customary charges. Freight charges are the customer's responsibility.

The foregoing warranty supersedes voids and is in lieu of all or any other warranties, expressed or implied, and no warranty of merchantability or fitness for particular purposes is intended or made. TM Electronics' sole obligation and the original use purchaser's sole remedy is as stated above and in no event shall TM Electronics be liable for any special, direct, indirect, incidental, consequential or other damages or expenses of any nature including, without limitations, loss of profits of production time incurred by the original use purchaser or any other party.

DO NOT ATTEMPT TO OPEN THE INSTRUMENT. **There are no user serviceable parts inside and opening or removing the cover** WILL VOID THIS WARRANTY. **Refer all servicing to authorized T.M. Electronics, Inc. Service Centers.**

Use of the *WORKER* in a manner not specified in this manual WILL VOID THIS WARRANTY**.**

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