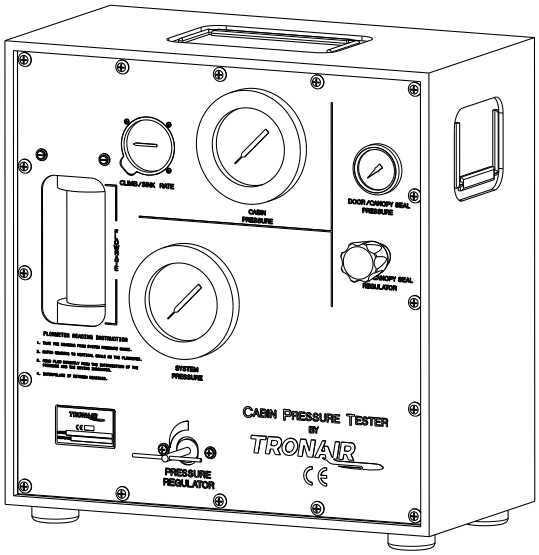
OPERATION & SERVICE MANUAL



Model: 15-7605-6010
Cabin Pressure Tester
(Compressed Air Operated)

CE

04/2023 – Rev. 04

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Tronair, Inc.
1 Air Cargo Pkwy East
Swanton, OH 43558

Phone: (419) 866-6301 | 800-426-6301
Web: www.tronair.com
Email: sales@tronair.com

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02	01/2013	Modified Parts List
03	05/2019	Major revision
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1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

Cabin Pressure Tester
Model 15-7605-6010 CE Compliant

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit

1.3 MANUFACTURER

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

1.4 FUNCTION

The Cabin Pressure Tester utilizes an external compressed air source (not included) to provide a controllable air supply for the pressurization of aircraft cabin and cockpit areas for the purpose of cabin leakage testing, and/or outflow valve tests.

Continuous duty air supply of 200 cfm @ 120 psi (8.3 bar) minimum (150 psi max) is <u>REQUIRED</u> to operate this unit

Adapter kits (sold separately) must be used to connect the supply hose from the Cabin Pressure Tester to the aircraft. (See Appendices for List of Adapter Kits)

This Cabin Pressure Tester is to be operated only by qualified trained technicians.

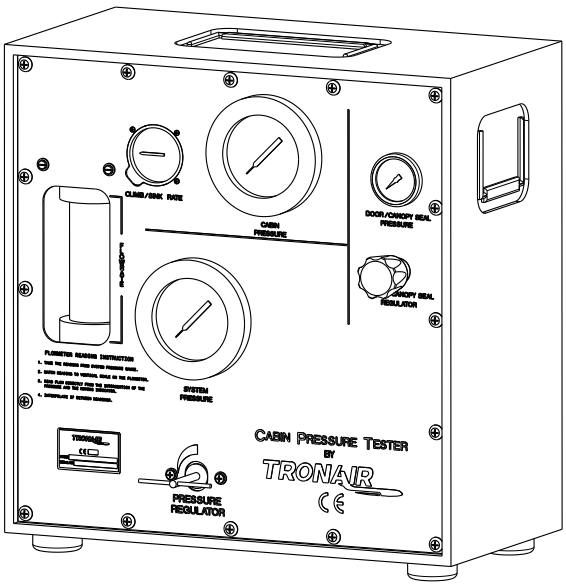
The technicians must be familiar with the operation of the unit before attempting to use.

1.5 LIST OF DRAWINGS

- Outline Dimensions
- Pneumatic Schematic

1.7 OVERVIEW

See illustration



2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.

WARNING!
Warning is used to indicate the presence of a hazard that can cause ***severe personal injury, death, and/or substantial property damage*** if the Warning Notice is ignored.

CAUTION!
Caution is used to indicate the presence of a hazard, which will or can cause ***minor personal injury or property damage*** is the Caution Notice is ignored.

2.3 ALARM AND WARNING SYSTEMS

This machine does not have any alarm or warning systems.

2.4 EXPLANATION OF WARNING AND DANGER SIGNS

Misuse of machine can cause personal injury and/or property damage.

Operation of the Cabin Pressure Tester must be in accordance with this manual, and the airframe manufacturer's instructions

2.4 COMPONENT SAFETY FEATURES

Safety Valve stops flow of air to aircraft when cabin pressure reaches 13.25-13.75 psi (0.91-0.95 bar).

2.5 FUNCTIONAL SAFETY FEATURES

The Safety Valve is operated by a pilot signal supplied by an air switch. The air switch senses actual cabin pressure. When the cabin pressure set point is reached, the air switch sends full pressure pilot air to the safety valve, causing the valve to shift, and stop the flow of air to the aircraft. When cabin pressure drops below the set point, the safety valve will open, allowing air to flow into the cabin again.

2.6 STOPPING AIRFLOW TO CABIN

To stop the flow of air to the aircraft cabin, close the shut-off ball valve.

2.7 PERSONAL PROTECTIVE EQUIPMENT

Operators must use personal protective equipment in accordance with their employer's requirements.

2.8 SAFETY GUIDELINES

Any uses other than those identified in section 1.1 of this manual are prohibited.

2.9 CONDITIONS FOR SAFE USE

- Recommended Ambient Temperature Range: 32° to 90° F (0° to 32° C).
- Do not operate outdoors while raining.

2.10 TECHNICAL EXPERTISE

2.10.1 Installation

Connection of compressed air supply to this device is to be performed in accordance with all applicable regulations.

2.10.2 Operation

This machine is to be used by skilled and trained aircraft technicians in accordance with this manual, and the airframe manufacturer's instructions. See Section 7 for Operation Instructions.

2.10.3 Maintenance

This machine is to be maintained by qualified maintenance personnel. See Section 9 for maintenance information.

2.11 ADDITIONAL SAFETY INFORMATION

Always ensure **Shut-Off Ball-Valve** is closed, the **Airflow** control valve handle is turned fully counter-clockwise (no pressure), and **Door Seal Regulator** knob is turned fully counter-clockwise (no pressure), **before** connecting compressed air supply to the Cabin Pressure Tester.

CAUTION

- **ALWAYS follow the airframe manufacturer's instructions when pressurizing an aircraft.**
- **NEVER open any aircraft door or access panel while there is any pressure within the cabin/cockpit.**
- **ALWAYS use applicable safety equipment required for aircraft pressurization tests.**

3.0 PREPARATION PRIOR TO FIRST USE

3.1 ASSEMBLY

The Cabin Pressure Tester is shipped complete and ready to use, however all fasteners and hose connections should be checked for tightness prior to use.

3.2 INSTALLATION REQUIREMENTS

3.2.1 Compressed Air Connection

Compressed air must be supplied to the Cabin Pressure Tester. The connection is located on the control panel of the machine, and is labeled as SUPPLY AIR IN.

Maximum pressure..... 150 psi (10.3 bar)
Connection size..... 1 inch NPT minimum
Supply Line size required..... 1 inch I.D. up to 100 ft from compressor to CPT.
Airflow requirements..... The compressor used must be able to supply airflow greater than the expected leak rate of the aircraft to be tested. Example: Aircraft leak rate = 100 scfm, Compressor airflow delivery should be 125 scfm at 120 psi minimum.

3.2.2 Safety Valve

The Safety Valve is factory set at 13.25-13.75 psi (0.91-0.95 bar). The air switch that controls this valve can be adjusted to a lower setting if required. Contact Tronair Engineering Department for approval.

3.3 PERSONNEL REQUIREMENTS (TECHNICAL EXPERTISE) FOR INSTALLATION

3.3.1 Shop Air Connections

Shop air connections are to be made by qualified personnel per all applicable codes and regulations.

3.4 INSPECTION AND TESTING PROCEDURE ON INSTALLATION

3.4.1 Before Connection to Aircraft

- Do not connect any hoses to the aircraft.
- Ensure that the **Pressure Regulator** and the **Door/Canopy Seal Regulator** are set to 0 pressure (handles/knob turned fully counter-clockwise).
- Connect the compressed air supply to the Cabin Pressure Tester.
- With the shut-off ball valve closed, slowly turn the handle on the Pressure Regulator, and verify that the system pressure increases as the handle is turned clockwise, and decreases as the handle is turned counter-clockwise.
- Remove all system pressure by turning the Pressure Regulator handle fully counter-clockwise until system pressure reads 0 psi.
- Slowly rotate the **Door/Canopy Seal Regulator** knob clockwise.
- Verify that air is flowing from **Regulated Air (To Aircraft)** connection on control panel.
- Slowly rotate the **Door/Canopy Seal Regulator** knob counter-clockwise.
- Verify that the air stops flowing from **Regulated Air (To Aircraft)** connection on control panel.

4.0 TRAINING

4.1 TRAINING REQUIREMENTS

- Cabin Pressure Tester operators must be properly trained in all aspects of aircraft cabin pressurization tests.
- It is the employer's responsibility to ensure that the operator is qualified to perform aircraft cabin pressurization and testing.
- This Cabin Pressure Tester Operation and Maintenance Manual does not provide qualified training to perform aircraft cabin pressurization and testing.

4.2 TRAINING PROGRAMS, MANUALS, METHODS, SUPERVISORS, AND OPERATORS

- Tronair does not provide training materials beyond the scope of this manual.
- It is the employer's responsibility to provide any training requirements beyond the scope of this manual.

5.0 OPERATION

5.1 OPERATING PARAMETERS

Due to the complexities, differences, and changes in aircraft pneumatic systems, no attempt has been made to relate to any specific aircraft. The user must ***always*** follow the aircraft manufacturer's instructions regarding aircraft cabin pressurization procedures and pressure levels. It is mandatory that the operators read, and understand, this manual and the aircraft maintenance manual prior to using this equipment.

WARNING!

To prevent personal Injury and/or damage to aircraft:

1. **ALWAYS follow aircraft manual procedures for aircraft pressurization.**
2. **NEVER exceed specified aircraft pressure levels.**
3. **NEVER operate this Cabin Pressure Tester prior to reading this manual.**
4. **NEVER open any aircraft cabin door or access panel if there is any pressure in the cabin.**
5. **ALWAYS use applicable safety equipment required for aircraft pressurization tests.**

5.1.1 General

This aircraft Cabin Pressure Tester is a pneumatic device and as such follows the laws of compressible fluids. The operator should be aware of the following information.

5.1.1.a Compressed Air

As air is compressed, a tremendous amount of energy is stored. This is similar to the energy stored in a coil spring when compressed. Under **no circumstances** are aircraft doors or access panels to be opened if there is any pressure at all in the aircraft above atmospheric pressure.

As an example, the force produced on a door two (2) feet (0.61 cm) wide by five (5) feet (152.4 cm) high with only one (1) psig (0.7 bar) is equal to 1,440 lbs (20.3 kg).

5.2 NUMERICAL VALUES AND LIMITS

5.2.1 General

Max Shop Air Supply Pressure	150 psi (10.3 bar)
Pressure Range	0 – 13 psi (0 – 0.90 bar)
Cabin Pressure Gage	0 – 15 psi (0 – 1.03 bar) 0.5% accuracy
System Pressure Gauge	0 – 30 psi (0-2.0 bar) 0.5% accuracy
Door Seal Pressure Gage	0 – 60 psi (0-4.0 bar) 2% accuracy
Measurable Flow Range	20 - 200 scfm 5% accuracy
Maximum Flow	250 scfm
Safety Valve setting	13.25-13.75 psi (0.91-0.95 bar)
Calibrated Flowmeter	Standard

5.2.2 Dimensions

Overall	25¼ in x 21 in x 25¼ in (64 cm x 53 cm x 64 cm)
Cabin Supply Hose	1½ in (3.8 cm) diameter x 20 ft (6 m) long
Cabin Sensor Feedback Hose	¼ in (0.6 cm) diameter x 20 ft (6 m) long (red)
Door/Canopy Seal Supply Hose	¼ in (0.6 cm) diameter x 20 ft (6 m) long (gray)
Weight	167 lbs (76 kg)

5.2.3 Instrumentation

5.2.3.a Aircraft Cabin Data

Cabin Pressure Gage	0 – 15 psi (0 – 1.03 bar)
Climb/Sink Rate	0 – 6,000 ft/min (0 – 1,829 m/min)

5.2.3.b Airflow Measurement Data

Flowrate Indicator	20 - 200 scfm

5.2.3.c Door Seal Regulator

Pressure Gage	0 – 60 psi (0 – 4.0 bar)

5.3 FEATURES

5.3.1 Cabin Air Supply

The Cabin Pressure Tester uses an external compressed air supply to provide a source of clean, low-pressure air. As shown in the Pneumatic System Schematic, compressed air is supplied to a filter/separator, then to a high flow precision regulator. Regulated air is then passed through the safety valve, the Flowrate Indicator, and then out to the aircraft cabin.

5.3.2 Pressure Regulator

This is the pressure regulating valve used to supply air to the cockpit or cabin. The valve handle must be fully turned counter-clockwise prior to connecting either the supply hose to the aircraft, opening the shut-off valve or connecting compressed air to the Cabin Pressure Tester.

This valve reduces the supply pressure (150 psi maximum) to 0 psi with the handle turned fully out (counter-clockwise). As this handle is slowly turned in clockwise, the valve will allow enough air to pass to raise the pressure downstream of the valve to the pressure set by the handle. The handle bears down on a pressure control bias spring contained within the control valve. Ultimately, it is the force generated by this spring, adjusted by the handle that determines the pressure downstream of the control valve.

5.3.3 Aircraft Cabin Instrumentation

Instruments are provided to measure the cabin pressure and rate of climb or descent inside the cabin.

5.3.4 Airflow Measurement

The Cabin Pressure Tester is equipped with an inline, variable orifice, multi-pressure flowmeter to determine leakage Flowrate.

Flow is read by first finding the “system pressure” displayed on the system pressure gauge, then match the pressure to a vertical scale on the flowmeter.

The leakage flowrate (SCFM) is read directly from the intersection of the pressure and the moving indicator. Interpolate if between readings.

5.3.5 Door Seal Regulator

The Cabin Pressure Tester is equipped with a regulator and pressure gauge for the purpose of supplying regulated air to the aircraft door/canopy seals.

The valve knob must be fully turned counter-clockwise prior to connecting either the supply hose to the aircraft, or connecting compressed air to the Cabin Pressure Tester.

5.3.6 Shut-off valve

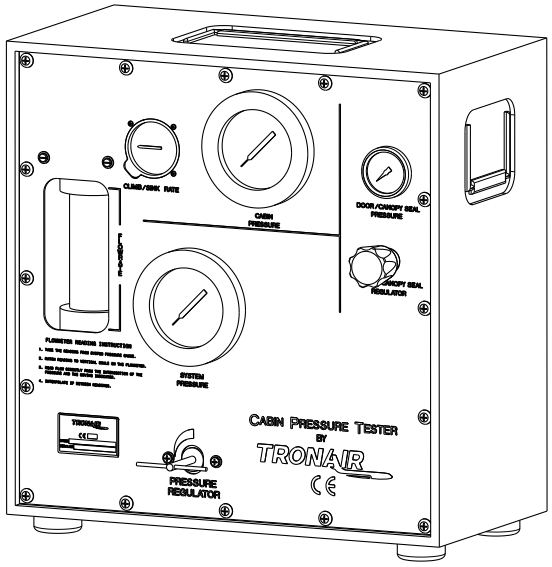
A ball valve is located on the Cabin Supply Hose connection for the purpose of shutting off the supply of air to the aircraft cabin.

5.3.7 Filter/Separator

A coalescing Filter/Separator, equipped with a 40 micron filter element, is provided to remove dirt, water, and oil from the supplied air.

5.3.8 Additional Features

- Retractable towing handle
- CE Marked (Machinery Directive)
- Safety Valve



5.4 LOCATION AND LAYOUT OF CONTROLS

5.4.1 Instrument Panel

See illustration

5.4.2 Description of Controls

5.4.2.a Pressure Regulator

Regulator - controls the flow of air into the aircraft cabin.

5.4.2.b Door/Canopy Seal Regulator

Regulator – provides for supply of air to aircraft door and canopy seals.

5.4.2.c Shut-off Valve Located on the Cabin Supply Hose

Ball valve – provides a means to stop the flow of air into the aircraft cabin.

5.4.2.d Aircraft Cabin Data

- Cabin Pressure Gage – indicates air pressure inside aircraft cabin.
- Climb/Sink Rate – This is a Vertical Speed Indicator that displays the rate of climb or descent (rate of pressure change) inside the aircraft cabin in ft/min.

5.4.2.e Flowrate Indicator

A direct acting, direct reading, multi-pressure flowmeter calibrated in scfm.

5.4.3 Connection Locations (Reference 7.4.1 Illustration)

1. Aircraft Cabin Supply Air – Cabin Supply Hose with ball valve connection.
2. Aircraft Cabin Sensor Line – Feedback connection to aircraft.
3. Supply Air In – Connection to facilities compressed air supply.
4. Regulated Air (to Aircraft) – Regulated air supply for aircraft door seals.

5.5 PREPARATION PRIOR TO FIRST USE

1. Always ensure that **Shut-Off Ball-Valve** is closed, the **Pressure Regulator** control valve handle is turned fully counter-clockwise (no pressure), and **Door Seal Regulator** knob is turned fully counter-clockwise (no pressure), **before** connecting compressed air supply to the Cabin Pressure Tester.
2. Visually inspect the Cabin Pressure Tester for loose fasteners, shipping damage, loose internal air connections, etc. Repair any faults found.

5.6 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment must be used in accordance with employer's instructions, and local and federal regulations.

5.7 CHECKS PRIOR TO START UP

1. Reduce airflow thru Pressure Regulator by rotating handle fully counter-clockwise.
2. Reduce airflow thru Door Seal Regulator by rotating knob fully counter-clockwise.
3. Close ball valve.
4. Connect compressed air supply to "Supply Air In" connection.

5.8 START UP PROCEDURE

CAUTION!

To prevent personal injury and/or damage to aircraft:

- **ALWAYS follow aircraft manual procedures for aircraft pressurization.**
- **NEVER exceed specified aircraft pressure levels.**
- **NEVER operate this Cabin Pressure Tester prior to reading this manual.**
- **NEVER open ANY aircraft cabin door or access panel if there is any pressure in the cabin.**
- **ALWAYS use applicable safety equipment required for aircraft pressurization tests.**

1. The Cabin Pressure Tester must be operated with the flowrate indicator vertical, as shown in section 7.4.1 Illustration.
2. Ensure that steps in section 7.7 have been completed.
3. Connect hoses from Cabin Pressure Tester to aircraft. (Adapter kit is required to connect cabin supply hose to aircraft is sold separately – See Appendix.)

5.9 OPERATING PROCEDURES

5.9.1 Basic Operation

Follow aircraft manufacturer's instructions on cabin pressurization. See Appendices for more detailed instructions.

5.9.1.a Cabin Pressurization

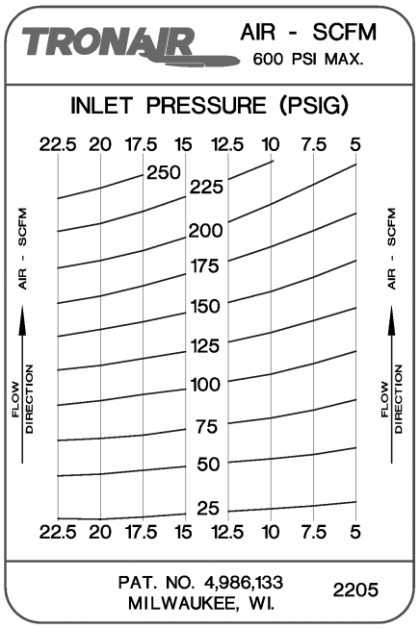
1. Secure the aircraft per aircraft manufacturer's instructions.
2. Inflate door/canopy seals, using the Door/Canopy Seal Regulator and gage per aircraft manufacturer's instructions.
3. Ensure that the Pressure Regulator is set to zero pressure by turning handle fully counter-clockwise.
4. Open the ball valve to allow air to enter the aircraft cabin.

NOTE: Do not exceed the rate of descent specified by the aircraft manufacturer.

5. Slowly rotate the handle on the Pressure Regulator clockwise to begin increasing the pressure inside the aircraft cabin.

WARNING!

Do not exceed the maximum rate of descent specified by the aircraft manufacturer.



6. As the cabin pressure approaches the test pressure specified by the aircraft manufacturer, begin reducing the rate of pressure increase by turning the Pressure Regulator counter-clockwise.
7. When the specified cabin test pressure has been reached, adjust the Pressure Regulator as required to maintain the test pressure, and to achieve a Climb/Descent Rate equal to 0 ft/min.

WARNING!

Do not exceed the maximum cabin pressure specified by aircraft manufacturer.

8. Read the system pressure display on the "system pressure" gauge.
9. Match the system pressure to a vertical scale on the flowmeter.
10. The leakage flowrate (SCFM) is read directly from the intersection of the pressure and the moving indicator. Interpolate if between readings (see scale to right).

5.9.1.b Cabin Pressure Tester Safety Valve Operation

The Cabin Pressure Tester is equipped with a safety valve system consisting of two pilot operated two-way, two position valves. The first valve is normally closed, and is called an air switch. It receives its pilot signal from the cabin pressure. The air switch has an adjustable bias spring which controls the amount of pilot pressure required to shift the valve. When this valve shifts, it directs full supply pressure to the pilot port on the safety valve. The safety valve is normally open, and is connected inline with the main air circuit, immediately upstream from the Pressure Regulator. When the air switch shifts and sends pressure to the safety valve pilot port, the safety valve shifts, and stops the flow of air into the aircraft. **Once the pressure inside the aircraft drops below the set point of the air switch, the safety valve will re-open automatically and allow air to flow into the aircraft cabin.**

5.9.1.c Manually Stopping Airflow to Cabin

To manually stop the flow of air into the cabin, close the ball valve located at the aircraft cabin supply air connection

5.9.1.d Cabin Depressurization

Follow aircraft manufacturer's instructions on cabin pressurization. See Appendices for more detailed instructions.

1. Slowly turn the Pressure Regulator counter-clockwise to reduce the pressure inside the cabin.

WARNING!

Do not exceed the maximum Climb/Descent rate specified by the aircraft manufacturer.

2. After the Pressure Regulator has reached its full open position, close the ball valve.
3. Any remaining pressure inside the cabin will bleed off naturally.

WARNING!

NEVER open ANY aircraft cabin door or access panel if there is any pressure in the cabin.

5.9.2 General Plan

In general, aircraft cabin leakage testing should be done as follows:

a. Using the Cabin Pressure Tester, establish aircraft leakage rate.
b. Compare the leakage rate (scfm) to the aircraft manufacturer's specification.
c. Repair cabin leaks, starting with major leaks first. Use low-pressure air, 1 – 2 psi (0.07 – 0.14 bar) to find leaks.
d. After repair, using the Cabin Pressure Tester again, determine the new leakage rate (scfm) and compare to aircraft specification.
e. Repeat steps c and d above until the cabin leakage rate meets or is less than that required by the aircraft manufacturer's specifications.

5.9.3 Test Methods

Two different test methods are generally specified by aircraft manufacturers to determine aircraft cabin leakage rates:

a. Flow measurement method
b. Pressure decay method

The following paragraphs explain each of the above methods.

CAUTION!

To prevent personal injury and/or damage to the aircraft, always follow the aircraft manufacturer's instructions for pressurizing aircraft.

a. Flow Measurement:
The Flow Measurement method measures the rate of air leakage from the aircraft cabin in scfm.

Pressurize the aircraft cabin to the required test pressure. Stabilize the cabin pressure, ensuring a 0 Climb/Descent Rate.

Read the leakage from the Flowrate indicator. The basic procedure for this test method is given in Appendix I.

b. Pressure Decay Method:
The Pressure Decay method determines cabin air leakage by measuring the time required for the cabin pressure to drop from a set pressure to a lower pressure. The time is normally measured in seconds. A stopwatch readable in 1/10 of a second may be used for this test.

The basic procedure for this test method is given in Appendix II.

5.9.4 Aircraft Leakage

Aircraft cabins generally leak in the following areas:

- Door seals
- Outflow valves and valve gaskets
- Safety valves and valve gaskets
- Pneumatic air line connections
- Control cable seals in pressure bulkheads
- Electrical wiring bundles through pressure bulkheads
- Window seals
- Fuselage rivets and overlapping fuselage panels

5.9.5 Locating Aircraft Cabin Leaks

a. It does not require high-pressure air to find leakage points in the aircraft cabin. Whenever possible, all leakage investigations should be performed at aircraft cabin pressures of between 1 and 2 psig (0.07 – 0.14 kg/sq cm).
b. Non-audible leaks can be found by spraying the aircraft exterior with a soap and water solution. Leaks are revealed by the bubbles generated and can be marked with a colored grease pencil for later correction.

5.10 STOPPING PROCEDURES

a. To stop the output of the Cabin Pressure Tester, close the shut-off valve.
b. Drain the filter bowl after each use.

CAUTION!

Disconnecting the Supply Air In without shutting the ball valve may cause rapid depressurization of the aircraft.

5.11 EMERGENCY STOPPING PROCEDURES

If The Aircraft Is Not Pressurized: Close the shut-off valve.
If The Aircraft Is Pressurized: Close the shut-off valve.

6.0 PACKAGING AND STORAGE

6.1 PACKAGING REQUIREMENTS

Packaging for shipment should include a suitable pallet with surrounding crating, or container to prevent damage to unit. The machine should be securely strapped to the pallet.

6.2 METHODS OF HANDLING

The Cabin Pressure Tester can be rolled freely by hand by using the retractable handle. Recessed handles are provided for manual lifting. Consult OSHA and employer's limitations for maximum weight to be lifted by manual means.

No provisions for lifting by overhead crane are provided.

6.3 STORAGE

The Cabin Pressure Tester should be stored indoors.

6.4 STORAGE SPACE AND HANDLING FACILITIES

Minimum: 25 ¼ x 25 ¼ x 22 in (64 cm x 64 cm x 55 cm)
No specific handling facilities are required.

7.0 TRANSPORTATION

7.1 HANDLING POINTS

- Wheels and a telescoping handle are provided for manual movement.
- Recessed handles are provided on the sides of the case for manual or machine lifting.
- No other handling points are provided.

7.2 WEIGHT

167 lbs (76 kg)

8.0 TROUBLE SHOOTING

8.1 TROUBLESHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
Cannot build required cabin air pressure – Flow HIGH – Cabin Pressure Tester Pressure LOWER	Excessive cabin leakage	Assure all aircraft inspection panels in place
		Assure door seal inflated
		Assure aircraft cabin air controls are properly set Check outflow and safety valves
Cannot build required cabin air pressure – Flow LOWER – CPU Pressure HIGH	Back pressure loss in aircraft system	Assure aircraft cabin air controls are set properly
		Common on aircraft where CPU air enters upstream of aircraft mass air flow valve. Re-plumb downstream of aircraft mass air flow valve
Low Cabin Pressure Tester output pressure and/or flow	Clogged filter	Drain and/or replace

9.0 MAINTENANCE

9.1 DESCRIPTION OF EQUIPMENT

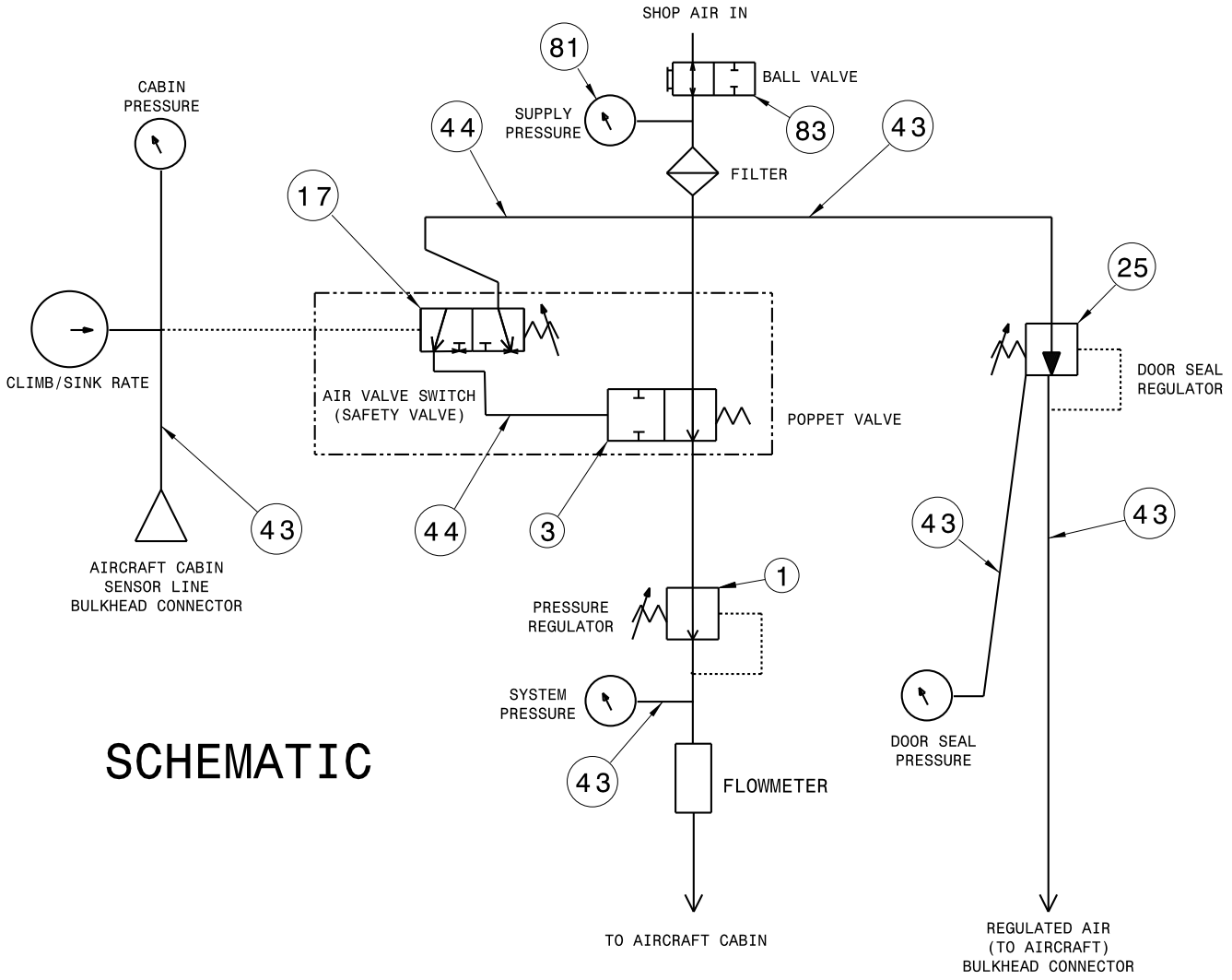
- Filter – Coalescing Filter Separator with manual drain.
- Pressure Regulator – High flow precision pressure regulator.
- Poppet Valve – two-way, two-position pilot operated internal return (slaved by Safety Valve Air Switch).
- Safety Valve Air Switch – two-way, two-position pilot operated adjustable spring return (senses cabin pressure).
- Flowrate Indicator – variable orifice flowmeter 5% accuracy.

9.2 DESCRIPTION OF PNEUMATIC PROTECTION SYSTEMS

9.2.1 Safety Valve System

- The Cabin Pressure Tester is equipped with a safety valve system consisting of two pilot operated two-way, two position valves. The first valve is normally closed, and is called an air switch. It receives its pilot signal from the cabin pressure. The air switch has an adjustable bias spring which controls the amount of pilot pressure required to shift the valve. When this valve shifts, it directs full supply pressure to the pilot port on the safety valve. The safety valve is normally open, and is connected inline with the main air circuit, immediately upstream from the pressure regulator. When the air switch shifts and sends pressure to the safety valve pilot port, the safety valve shifts, and stops the flow of air into the aircraft. **Once the pressure inside the aircraft drops below the set point of the air switch, the safety valve will re-open automatically and allow air to flow into the aircraft cabin.**
- **DO NOT adjust the air switch.**
- If required, the set point on the air switch may be adjusted to a lower pressure, however Tronair Engineering Department must be contacted for approval and instructions prior to this adjustment.

9.3 PNEUMATIC SCHEMATIC



Item	Part Number	Description	Qty
1	H-2706	Regulator, High Flow 1in	1
3	H-2707	Valve, Poppet Inline 1 in	1
17	H-2711	Switch, Air Valve	1
25	PC-1089-01	Regulator, Low Pressure	1
81	HC-1836	Gauge, Pressure 200 PSI	1
83	H-2666-04	Valve, Ball	1
N/S	TF-1012*096.00	Hose, ¼ Polyethylene	1
N/S	TF-1139*024.00	Tube, Nylon 5/32	1

9.0 MAINTENANCE (continued)

9.4 INSPECTION POINTS

- Drain filter bowl: Each use.
- Vertical Speed Indicator zeroing: Each use.
- Instrument Calibration: Verify last calibration is within previous 12 months.
- Instruments are to be calibrated annually.

9.5 SCHEDULED MAINTENANCE

9.5.1 Instrumentation

All instruments should be calibrated annually to maintain accuracy of machine.

9.5.2 Filter element

Replace annually or sooner if performance drops.

9.6 MAINTENANCE PERSONNEL REQUIREMENTS

Maintenance personnel should have a basic knowledge of mechanical, electrical, and pneumatic systems.

10.0 PROVISION OF SPARES

10.1 SOURCE OF SPARE PARTS

Spare parts may be obtained from the manufacturer:

TRONAIR, Inc.	Telephone:	(419) 866-6301 or 800-426-6301
1 Air Cargo Pkwy East	Fax:	(419) 867-0634
Swanton, Ohio 43558 USA	E-mail:	sales@tronair.com
	Website:	www.tronair.com

For Spare Parts, Operations & Service Manuals or Service Needs:
Scan the QR code or visit Tronair.com/aftermarket

10.2 RECOMMENDED LEVEL OF SPARE PARTS LIST

Reference the following page(s) for Replacement Parts and Kits available.

Recommended Spares to be kept on hand:
H-2726 ..... Replacement Filter Element

11.0 IN-SERVICE SUPPORT

Contact Tronair, Inc. for technical services and information. See Section 1.3 – Manufacturer.

12.0 GUARANTEES/LIMITATION OF LIABILITY

Tronair products are warranted to be free of manufacturing or material defects for a period of one year after shipment to the original customer. This is solely limited to the repair or replacement of defective components. This warranty does not cover the following items:

a) Parts required for normal maintenance
b) Parts covered by a component manufacturers warranty
c) Replacement parts have a 90-day warranty from date of shipment

If you have a problem that may require service, contact Tronair immediately. Do not attempt to repair or disassemble a product without first contacting Tronair, any action may affect warranty coverage. When you contact Tronair be prepared to provide the following information:

a) Product Model Number
b) Product Serial Number
c) Description of the problem

If warranty coverage is approved, either replacement parts will be sent or the product will have to be returned to Tronair for repairs. If the product is to be returned, a Return Material Authorization (RMA) number will be issued for reference purposes on any shipping documents. Failure to obtain a RMA in advance of returning an item will result in a service fee. A decision on the extent of warranty coverage on returned products is reserved pending inspection at Tronair. Any shipments to Tronair must be shipped freight prepaid. Freight costs on shipments to customers will be paid by Tronair on any warranty claims only. Any unauthorized modification of the Tronair products or use of the Tronair products in violation of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied.

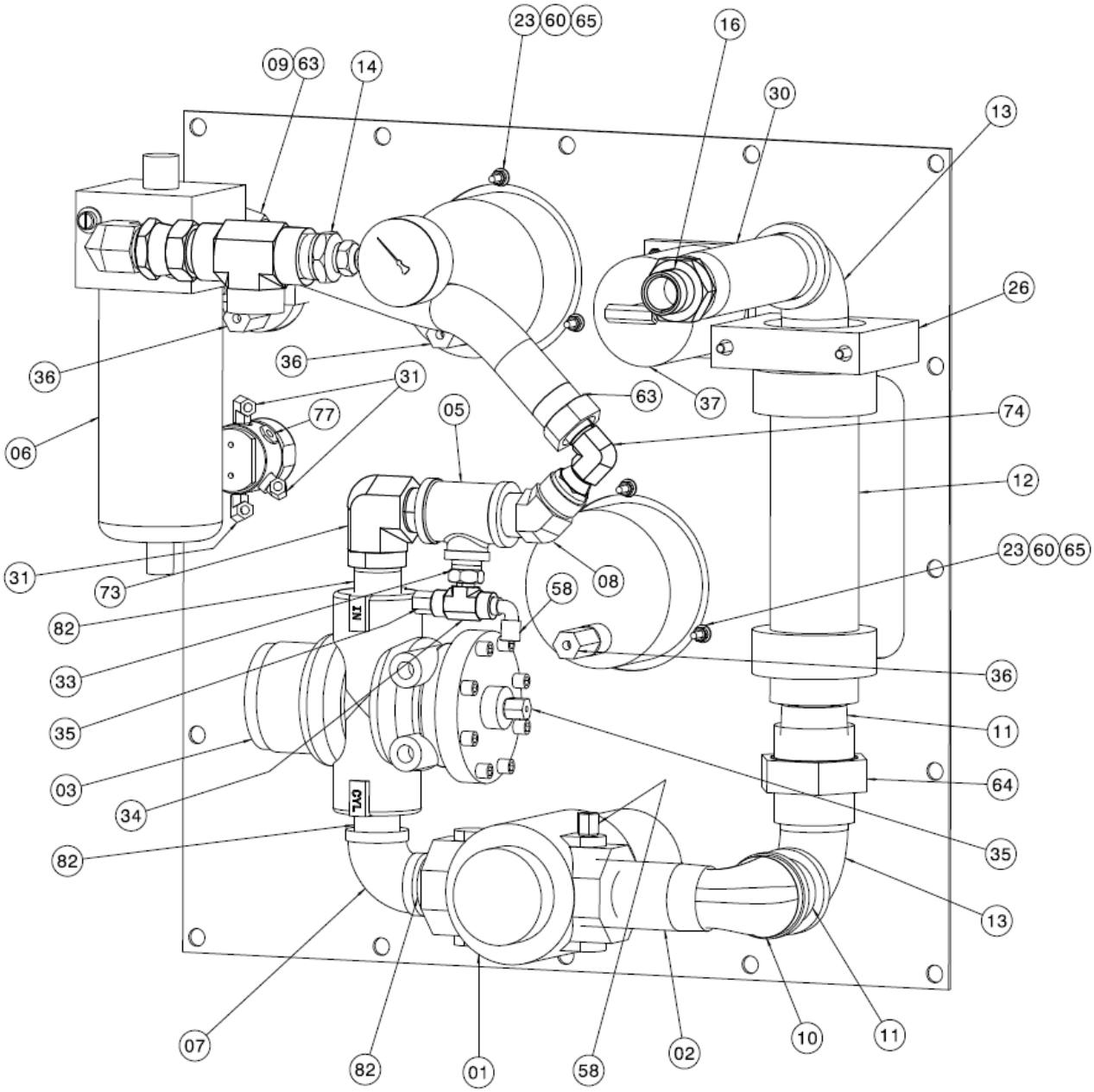
The obligations of Tronair expressly stated herein are in lieu of all other warranties or conditions expressed or implied. **Any unauthorized modification of the Tronair products or use of the Tronair products in violations of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately *void any warranty, express or implied* and Tronair *disclaims any and all liability for injury (WITHOUT LIMITATION and including DEATH), loss or damage arising from or relating to such misuse*.**

13.0 APPENDICES

APPENDIX I	Leak Flow Rate Measurement Test Procedure
APPENDIX II	Pressure Decay Test Procedure
APPENDIX III	Cabin Pressure Tester Adapters
APPENDIX IV	Declaration Of Conformity
APPENDIX V	Vertical Speed Indicator Calibration Data
APPENDIX VI	Pressure Gauge Calibration Data
APPENDIX VII	Installation & Service Instructions V610P and 2F300DP
APPENDIX VIII	Installation, Operation & Maintenance 100 Pneumatic Pressure Regulator
APPENDIX IX	Installation & Operation Flowmeter
APPENDIX X	Instrument Certification Notice

Parts List

When ordering replacement parts/kits, please specify model, serial number & color of your unit.



Item	Part Number	Description	Qty
1	H-2706	Regulator, High Flow 1in	1
2	N-2237-06-31	Nipple, Galvanized Pipe, 1 in NPT x 3.5 in long	1
3	H-2707	Valve, Poppet Inline 1 in	1
4	N-2237-06-28	Nipple, Galvanized Pipe, 1 in NPT x 2 in long	3
5	N-2320-18	Tee, Female Pipe Galvanized	1
6	H-2705	Filter, Coal. HI Flow 1 in	1
7	N-2735-06	Elbow, 90° Galvanized	1
8	N-2021-23-S	Elbow, Male 45º	1
9	N-2005-23-S	Elbow, Male 90º	1
10	N-2737-01	Elbow, 90° Reducing Galvanized	1
11	N-2237-08-27	Nipple Galvanized Pipe	2

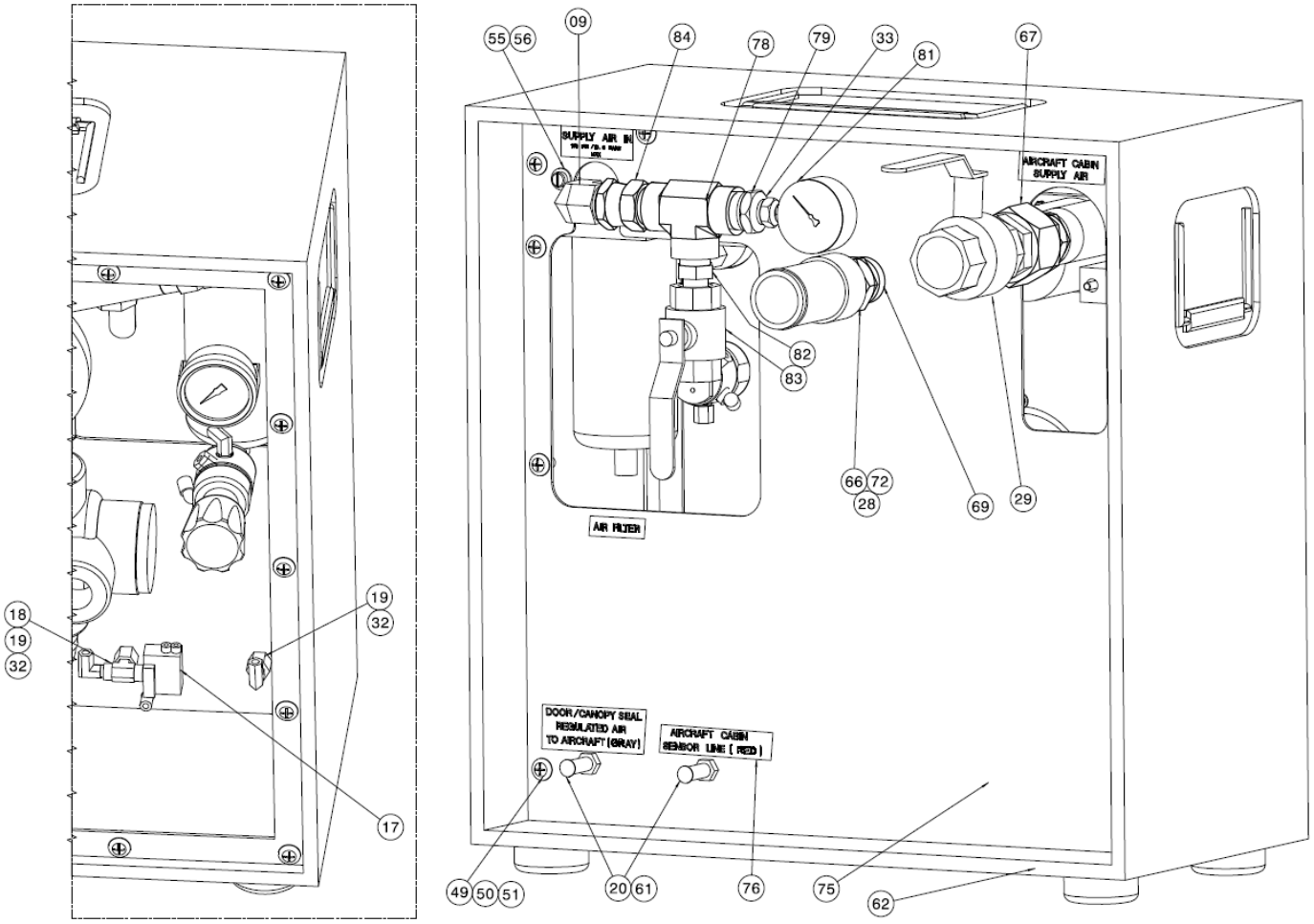
Parts List

When ordering replacement parts/kits, please specify model, serial number & color of your unit.

Item	Part Number	Description	Qty
12	H-2836	Flowmeter, Pneumatic	1
13	N-2738-08	Elbow, 90° Galvanized	2
14	TF-1047-08-12.0	Hose, Push-Lok, 1 x 5. 5 LG	1
16	N-2010-19-S	Connector, Female	1
23	G-1250-1030N	Flatwasher, #10 Narrow	6
26	H-2837	Clamp, 3” Tube	1
30	N-2237-08-36	Nipple, Galvanized Pipe	1
31	N-2446-05	Elbow, 90° Male, ¼ NPT x ¼ Tube	2
33	N-2210-08-S	Pipe Thread Reducer, ½ NPT x ¼ NPT	1
34	N-2208-03-S	Tee, Male Branch, ¼ NPT	1
35	N-2443-05	Connector, Male, ¼ NPT x 5/32 Tube	2
36	N-2444-05	Connector, Female, ¼ Pipe x ¼ Tube	3
37	N-2448-03	Swivel, Male Branch Tee, ⅛ NPT x ¼ Tube	1
58	N-2443-08	Connector, Male	1
59	G-1251-1030R	Lockwasher, #10 Regular	6
60	G-1202-1035	Nut, Hex #10 – 32	6
63	N-2026-13-B	Swivel, JIC 37º	2
64	N-2772	Union 1 ½ inch Galvanized	1
65	G-1156-103506	Machine Screw, #10 – 32 x ¾ LG	6
73	N-2200-18-S	Elbow, Street	1
74	N-2002-10-S	Adapter, #12 SAE x ¾ FPT	1
82	N-2237-06-28	Nipple, Galvanized Pipe	3

Parts List

When ordering replacement parts/kits, please specify model, serial number & color of your unit.



Item	Part Number	Description	Qty
9	N-2005-23-S	Elbow, Male 90º	1
17	H-2711	Switch, Air Valve	1
18	N-2208-01-S	Tee, Male Branch, ⅛ NPT	1
19	N-2024-03-S	Bulkhead, #4 JIC x ⅛ NPT	2
20	H-1442-03	Protector, Thread	2
28	N-1523	Coupling, Hose	1
29	H-2666-07	Valve, Ball 1 ½ NPT	1

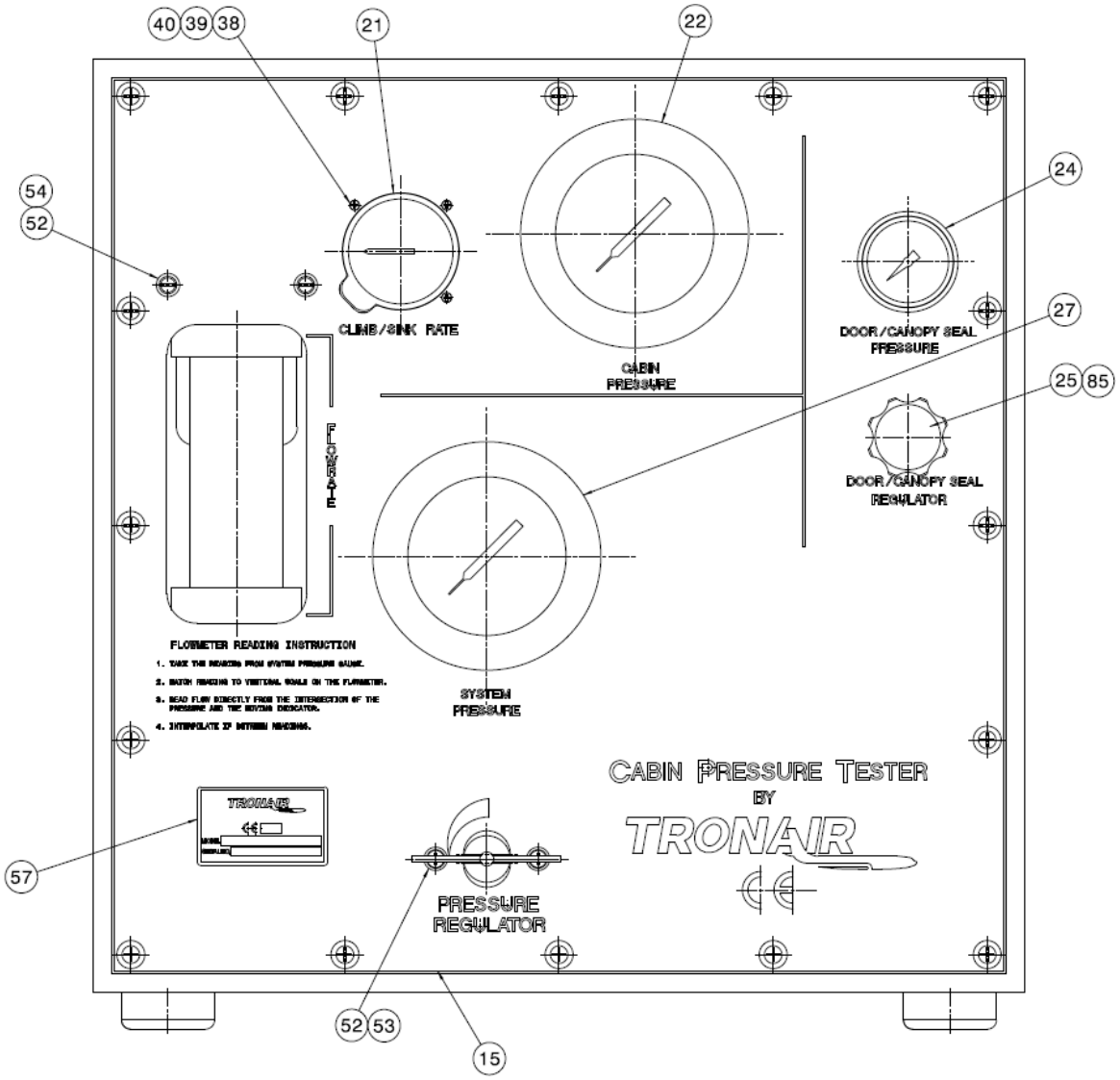
Parts List

When ordering replacement parts/kits, please specify model, serial number & color of your unit.

Item	Part Number	Description	Qty
32	N-2446-04	Elbow, 90° Male, ⅛ NPT x ¼ Tube	3
33	N-2210-08-S	Reducer, Pipe Thread	2
49	G-1439-1050-S	Nutsert, Thinwall, ¼ - 20	25
50	G-1489	Washer, Countersunk Finish	25
51	G-1158-106110	Screw, ¼ - 20 x 1 LG Oval HD Machine	25
55	G-1250-1050W	Flatwasher, ¼ Wide	2
56	G-1505	Bolt, Metric PAN HD Class 8.8 x 20mm	2
61	G-1250-1080N	Flatwasher, 7/16 Narrow	2
62	H-2761	Case CPT	1
66	TR-2269-00	CPT, Hose Output	1
67	N-2030-15-S	Swivel, #24 JIC x 1 ½ NPT	1
69	N-2203-15-S	Nipple, Pipe	1
72	H-1426-10	Clamp, Hose	4
75	J-5279-01	Panel, Rear	1
76	V-2439	Label, Back Panel	1
78	N-2207-13-S	Tee, Female Pipe	1
79	N-2210-16-S	Reducer, Pipe Thread	1
81	HC-1836	Gauge, Pressure 200 PSI	1
82	N-2203-12-S	Nipple, Pipe	1
83	H-2666-05	Valve, Ball	1
84	N-2030-11-S	Swivel, #16 x JIC x 1 NPT	1
N/S	TF-1188-240	Hose, Fire	1
N/S	Z-1697-03	Assembly, Sensor Hose	1
N/S	Z-1698-04	Assembly, Door/Canopy Hose	1

Parts List

When ordering replacement parts/kits, please specify model, serial number & color of your unit.



Item	Part Number	Description	Qty
15	H-3583-01	Panel, CPT	1
21	H-2630	Indicator, Vertical Speed	1
22	H-3528	Gauge, Pressure 0-15 PSI (0-1 Bar)	1
24	H-3540	Gauge, Pressure 0-60 PSI (0-4 Bar)	1
25	PC-1089-03	Regulator, Low Pressure 0-100 PSI (0-6.9 Bar)	1
27	H-3529	Gauge, Pressure 0-30 PSI (0-2 Bar)	1
38	G-1159-101012	Screw, Cross Recessed, Pan HD, #6 – 32 x 1 ¼ LG	3
39	G-1250-1010N	Flatwasher, #6 Narrow	3
40	G-1202-1010	ESN, #6-32	3
52	G-1250-1050N	Flatwasher, ¼ ID Narrow	4
53	G-1157-105005	Screw, Pan Head CR REC ¼ – 20 x .625 LG	2
54	G-1161-105044	Screw, Machine Pan HD ¼ – 20 x 4.5 LG	2
57	V-1779	Label, CE Serial Number	1
85	H-2259	Nut, Panel (Regulator)	1

APPENDIX I

Leak Flow Rate Measurement Test Procedure

LEAK FLOW RATE MEASUREMENT TEST PROCEDURE

This test procedure should be used when the aircraft manufacturer requires cabin air leakage be measured in terms of air flow; scfm (standard cubic feet per minute).

DANGER!

To prevent personal injury and/or damage to the aircraft:

1. **ALWAYS follow the aircraft manufacturer's instructions for pressurizing aircraft.**
2. **NEVER operate this Cabin Pressure Tester prior to reading and understanding this Operation and Service Manual.**

1. Determine the aircraft pressurization limits and leakage rates from the aircraft manufacturer's manual. A form for recording this data is provided at the end of this procedure.
2. Set aircraft cabin pressurization controls in the cockpit in accordance with the aircraft manufacturer's instructions for ground pressurization testing using an external air source.
3. Secure all aircraft windows, access panels, and doors as if preparing the aircraft for takeoff.
4. Close the Cabin Pressure Tester Shut off valve located on the Cabin Supply Hose.
5. Ensure that the Pressure Regulator is turned fully counter-clockwise.
6. Ensure that the Door Seal Regulator knob is turned fully counter-clockwise.
7. Connect the compressed air source to the Supply Air In connection on the Cabin Pressure Tester.
8. Verify that the System Pressure gage on the Cabin Pressure Tester indicates 0 psig.
9. Connect all hoses from the Cabin Pressure Tester to the aircraft (see Appendix for a list of adapters).
10. Inflate door seals, using the Door Seal Regulator and gage per aircraft manufacturer's instructions.
11. Open the ball valve to allow air to enter the aircraft cabin.
12. Slowly rotate the handle on the Pressure Regulator clockwise to begin increasing the pressure inside the aircraft cabin
    a. The Cabin Pressure Tester climb/descent rate gauge will start reading (on most aircraft) showing air is going into the aircraft.
    b. The climb/descent rate gauge indicates an **increase** in pressure when the needle moves in the **DOWN** direction (counter-clockwise).
    c. Check and correct any leaks in the air supply hose connections between Cabin Pressure Tester and aircraft as these will contribute to the aircraft leakage rate and give erroneous readings.

    NOTE: Do not exceed the maximum rate of descent specified by the aircraft manufacturer.

13. As the cabin pressure approaches the test pressure specified by the aircraft manufacturer, begin turning the Pressure Regulator counter-clockwise to slow down the rate of pressure increase.
14. When the specified cabin test pressure has been reached, adjust the Pressure Regulator as required to maintain the test pressure, and to achieve a Climb/Descent Rate equal to 0 ft/min.

NOTE: Prior to each use, the regulator must be adjusted to its minimum setting and reset as required.

WARNING!

- **Damage to the aircraft instrumentation is possible.**
- **Do not exceed aircraft manufacturer's rate of climb specification.**
- **Do not exceed the rate of descent specified by the aircraft manufacturer.**
- **To prevent personal injury, attach warning tags to all door handles: "DO NOT OPEN".**

CAUTION!

To obtain true aircraft cabin feedback data and prevent over- pressurizing the aircraft cabin:

1. **All connections must be tight and free of leaks.**
2. **Aircraft connection port must be unobstructed and connected directly to the cabin and/or cockpit area.**

15. Maintaining the Cabin Pressure Tester's Climb/Descent Rate indicator at zero, record the following data:
    a. Flowrate
    b. Cabin Pressure

5. After the data has been obtained, close the ball valve located on the Cabin Supply Hose and allow the aircraft cabin pressure to bleed off to zero.

NOTES:

1. **If the bleed off rate is low, disconnect the compressed air supply to the Cabin Pressure Tester, and open the ball valve slightly to increase bleed off rate, however, do not exceed rate of descent limits.**
2. **The rate of climb gauge shows DECREASE in cabin pressure when the needle moves in the UP direction, (clockwise).**

17. Ensure all cabin pressure is bled off.

Test Procedure continued on following page.

LEAK FLOW RATE MEASUREMENT TEST PROCEDURE

NOTE: If the leakage rate is too high, the required pressure may not be attainable. At this point, record the data stated in Step 15 in Data Sheet .

WARNING!

- **Damage to the aircraft instrumentation is possible.**
- **DO NOT exceed aircraft manufacturer's rate of descent specification.**

DATA SHEET: LEAK RATE MEASUREMENT

Aircraft :	**Notes:**
Aircraft Registration No:	
Pressures: • Not to exceed _____psig • Safety Valve Operation _____psig • Leakage Test _____psig	
Rate of Climb (not to exceed): Ascent _____ft/min Descent _____ft/min	
Cabin Leakage Limit: Indicated Leakage Flowrate _____SCFM	
Tested By: Date:	
Repair Station Cert. No:	

APPENDIX II

Pressure Decay Test Procedure

This test procedure should be used when the aircraft manufacturer requires cabin air leakage be measured in terms of pressure decay during a period of time; seconds.

PRESSURE DECAY TEST PROCEDURE

This test procedure should be used when the aircraft manufacturer requires cabin air leakage be measured in terms of pressure decay during a period of time; seconds.

DANGER!

To prevent personal injury and/or damage to the aircraft:

1. **Always follow the aircraft manufacturer's instructions for pressurizing aircraft.**
2. **Never operate this Cabin Pressure Tester prior to reading and understanding this Operation and Service Manual.**

The Pressure Decay method determines cabin air leakage by measuring the time required for the cabin pressure to drop from a set pressure to a lower pressure. The time is normally measured in seconds. A stopwatch readable in 1/10 of a second may be used for this test.

1. Determine the aircraft pressurization limits and leakage rates from the aircraft manufacturer's manual. A form for recording this data is provided at the end of this procedure.
2. Set aircraft cabin pressurization controls in the cockpit in accordance with the aircraft manufacturer's instructions for ground pressurization testing using an external air source.
3. Secure all aircraft windows, access panels, and doors as if preparing the aircraft for takeoff.
4. Close the Cabin Pressure Tester shut-off valve located on the Cabin Supply Hose.
5. Ensure that the Pressure Regulator is turned fully counter-clockwise.
6. Ensure that the Door Seal Regulator knob is turned fully counter-clockwise.
7. Connect the compressed air source to the Supply Air In connection on the Cabin Pressure Tester.
8. Connect all hoses from the Cabin Pressure Tester to the aircraft (See Adapters Appendix).
9. Inflate door seals, using the Door Seal Regulator and gage per aircraft manufacturer's instructions.
10. Open the ball valve to allow air to enter the aircraft cabin.
11. Slowly rotate the handle on the Pressure Regulator clockwise to begin increasing the pressure inside the aircraft cabin
    a. The Cabin Pressure Tester climb/descent rate gauge will start reading (on most aircraft) showing air is going into the aircraft.
    b. The climb/descent rate gauge indicates an **increase** in pressure when the needle moves in the **DOWN** direction (counter-clockwise).
    c. Check and correct any leaks in the air supply hose connections between Cabin Pressure Tester and aircraft as these will contribute to the aircraft leakage rate and give erroneous readings.

    NOTE: Do not exceed the maximum rate of descent specified by the aircraft manufacturer.

12. As the cabin pressure approaches the test pressure specified by the aircraft manufacturer, begin turning the Pressure Regulator counter-clockwise to slow down the rate of pressure increase.
13. When the specified cabin test pressure has been reached, adjust the Pressure Regulator as required to maintain the test pressure, and to achieve a Climb/Descent Rate equal to 0 ft/min.

    NOTE: Prior to each use, the regulator must be adjusted to its minimum setting and reset as required.

WARNING!

- **Do not exceed the maximum rate of descent specified by the aircraft manufacturer.**
- **Damage to the aircraft instrumentation is possible.**
- **DO NOT exceed aircraft manufacturer's rate of climb specification.**

CAUTION!

To obtain true aircraft cabin feedback data and prevent over- pressurizing the aircraft cabin:

1. **All connections must be tight and free of leaks.**
2. **Aircraft connection port must be unobstructed and connected directly to the cabin and/or cockpit area.**
3. **To prevent personal injury, attach warning tags to all door handles: "DO NOT OPEN".**

14. With the rate of climb gauges stabilized at zero (0), the following tasks must be performed in rapid succession:
    a. Close the Aircraft Cabin Supply Air ball valve located on the Cabin Supply Hose.
    b. Start the stop watch.
    c. Record the elapsed time rate between the two specified pressure levels.
15. After the data has been obtained, close the aircraft cabin supply air ball valve and allow the pressure to bleed off to zero.

Test Procedure continued on following page.

PRESSURE DECAY TEST PROCEDURE

NOTES: ***1. If the bleed off rate is low, disconnect the compressed air supply to the Cabin Pressure Tester, and open the ball valve slightly to increase bleed off rate, however, do not exceed rate of descent limits.***
2. The rate of climb gauge shows DECREASE in cabin pressure when the needle moves in the UP direction, (clockwise).

16. Ensure all cabin pressure is bled off.

DANGER!

Under possibility of bodily injury, DO NOT open cabin door until:

1. **Tapped cabin feed back pressure gauge reads zero (0).**
2. **Disconnected air supply hose from cabin pressurization unit is checked to assure no air is coming from aircraft.**
3. **Slowly unlatch cabin door.**

DATA SHEET: PRESSURE DECAY METHOD

Aircraft :	**Notes**
Aircraft Registration No:	
Pressures: • Not to exceed _____psig • Safety Valve Operation _____psig • Leakage Test: Initial Pressure _____psig Final Pressure _____psig	
Rate of Climb (not to exceed): • Ascent _____ft/min • Descent _____ft/min	
Cabin Pressure Decay: • Specification Time Limit _____sec • Actual Time _____sec	
Tested By:_____Date:_____	
Repair Station Cert. No:_____	
AIRCRAFT CABIN PRESSURE, NOT CABIN PRESSURE TESTER SYSTEM PRESSURE	

APPENDIX III

Cabin Pressure Tester Adapters

AIRCRAFT ADAPTERS

The following Cabin Pressure Tester aircraft Adapters are available from Tronair. If you cannot find the specific Adapter you require, please contact Tronair sales.

	ADAPTER KIT NUMBER	AIRCRAFT
	K-1285	Beech King Air
	K-1286	Lear 21, 25, 36, 36
	K-2601	Cessna Citation I, II, V, S/II & Ultra
♦	K-1288	Cessna Citation III, VI, VII, X
	K-1358	Citation I & II (Threaded)
	K-1359	Cessna 421, 425, 441 & Lear 45
	K-1360	Lear 55 & Embraer 120
	K-1381	Piper PA-31T Cheyenne
	K-1456	Beech Duke
	K-1491	Cessna 337
	K-2610	Raytheon Hawker
	K-1622	Falcon 10, 20, 50, 100, 200, 900
	K-1623	Aero Commander
	K-1660	MU-2 & Beech Jet (Diamond)
	K-1661	Lear 24
	K-1943	Beech Starship
♦♦	K-2182	Lear 55 (Prior To S/N 124), Lear 60
	K-2403	Sabre 65
	K-2418	Westwind/Astra
	K-2453	Pilatus PC-12
	K-3317	SJ 30-2
	K-2081	Piaggio P-180

♦ Citation III must use the kit only; deflector for temperature dissipation.
♦♦ A/C must have LearJet part number S419057-8 duct.

APPENDIX IV

Declaration of Conformity

DECLARATION of CONFORMITY

The design, development and manufacture is in accordance with European Community guidelines

CABIN PRESSURE/LEAKAGE TESTER

Relevant provisions complied with by the machinery:
2006/42/EC

Relevant standards complied with by the machinery:
EN ISO 12100-1
BS EN 983:1996
BS EN 1050:1997
prEC 1915-1:1995

Identification of person empowered to sign on behalf of the Manufacturer:

Patrick Finch

Quality Assurance Representative

Tronair, Inc.
1 Air Cargo Pkwy East
Swanton, OH 43558

Phone: (419) 866-6301 | 800-426-6301
Web: www.tronair.com
Email: sales@tronair.com

TRONAIR®

APPENDIX V

Vertical Speed Indicator Calibration Data

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APPENDIX VI

Pressure Gauge Calibration Data

TRONAIR®

APPENDIX VII

V610P and 2F300DP
Installation & Service Instructions

Parker Pneumatic

Pneumatic Division
Richland, Michigan 49083

Installation & Service Instructions
V610P
Internal Pressure Return
3/8 - 1-1/4 Remote Operated
Poppet Valves
ISSUED: June, 2002
Supersedes: May, 2001
Doc.# V-610P, ECN# 020070, Rev. 8

⚠ WARNING

To avoid unpredictable system behavior that can cause personal injury and property damage:

- **Disconnect electrical supply (when necessary) before installation, servicing, or conversion.**
- **Disconnect air supply and depressurize all air lines connected to this product before installation, servicing, or conversion.**
- **Operate within the manufacturer's specified pressure, temperature, and other conditions listed in these instructions.**
- **Medium must be moisture-free if ambient temperature is below freezing.**
- **Service according to procedures listed in these instructions.**
- **Installation, service, and conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.**
- **After installation, servicing, or conversion, air and electrical supplies (when necessary) should be connected and the product tested for proper function and leakage. If audible leakage is present, or the product does not operate properly, do not put into use.**
- **Warnings and specifications on the product should not be covered by paint, etc. If masking is not possible, contact your local representative for replacement labels.**

Introduction

Follow these instructions when installing, operating, or servicing the product.

Installation / Operating Instructions

Valve should be installed with reasonable accessibility for service whenever possible — repair service kits are available. Keep pipe or tubing lengths to a minimum with inside clean and free of dirt and chips. Pipe joint compound should be used sparingly and applied only to the male pipe — never into the female port. Do not use PTFE tape to seal pipe joints — pieces have a tendency to break off and lodge inside the unit, possibly causing malfunction. Care should be taken to avoid undue strain on the valve. Use mounting lugs (cast on valve body) as support when required.

Air applied to the valve must be filtered to realize maximum component life.

Life Expectancy - Normal multi-million cycle life expectancy of these valves is based on the use of properly filtered and lubricated air at room temperature. These valves are also designed to operate under nonlubricated conditions and will yield millions of maintenance free cycles.

Factory Pre-Lubrication - Valves are pre-lubricated at assembly with Sunaplex 781 or equivalent (Petroleum Base - Lithium Content) grease. Valves specified for vacuum service are lubricated with Dow Corning Valve Seal A.

In-Service Lubrication - In-service lubrication is not required; however, if lubrication is to be used, F442 oil is recommended. This oil is specially formulated to provide peak performance and maximum service life from all air operated equipment. Otherwise, use an air line lubricant (compatible with Nitrile & Polyurethane seals) which will readily atomize and be of the medium aniline type. Aniline point range must be between 180° and 220° F. Viscosity at 100° F: 140 - 170 SUS.

⚠ **CAUTION:** Do not use synthetic, reconstituted, or oils with an alcohol content or detergent additive.

Application Limits

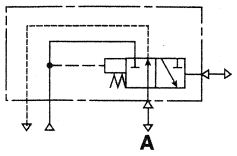
These products are intended for use in general purpose compressed air systems only.

Operating Temperature Range: Minimum 0° F (-18° C)
Maximum 200° F (93° C)

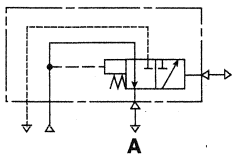
Inlet Operating Pressure Range:	**PSIG**	**bar**	**kPa**
Minimum (Standard)	20	1.38	138
Maximum	250	17.24	1724

ANSI Symbols

Normally Closed



Normally Open



⚠ WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application, including consequences of any failure and review the information concerning the product or systems in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

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Minimum Remote Pilot Signal Pressure 3/8" Basic Valves

Inlet Pressure			Function*	Minimum Remote Pilot Signal Pressure		
PSIG	bar	kPa		PSIG	bar	kPa
25	1.72	172	091	**25**	1.72	172
50	3.45	345	091	**45**	3.10	310
75	5.17	517	091	**65**	4.48	448
100	6.90	690	091	**90**	6.20	620
150	10.34	1034	091	**135**	9.31	931
200	13.79	1379	091	**170**	11.72	1172
250	17.24	1724	091	**210**	14.48	1448

Minimum Remote Pilot Signal Pressure 3/4" Basic Valves

Inlet Pressure			Function*	Minimum Remote Pilot Signal Pressure		
PSIG	bar	kPa		PSIG	bar	kPa
25	1.72	172	091	**25**	1.72	172
50	3.45	345	091	**45**	3.10	310
75	5.17	517	091	**70**	4.83	483
100	6.90	690	091	**90**	6.20	620
150	10.34	1034	091	**140**	9.65	965
200	13.79	1379	091	**180**	12.41	1241
250	17.24	1724	091	**225**	15.51	1551

Minimum Remote Pilot Signal Pressure 1-1/4" Basic Valves

Inlet Pressure			Function*	Minimum Remote Pilot Signal Pressure		
PSIG	bar	kPa		PSIG	bar	kPa
25	1.72	172	091	**25**	1.72	172
50	3.45	345	091	**45**	3.10	310
75	5.17	517	091	**65**	4.48	448
100	6.90	690	091	**85**	5.86	586
150	10.34	1034	091	**125**	8.62	862
200	13.79	1379	091	**170**	11.72	1172
250	17.24	1724	091	**200**	13.79	1379

* Function code is the 8th and 9th digit of the model number (i.e. "91" in N3542109153).

Remote Pilot Signal Pressure:	**PSIG**	**bar**	**kPa**
Maximum	250	17.24	1724

Installation Port Connections

1) Connect inlet air supply to port "IN".
2) Connect mufflers (or plumb exhaust) from port "EXH" for 3-Way valves.
3) Connect cylinder ports "CYL" to cylinder or other device to be supplied air.
4) Connect airline from normally closed pilot signal valve to port in cover.

Service Kits / Parts

Service Kits

Basic Valve Size	Kit Number
3/8"	K352073
3/4"	K352074
1-1/4"	K352075

Parts

Description	Basic Valve Size		
	3/8"	3/4"	1 1/4"
Lower Piston	K202001	K202002	K313028
Upper Piston	K212001	K212002	K313029
Gasket	K183049	K183057	K183058

Parker Pneumatic

Pneumatic Division
Richland, Michigan 49083

Installation & Service Instructions:
2F300DP

1" P3N Series
Particulate, Adsorber & Coalescing

ISSUED: August, 2002
Supersedes: October, 2001

ECN# 020256, Rev.# 6

⚠ WARNING

To avoid unpredictable system behavior that can cause personal injury and property damage:

- **Disconnect electrical supply (when necessary) before installation, servicing, or conversion.**
- **Disconnect air supply and depressurize all air lines connected to this product before installation, servicing, or conversion.**
- **Operate within the manufacturer's specified pressure, temperature, and other conditions listed in these instructions.**
- **Medium must be moisture-free if ambient temperature is below freezing.**
- **Service according to procedures listed in these instructions.**
- **Installation, service, and conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.**
- **After installation, servicing, or conversion, air and electrical supplies (when necessary) should be connected and the product tested for proper function and leakage. If audible leakage is present, or the product does not operate properly, do not put into use.**
- **Warnings and specifications on the product should not be covered by paint, etc. If masking is not possible, contact your local representative for replacement labels.**

Application Limits

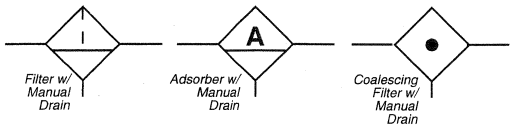
These products are intended for use in general purpose compressed air systems only.

Adsorber Filters are **not effective** on: Carbon monoxide, carbon dioxide, methane, ethane, ethylene or hydrogen. For a complete list of vapors that can and cannot be adsorbed effectively by activated charcoal adsorbers consult the factory.

Maximum Recommended Pressure Drop:

	kPa	PSIG	bar
Particulate Filter	70	10	0.7
Operating Pressure Maximum	1700	250	17.0
Operating Temperature Maximum	80°C (175°F)		
Operating Temperature Minimum	0°C (32°F)		

ANSI Symbols



Installation

1. The filter should be installed with reasonable accessibility for service whenever possible – repair service kits are available. Keep pipe or tubing lengths to a minimum with inside clean and free of dirt and chips. Pipe joint compound should be used sparingly and applied only to the male pipe – never into the female port. Do not use PTFE tape to seal pipe joints – pieces have a tendency to break off and lodge inside the unit, possibly causing malfunction. Also, new pipe or hose should be installed between the filter and equipment being protected.
2. The upstream pipe work must be clear of accumulated dirt and liquids.
3. Select a filter location as close as possible to the equipment being protected and upstream of any pressure regulator.
4. Install filter so that air flows in the direction of arrow on body.
5. Install filter vertically with bowl drain mechanism at the bottom. Free moisture will thus drain into the sump "quiet zone" at the bottom of the bowl.

Operation and Service

1. Manual drain filters must be drained regularly before the separated moisture and oil reaches the bottom of the lower baffle.
2. The particulate filter element should be removed and replaced when pressure differential across the filter is 10 PSIG.
3. Adsorber elements are designed to adsorb vaporous contaminates. The relative efficiency of an adsorber varies depending on the vapor to be adsorbed and the environmental temperature. At higher temperatures, adsorbers become less efficient.

   Adsorber elements are not particle filters. All particles and aerosols should be removed prior to adsorbing vaporous contaminants. The initial pressure drop across an adsorber element (1.5 PSIG maximum) should never increase. The presence of any liquids, aerosols or particulate matter in an adsorber indicates that the effective life of the element has been exceeded and the element should be replaced and the system cleaned.

   The most effective method of testing whether an element needs to be replaced is to smell the air coming from the adsorber. Offensive odors will be present well before oil levels become detectable.

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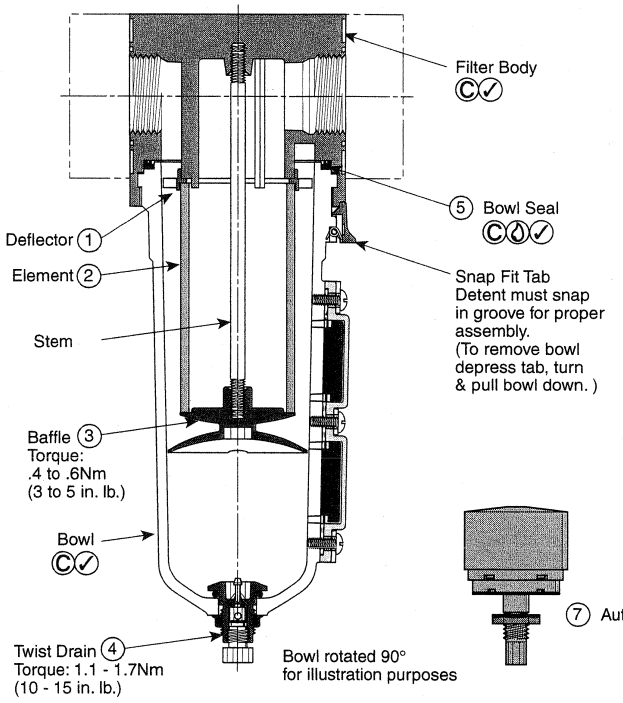
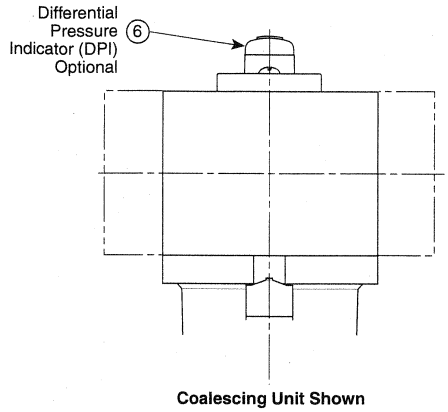
4. For Coalescing filter, a 5 micrometer pre-filter is recommended to protect the high efficiency filter and to prolong the elements life.
5. The differential pressure indicator, located on top of the filter body, gives a visual indication of the pressure differential across the filter element. Change the filter element when half or more of the orange piston is above the retaining ring when air is flowing. For units without a differential pressure indicator, pressure differential gauges should be used to determine when the maximum recommended pressure differential has been reached.
6. Shut off air supply and depressurize the unit, before servicing.
7. After servicing, apply system pressure and check for air leaks. If leakage occurs, **Do Not Operate** — conduct servicing again.

Service Kits Available

Description	Kit Number	Contains Items
Element Kits -		
5 Micron	GP3NKA00ESE	(5) Bowl Seal and (2) Element
40 Micron	GP3NKA00ESG	
Adsorber	GP3NKA00ESA	
25 Micron Porous Bronze	GP3NKA00ESJ	
Coalescing/Element Grade 6	GP3NKA00ESC	
Coalescing/Element Grade 10	GP3NKA00ES9	
DPI Repair Kit	PS781	(6) DPI components (not all shown)
Auto Drain Kit	PS506	(7) Auto Drain Assembly



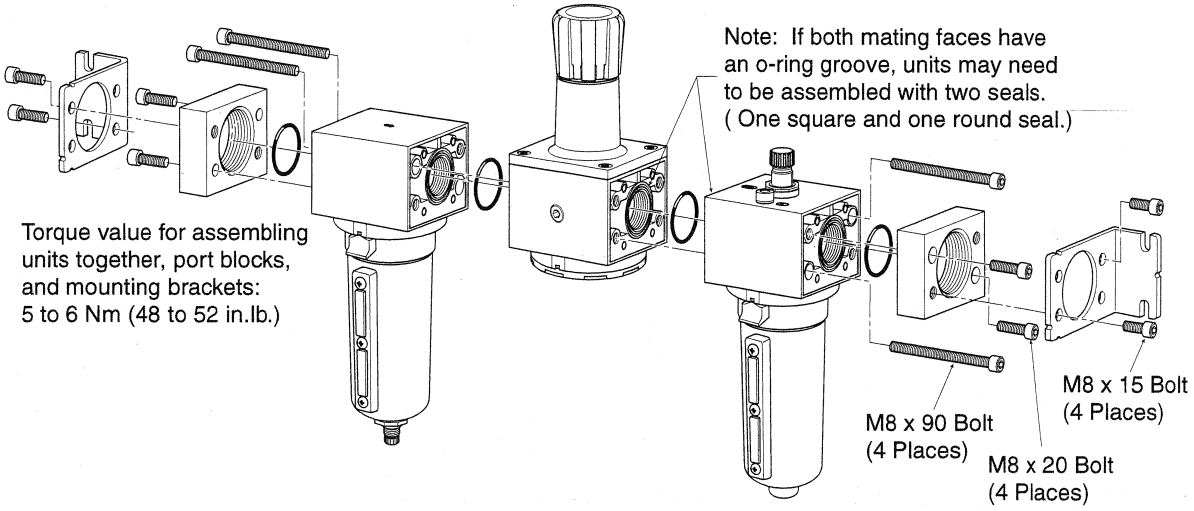


Coalescing Unit Shown

💧 Lightly grease with provided lubricant.

✓ Inspect for nicks, scratches, and surface imperfections. If present, reduced service life is probable and future replacement should be planned.

Ⓒ Clean with lint-free cloth.



Standard Regulator Literature No. 83-538-000 REV 1 08/02

MANUFACTURER'S WARRANTY

Manufacturer's products are warranted to be free from defects in material and workmanship under proper use, installation, application and maintenance in accordance with manufacturer's written recommendations and specifications for one year from the date of shipment from the factory. Manufacturer's obligation under this warranty is limited to and the sole remedy for any such defect shall be the repair or replacement (at manufacturer's option) of unaltered products returned to manufacturer and proven to have such defect provided such defect is promptly reported to manufacturer within one year period.

THIS IS THE ONLY AUTHORIZED MANUFACTURER'S WARRANTY AND IS IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATIONS, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OF FITNESS, OR OF ANY OTHER OBLIGATIONS ON THE PART OF MANUFACTURER. Warranty claims must be submitted and shall be processed in accordance with manufacturer's established warranty claim procedure. In no event will manufacturer be liable for business interruptions, loss of profits, personal injury, costs of delay or for any other special indirect incidental or consequential losses. costs or damages.

WARNING: USE LIMITATIONS

Manufacturer's warranties are void, and manufacturer assumes no responsibility for any resulting cost loss, injury or any other damages whatsoever with respect to any plastic bowl unit for which a metal bowl guard is standard equipment if the unit is placed in service without the metal bowl guard and except as otherwise specified in writing by manufacturer with respect to any manufacturer's products which are used in other than compressed air service. Specific warnings with respect to these and other use limitations appear elsewhere in this product instruction sheet.

YOU *have selected a quality product, and we appreciate it.....*
To be assured of maximum performance and satisfaction please read these instructions before installing this product.

VOUS *Avez choisi un produit de qualité et nous l'apprécions.*
Pour être assuré d'obtenir des performances et un fonctionnement parfait, lisezces instructions avant l'installation de notre matériel.

SIE *Haben ein Qualitätsprodukt ausgewählt und wir danken Ihnen für das uns erwiesene Vertrauen.*
Damit das Gerät mit optimaler Leistung und Sicherheit arbeitet, bitten wir Sie, vor dem Einbau die nachfolgenden instruktionen zu iesen.

VOI *avete scelto un prodotto di qualità e noi lo abbiamo apprezzato.*
Per ottenere le mazzime prestazioni e la massima soddisfazione da questi prodotti, Vi consigliamo di leggere queste istruzioni prima dell'installazione.

USTED *ha seleccionado un producto de calidad y lo apreciamos...Para asegurar un máximo rendimiento y satisfacción, sírvase leer estas instrucciones antes de instalar este producto.*

ENGLISH

IMPORTANT INSTALLATION INSTRUCTIONS FOR REGULATORS

1. **DO NOT** install the unit until you have read this entire product information sheet.
2. **EXCEPT** as otherwise specified by manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication and manufacturer assumes no responsibility for any resulting loss. Maximum pressure and temperature ratings are 300 psig (21 bar) 150°F (65.5°C).
3. **INSTALL** a filter before the regulator for maximum trouble-free operation.
4. **INSTALL** regulator after the filter when mounting in a combination.
5. **INSTALL** regulator in any convenient position.
6. **MOUNT** gauge in either gauge port.
7. **GAUGE PORTS** may be used as additional regulated air pressure outlet ports.
8. **TO ADJUST** air pressure turn adjustment knob/handle clockwise to raise the regulatedpressure, and counterclockwise to lower the regulated pressure.

IMPORTANT MAINTENANCE INSTRUCTIONS FOR REGULATORS

1. **TURN** air pressure off and vent air from system.
2. **REMOVE** the bottom plug and clean valve and seat. It is not necessary to remove regulator from the air line to remove plug.

FRENCH CANADIAN

INSTRUCTIONS IMPORTANTES POUR L'INSTALLATION DES REGULATEURS DE PRESSION

1. **NE PAS** installer l'appareil avant d'avoir lu en entier cette notice d'information sur let produit.
2. **SAUF** spécifications contraires du constructeur, cet appareil est prévu pour l'air comprimé, un emploi avec d'autres fluides (liquides ou gaz) est contre-indiqué. Par exemple, l'utilisation avec certains liquides ou gaz dangereux, ou leur injection, (tels que alcool, gaz de pétrole liquéfié) peut être dangereuz pour l'appareil ou peut entrainer des risques d'explosion ou des fuites dangereuses. Les garanties du constructeur sont nulles dans le cas d'une mauvaise utilisation et le constructeur dégage sa responsabilité dans le cas d'accident. La pression et la température maximales sont de (21 bar) et (65.5°C).
3. **INSTALLER** un filtre avant le régulateur pour une utilisation maximale sans problèmes.
4. **INSTALLER** le régulateur après le filtre quand il est monté dans une combinaison
5. **INSTALLER** le régulateur dans n'importe quelle position.
6. **MONTER** le manomètre sur l'un ou l'autre des orifices de raccordement du manomètre.
7. **LES ORIFICES** de raccordement du manomètre peuvent être utilisés comme des sorties additionnelles
   d'air régulé.
8. **POUR REGLER** la pression tourner le bouton de réglage dans le sens des aiguilles d'une montre pour augmenter la pressio régulée, et dans le sens inverse des aiguilles d'une montre pour diminuer la
   pression régulée.

INSTRUCTIONS IMPORTANTES POUR LA MAINTENANCE DES REGULATEURS DE PRESSION

1. **COUPER** l'air comprimé et purger l'installation.
2. **OTER** le bouchon inférieur et nettoyer la valve et le siège. Il n'est pas nécessaire d'ôter le régulateur de la ligne d'air pour enlever le bouchon.

GERMAN

WICHTIGE INSTALLATIONSANLEITUNG FÜR REGLER

1. **LESEN SIE** diese informationsbroschüre genau durch, bevor Sie das Gerät installieren.
2. **FALLS** vom Hersteller nicht ausdrücklich anders angegeben, wurde dieses Erzeugnis ausschließlich für den Betrieb mit Druckluft konstruiert. Die Verwendung eines anderen Mediums ist daher falsch. So kann zum Beispiel die Verwendung bzw. Einspritzung von bestimmten gefährlichen Flüssigkeiten oder Gasen in der Anlage (wie etwa Alkohol oder Petroleum) das Gerät beschädigen bzw. Explosionsgefahr oder ein gefährliches Außenleck verursachen. Im Falle einer solchen Fehlanwendung erlischt die Herstellergarantie und der Erzeuger übernimmt keine Verantwortung für einen etwa sich daraus ergebenden Verlust. Der zulässige Höchstdruck beträgt 21 bar, die zulässige Höchsttempeatur 65.5°C.
3. **INSTALLIEREN SIE** zur Gewährleistung eines störungsfreien Betriesbes einen Filter vor dem Regler.
4. **MONTIEREN SIE** bei einer Kombination den Regler nach dem Filter.
5. **INSTALLIEREN SIE** den Regler in einer bequemen Position.
6. **MONTIEREN SIE** ein Manometer in einer beliebigen Manometer-Öffnung.
7. **DIE MANOMETER-ÖFFNUNGEN** können als zusätzliche geregelte Druckluft-Auslaßöffnungen verwendet werden.
8. **DRUCKREGELUNG:** Knopf/Hebel im Uhrzeigersinn: höherer Druck; Knopf/Hebel gegen Uhrzeigersinn: niedrigerer Druck.

WICHTIGE WARTUNGSANLEITUNG FÜR REGLER

1. **DRUCK** abstellen und System entlüften.
2. **ENTFERNEN,** Ventil und Sitz reinigen. Um schraubstopfen entfernen zu können, braucht Regler nicht aus der Drucklufleitung ausgebant werden.

ITALIAN

IMPORTANTI INFORMAZIONI PER L'INSTALLAZIONE DE REGOLATORI

1. **NON INSTALLARE** l'unitá prima di avere interamente letto tutte le informazioni contenute in questo fogilo.
2. **SE** non altrimenti precisato dal costruttore, questo prodotto è specificatamente costruito per essere usaeo con aria compressa, e l'uso con ogni altro tipo di fluido (liquido o gas) è errato. Per esempio l'uso o l'iniezione nel sistema di certi liquidi o gas pericolosi (come alcool o gas liquido di petrolio) può essere dannoso all'apparecchio o portare a condizioni di combustione causando fughe pericolose. Nel caso di errate applicazioni, le garanzie di costruzione decadono ed il costruttore declina ogni responsabilità per qualsiasi tipo di danno. Ivalori massimi di pressione e temperatura sono 21 bar e 65.5°C.
3. **INSTALLARE** un filtro prima del regolatore per operazioni con la massima sicurezza.
4. **INSTALLARE** il regolatore dopo il filtro quando si tratta di una combinazione.
5. **INSTALLARE** il regolatore in ogni posizione conveniente.
6. **MONTARE** il manometro in uno degli appositi fori.
7. I **FORI LIBERI** possono essere usati come fori addizionali per uscita d'aria regolata.
8. **PER REGOLARE** la pressione: ruotare la manopola di regolazione in senso orario per aumentare la pressioneed in senso antiorario per ridurla.

IMPORTANTI INFORMAZIONI PER LA MANUTENZIONE DEI REGOLATORI

1. **CHIUDERE** la pressione e scaricare aria dal sistema.
2. **TOGLIERE** il tappo e pulire la valvola e la sede. Non è necessario staccare il regolatore dalla linea per togliere il tappo.

83-538-000 REV 1 08/02
Printed in the U.S.A.

SPANISH

INSTRUCCIONES IMPORTANTES PARA LA INSTALACION DE REGULADORES

1. **NO** instale la unidad hasta que haya leído completamente esta hoja de información sobre el producto.
2. **SALVO** que el fabricante especifique lo contrario, este producto está diseñado específicamente para el uso con aire comprimido, y su uso con cualquier otro fluido (líquido o gas) es una aplicación indebida. Por ejemplo, el uso con o la inyección de ciertos líquidos o gases peligrosos en el sistema (tales como el alcohol o el gas de petróleo líquido) podría ser nocivo para la unidad o resultar en una condición de combustión o una fuga externa peligrosa. Las garantías del fabricante no tendrán validez en el caso de aplicación indebida y éste no asume ninguna responsabilidad por cualquier pérdida resultante. Los valores máximos de presión y temperatura son de 300 lbs/pulgada2 (21 barias) y 150°F (65.5°C).
3. **INSTALE** un filtro antes del regulador para un funcionamiento sin problemas.
4. **INSTALE** el regulador después del filtro cuando esté montado dentro de una combinación.
5. **INSTALE** el regulador en cualquier posición conveniente.
6. **MONTE** el manómetro en cualquiera de los dos orificios de acoplamiento del manómetro.
7. **LOS ORIFICIOS DE ACOPLAMIENTO DEL MANOMETRO** pueden utilizarse como orificios de salida adicionales de la presión de aire regulada.
8. **PARA AJUSTAR** la presión de aire, gire la perilla/manija de ajuste en el sentido de las agujas del reloj para elevar la presión regulada y en sentido contrario a las agujas del reloj para disminuir la presión regulada.

INSTRUCCIONES IMPORTANTES PARA EL MANTENIMIENTO DE LOS REGULADORES

1. **CORTE** la presión de aire y purgue de aire la instalación.
2. **QUITE** el tapón inferior y limpie la válvula y el asiento. No hace falta quitar el regulador de la línea de aire para sacar el tapón.

TRONAIR®

APPENDIX VIII

100 Pneumatic Pressure Regulator
Installation, Operation & Maintenance

INSTRUCTIONS FOR THE INSTALLATION, OPERATION AND MAINTENANCE
FOR

FAIRCHILD MODEL 100 PNEUMATIC PRESSURE REGULATOR

GENERAL INFORMATION

The Model 100 is a spring opposed, diaphragm operated, pressure regulating valve with a large flow capacity.

Specifications Model 100

Flow Capacity ..... in excess of 3000 SCFM (5100 m³/HR)
150 psig [10 BAR] (1000 kPa) supply; 40 psig [2.8 BAR] (280 kPa) set (1½ NPT Conn.)

Exhaust capacity ..... 44 SCFM (74.8 m³/HR)
downstream pressure 5 psig [.35 BAR] (35 kPa) above set pressure

Sensitivity ..... ½" W.C. (1.27 cm)

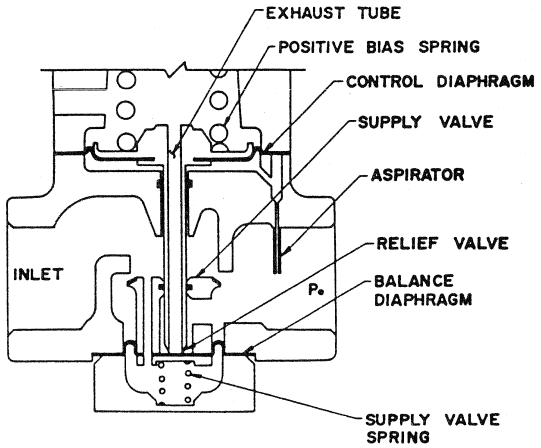
Effect of supply pressure variation ..... Less than 0.1 psig [.007 BAR] (.7 kPa) for 100 psig [7.0 BAR] (700 kPa) change

Maximum supply pressure ..... 250 psig [17 BAR] (1700 kPa)

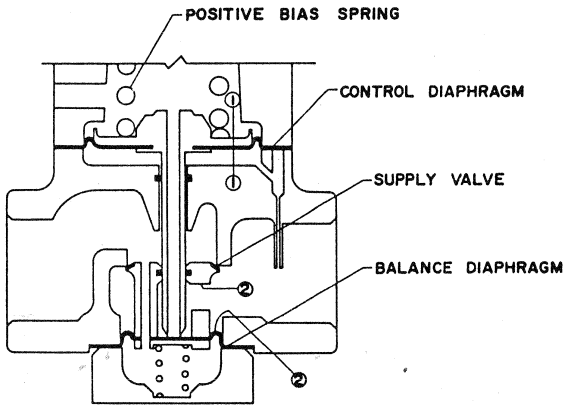
Ambient Temperature Limits ..... -40°F to +200°F (-40°C to 93.3°C)

PRINCIPLES OF OPERATION -

With supply pressure turned off, and the control knob turned to allow the range spring to be expanded, the supply valve and relief valve are seated. When supply air is introduced to the inlet port, it exerts pressure against the supply valve and is simultaneously transmitted through the channel in the supply valve, exerting pressure on the bottom of the balance diaphragm. When the knob of the regulator is adjusted to a specific set point, it compresses the range spring, which exerts a force against the top of the control diaphragm. As the diaphragm moves downward, the force transmitted by means of the exhaust tube opens

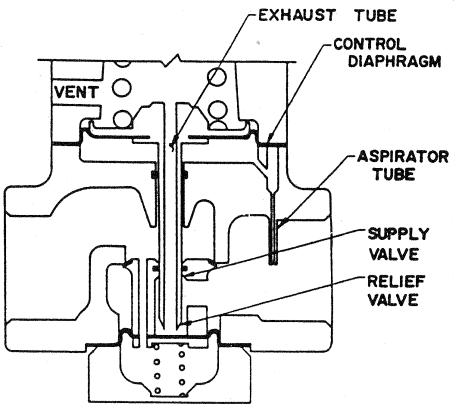


the supply valve, allowing supply air to be routed to the outlet port. Outlet (downstream) pressure is transmitted through the aspirator to the underside of the control diaphragm. The force due to downstream pressure acting upward on the bottom of the control diaphragm, aided by the supply valve spring force, acts against the range spring force exerted downward on the top of the control diaphragm, so that these forces are in balance and Po = K where Po is output pressure and K is spring constant. This condition is not reached until output pressure reaches the desired set point. Until then, the downward force opens the supply valve, allowing supply air to be routed to the outlet port. The increase



in pressure on the bottom of the control diaphragm causes it to move upward against the range spring force, allowing the supply valve to throttle and maintaining output pressure.

When set point is reached, the force acting on the bottom of the control diaphragm is in balance with the force acting on the top of the diaphragm. At this point the force (1) due to pressure acting on the bottom of the control diaphragm is equal to the force (1) due to the range spring acting on the top of the control diaphragm. The force (2) due to downstream pressure act-

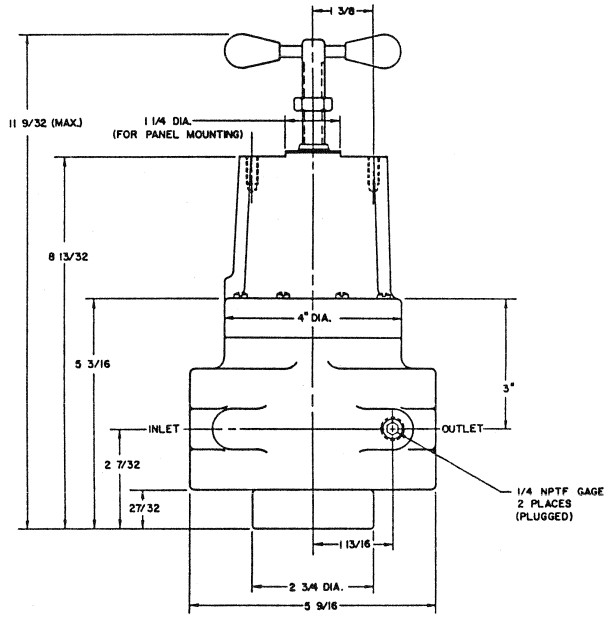


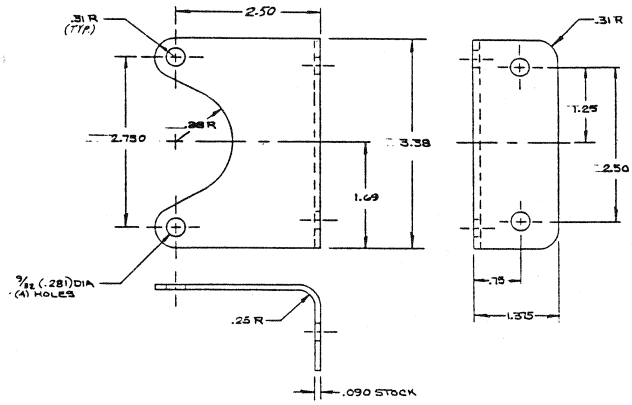
ing on the top of the supply valve is balanced by force (2) due to downstream pressure acting on the bottom of the balance diaphragm. if the downstream pressure increases, the increased pressure will be sensed on the underside of the diaphragm through the aspirator tube, and the diaphragm will move upward, seating the supply valve. As the diaphragm continues to move upward, it opens the relief valve, and air is exhausted through the exhaust tube and a vent in the bonnet. If downstream pressure decreases, the diaphragm will move downward, closing off the bottom of the exhaust tube and the relief valve, eventually opening the supply valve. This throttling action continues until forces are again in balance.

INSTALLATION

NOTICE

The presence of certain diester oils in the airlines may hasten deterioration of the elastomers and thus decrease the useful life of this unit.





Clean all pipe lines to remove dirt and scale before installation is made. Apply minimum amount of pipe compound to male threads of air line only. Start with third thread back and work away from end of line to avoid possibility of getting compound into regulator. Install regulator in air line; body is fitted with a ¾", 1", 1¼", or 1½" NPT for inlet and outlet connections. Regulator can be mounted in any position without affecting its operation. Inlet and outlet connections are labelled (look for arrows denoting direction of flow on underside of unit) and should be tightened securely. Avoid undersized fittings that will limit flow throught the regulator and cause pressure drop downstream. The use of a filter to remove dirt and entrained liquid in the air line ahead of the regulator is recommended for best performance. If an air line lubricator is used, it should be located downstream beyond the regulator in order to avoid interference with the regulator performance.

ADJUSTMENTS

No field adjustments are required

OPERATION

Relieve pressure on range spring before putting regulator into service for the first time. To operate, turn the adjusting screw slowly in a clockwise direction until required downstream pressure is obtained. Turned in this direction, the screw compresses the range spring causing increased output pressure. For decreased output pressure, turn the screw counterclockwise.

SERVICE KIT INSTALLATION

For Standard Unit

1. Check parts in the EA-( )-( ) service kit against parts marked with an asterisk in the exploded view and the associated table.
2. Mark Bonnet Assembly (6) and Body (15) so that they can be reassembled correctly.
3. Loosen Nut on Handle Assembly (1) and turn Handle so that pressure on Spring (8) is relieved.

For Tamper Proof Unit

1. Check parts in the EA-( )-( ) service kit against parts marked with an asterisk in the exploded view and the associated table.
2. Mark Bonnet Assembly (6) and Body (15) so that they can be reassembled correctly.
3. Remove Cap (1A), loosen Nut (1C) and turn screw (1B) so that pressure on Spring (8) is removed.

For All Units

4. Remove eight Screws (9) holding Bonnet Assembly (6) to Body (15) and set aside Bonnet Assembly (6).
5. Remove and set aside, Spring Seat Assembly (7), Spring (8) and Lower Spring Seat (30).
6. Remove Piston Assembly (14) and discard.

CAUTION

Note for Step 7: retainer (24) is under compression by Spring (25) of the Valve Assembly (23).

7. Carefully remove screws (9) holding retainer (24) to Body Assembly (15), releasing each screw a few turns at a time. Set Retainer (24) aside.
8. Remove Spring (25) and set aside. Remove Valve Assembly (23) and discard.
9. Secure Valve Assembly (23) from service kit and place into bottom well of Body Assembly (15), making sure that cross hole on Valve Assembly (23) lines up with Output port of Body Assembly (15) and that six mounting holes in diaphragm (20) are lined up with six bolt holes in Body Assembly (15).
10. Place Spring (25) into Plate (21) of Valve Assembly (23). Carefully position Retainer (24) over Diaphragm (20) and tighten opposite screws (9) one at a time until Retainer (24) is flush with body Assembly (15).
11. Secure Piston Assembly (14) from service kit and drop into top center hole of Body Assembly (15).
12. Align eight holes in Diaphragm (13) with eight holes in Body Assembly (15), making sure that the extra hole in Diaphragm (13) is NOT aligned with the hole in Body (15) which is directly over the Output port of the regulator.
13. Place a light coat of Molycote G-N paste over nut (11) of the Piston Assembly (14). Place Spring Seat (30) on top of the Nut (11) on Piston Assembly (14).
14. Place Spring (8) and Spring Seat Assembly (7) over Lower Spring Seat (30). The ball on Spring Seat Assembly (7) should be facing up.
15. Align marks on Body Assembly (15) and Bonnet Assembly (6) made in Step 2. Tighten opposite screws (9) in Bonnet Assembly (6) to secure Bonnet Assembly (6) to Body Assembly (15).
16. Reinstall the regulator in accord with instructions in the IOM and follow instructions in the Operation section for placing the regulator back in service.

OPTIONS

Body Assembly	1 NPTF	1 ½ NPTF	E	N	T
10 psig	* EB-10035-6	EB-10035-8			
30, 60, 100, 150 psig	EB-10035-2	EB-10035-4			
Bonnet Assembly	EB-10036-3	EB-10036-3	EB-10036-5	EB-10036-3	
Piston Assembly	EB-10027-2	EB-10027-2	EB-10027-2	EB-10478	
Valve Assembly	EB-10028-3	EB-10028-3	EB-10028-1	EB-10028-3	
Cap	N/A	N/A	N/A		EB-10307
Set Screw	N/A	N/A	N/A		EB-10309
Nut	N/A	N/A	N/A		EB-10050
Gasket	N/A	N/A	N/A		EB-11906

N/A — Not Applicable
All numbers are prefixed by EB-

MAINTENANCE

The regulator is easily disassembled for the occasional cleaning or removal of foreign matter. Before this is done, however, shut off valve upstream of the regulator to prevent escape of air when regulator is disassembled. There is no need to remove the regulator from the pipe line; remove the six No. 10-32 screws on the bottom of the unit and pull out the inner valve assembly. Wash inner valve assembly with solvent exercising care to avoid damaging diaphragms and valve facings. Replace assembly carefully. The vent hole in the bonnet should be kept clear. A slight flow of air through this hole is necessary for the proper operation of the regulator. The adjusting screw should be lubricated with Molycote type "G" grease.

CAUTION

(Avoid such solvents as acetone, carbon tetrachloride, trichlorethylene)

TROUBLE SHOOTING

PROBLEM	CHECK
Leakage	Body screw tightness, Diaphragm
High Bleed	Relief pintle and relief seat for damage or contamination
Difficult to Adjust	Adjusting screw and ball
	Seal ring lubrication

REPAIR PARTS LIST

A Service Kit is available for maintenance of the Model 100:

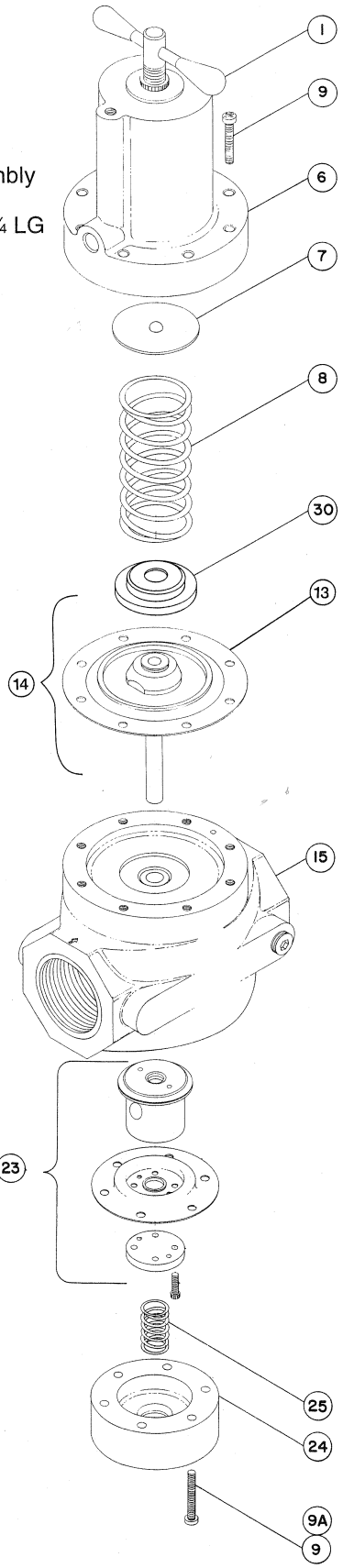
Standard	EA-12150-1
Non-Relieving	EA-12168
Tamper Proof	EA-12164

Index.	Part No.	Description
1	EB-10106	Handle Assembly
1 A	EB-10307	Cap
1 B	EB-10309	Set Screw
1 C	EB-10050	Nut
1 D	EB-11906	Gasket
6	See Table	Bonnet Assembly
7	EB-10037	Spring Seat Assembly
8	EB-10022-	Spring
9	EB-1032-20	Screw #10-32 x 1¼ LG
9 A	EB-10502	Washer
12	EB-10192	Piston
13	EB-13461	Diaphragm
*14	See Table	Piston Assembly
15	EB-10035-	Body Assembly
*23	See Table	Valve Assembly
24	EB-10019	Retainer
25	EB-10141	Spring
30	EB-14571	Spring Seat Lower

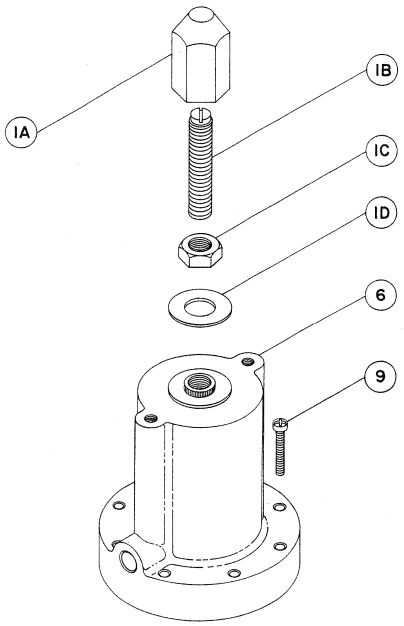
*Service Kit Components

Option	Suffix
Tamper Proof	T
Tapped Exhaust	E
Non-Relieving	N

STANDARD



TAMPER PROOF



TRONAIR®

APPENDIX IX

Flowmeter
Installation & Operation

FLOW METERS

Specifications		
Casing Material	Aluminum, Brass or Stainless Steel #304	
Maximum Pressure	Aluminum and Brass: 3500 psi (240 Bar) Stainless Steel #304: 6000 psi (413 Bar)	
Maximum Temperature	240°F (115°C)	
Reading	Direct Reading - 360° Ref. Line (Non-Electrical)	
Scale Accuracy	+/- 4% FS, Center 1/3 of scale +/- 2.5% FS	
Repeatability	+/- 1% FS	
Port Sizes	1/8" - 2" NPTF, #6 - #32 SAE (No Brass) 1/4" - 2" BSP	
Installation Dimensions *(Port Sizes/Dimensions)*	***Series 2*** 1/8", 1/4"	1-1/4" O.D. x 4-13/16" Length (32mm O.D. x 122mm Length)
	Series 3 1/4", 3/8", 1/2"	1-7/8" O.D. x 6-9/16" Length (48mm O.D. x 167mm Length)
	Series 4 3/4", 1"	2-3/8" O.D. x 7-5/32" Length (60mm O.D. x 182mm Length)
	Series 5 1-1/4", 1-1/2"	3-1/2" O.D. x 10-1/8" Length (90mm O.D. x 258mm Length)
	Series 5 2"	3-1/2" O.D. x 12-5/8" Length (90mm O.D. x 322mm Length)
Installation Orientation	Horizontal or Vertical (Scaled Vertically)	
Flow Straighteners	Not Required	
Test Fluid	Mobile DTE 25 Medium @ 110°F (43°C)	

Basic Application Information

The flow meter can be installed directly in the fluid line without flow straighteners or special piping. The meter is used to measure the flow rate of most liquids which do not contain particles greater than 74 micron.

1) External components are sealed inside the Lexan window tube to permit use in areas where the meter may be sprayed or washed with soap and water.
2) Mount the meter in the most convenient location to allow easy access for reading and maintenance.
3) The meter should NOT be mounted near hot pipes or equipment which can cause deformation of the window tube and scale.
4) The meter should be mounted at least one foot (.3 meter) from large electric motors, or the internal magnet may weaken or become demagnetized.
5) Aluminum and brass meters should not be mounted where assembled piping is not supported.

Warning and Precautionary Areas

1) The meters are designed to operate in systems that flow in only one direction: the direction of the arrow on the flow scale. Attempting operation in the reverse direction may cause damage to the meter or other system components.

2) The window tube of standard meters is made of Lexan. Lexan can be safely cleaned with soap and water. However, many other cleaning agents can damage Lexan, causing discoloration or crazing. If you are unsure of your cleaning agent, call the General Electric Lexan Compatibility Reference Line at 800-845-0600.

3) To retain accuracy and repeatability many internal moving parts are precision machined and require filtration of at least 74 micron or a 200 mesh screen.

4) All meters are tested and calibrated at our test facility using a light hydraulic oil. The units are well drained, but some oil residue may still remain within the meters. Please check the compatibility with your fluid. The meter may have to be cleaned before use. (See "Cleaning & Inspection")

5) When installing aluminum or brass meters onto steel pipe caution should be taken not to over tighten the pipe connections. The thread in the meter end fittings may strip if over tightened.

6) Aluminum and brass meters should not be used in systems where the assembled piping is not supported. Heavy weight may cause the meter to bend or malfunction.

7) **Operating Temperature**: In standard meters, several components have a maximum temperature rating of 240ºF (115ºC).

8) **Operating Pressure**: All meters are tested at a burst pressure three times of operating pressure. Meters should not be used over the operating pressure rating.

9) Pressure and flow surges may disengage the outer magnet follower from the transfer magnet. If this occurs, a shock suppressor should be used to eliminate malfunction.

10) **Teflon tape**: Caution should be used when using Teflon tape on pipe thread joints. Leave at least 1/8" (3mm) of pipe thread exposed from end of pipe when applying tape.

11) These meters, as well as many other meters, use an internal transfer magnet in the design. Because of this magnet, be aware of the following:

    a) Keep flow meters away from computer disks and tapes.

    b) If metal particles are moving through the system, a magnetic filter may be required.

INSTALLATION

Basic Installation Instructions

The meters are mounted in-line and are direct reading. The meters can be mounted in a vertical or horizontal position as long as the fluid is flowing in the direction of the arrow on the flow scale. No straight pipe is required before or after the meter. In fact, 90° elbows can be installed on both ends without any noticeable flow variation.

When installing a meter, apply "Teflon Tape" or "Liquid Teflon Sealant" on pipe threads. If tape is used, be sure to leave 1/8" (3 mm) of pipe thread exposed on end of pipe. Position filter in front of meter and in a location that allows easy access for routine maintenance. Refer to "Warnings and Precautionary Areas" for additional information.

INSTALLATION DOS AND DON'T

To obtain satisfactory operation from a flow meter, the following points should be considered:

DO:

- install a pressure gauge near the inlet of the meter
- place throttling valves at the outlet of the meter
- use pipe sealer on the connections
- install a union on one side of the meter for easy removal for maintenance and calibration
- install solenoid valves at meter outlet (as far downstream as possible)
- mount in any orientation: vertical, horizontal or upside down

DO NOT:

- place restrictions between the meter's pressure gauge meter inlet
- use in systems where reverse flow is possible
- place meter in non-aligned piping
- over-flow the meter by more than 150% of maximum reading
- operate at pressures and temperatures greater than specified
- *install restrictions between pressure gauges and the meter inlet
- *install solenoid valves at the meter inlet

**pneumatic flow meter applications*

Fluid Flow in Reverse Direction

The standard meter will not permit flow in the reverse direction (opposite direction to the arrow printed on the flow rate scale). In the reverse direction, the meter will behave in a manner similar to a leaky check valve.

Prolonged flow in the reverse direction will cause damage to the standard monitor's internal mechanism that could result in inaccurate readings or premature failure of the meter. If the standard meter will be installed in a system where reverse flow is possible, it is recommended that a check valve be installed in parallel with the meter in order to facilitate reverse flow around the meter. Check valves are readily available through fluid component distributors.

Alternatively, flow meters with a built-in reverse flow bypass mechanism may be specified and ordered for a small additional cost. These monitors are designated by a "-RF" suffix attached to the end of the standard model code.

Flow meters with the built-in reverse flow bypass will allow flows in the reverse direction of up to the maximum flow rate printed on the flow rate scale without any damage to the monitor's internals.

If the part number label on the meter that is being installed shows a model code containing the "-RF" suffix, then the meter may be installed in systems where reverse flow is possible without the need for an external check valve.

Bi-Directional Flow Measurement

In certain situations it may be necessary to measure flow rates in both directions. For a small additional fee, an option for bi-directional flow measurement may be specified. Meters that include this option are designated by a "-BI" suffix attached to the end of the standard model code.

If the part number label on the meter that is being installed shows a model code containing the "-BI" suffix, then the meter may be installed in any orientation regardless of flow direction.

OPERATION

Operating Principles

A line of unique flow meters which combine the simplicity of a sharp-edged orifice disk and a variable area flow meter has been developed. See **Illustration 1** "Flow Meter Cross Section" on page 9.

The meters are tubular, with all internal wetted parts sealed within the body casing. Running through the center of the body casing is a tapered center shaft which is centered in the bore by pilot disks at each end. Encircling the shaft is a sharp-edged, floating orifice disk, transfer magnet and return spring. The disk and transfer magnet are held in the "no flow" position by the biased return spring.

As the flow moves through the meter it creates a pressure differential across the floating orifice disk, forcing the disk and transfer magnet against the return spring. As flow increases, the pressure differential across the disk increases, forcing the disk and transfer magnet to move along the tapered center shaft. As flow decreases, the biased return spring forces the disk and transfer magnet down the tapered center shaft, returning to the "no flow" position.

In metal casing meters we cannot see the movement of the floating orifice disk and transfer magnet because they are sealed inside the body casing. Therefore, a magnet follower is positioned around the outside of the body casing and is magnetically coupled to the internal transfer magnet. As the flow rate increases, the internal magnet moves along the tapered center shaft (inside the body casing) and the magnet follower moves along the outside of the body casing (under the scale).

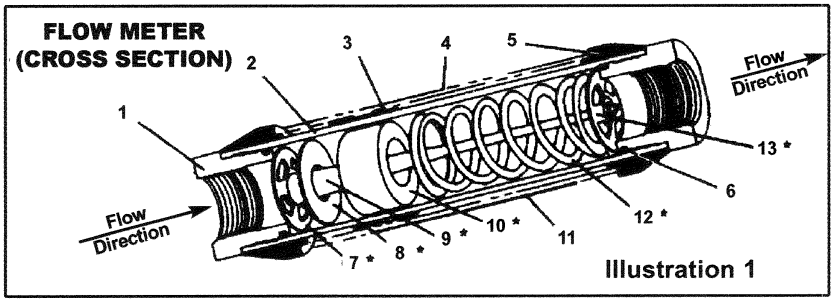


Illustration 1

1. End Porting
2. Body Casing
3. Magnet Follower
4. Window Tube
5. Window Seal
6. Seal Assembly
7. Pilot Disk
8. Flowing Sharp-Edged Orifice Disk
9. Tapered Center Shaft
10. Transfer Magnet
11. Scale
12. Return Spring
13. Retainer Ring

** Cartridge contains: 7, 8, 9, 10, 12 and 13*

Reading the Meter

Notice the black reference line which runs 360° around the white magnetic follower. This reference line moves under the scale in direct relation to the movement of the internal orifice disk. When fluid is flowing, the flow rate through the meter is read by lining up the black reference line with the closest rate line on the external flow scale.

Specific Gravity or Density Effect

Standard meters are calibrated for either WATER with a specific gravity of 1.0 or OIL with a specific gravity of .873. The floating disk meter is effected by fluid density as are most other similar types of meters. These meters have less of this effect because of the sharpness of the floating orifice disks being used.

The indicated flow reading will read high for heavier fluids and low for lighter fluids. A corrective factor can be applied to the standard scale or a special scale can be added at a slight additional cost. When flowing other specific gravities, the basic equations below can be used.

For WATER Meters use: $\sqrt{1.0/\text{Specific Gravity}}$ x scale reading

For OIL Meters use: $\sqrt{.873/\text{Specific Gravity}}$ x scale reading

Viscosity Effect

The meters incorporate a unique floating, sharp-edged orifice disk. The floating, sharp-edged orifice disk offers greater operating stability and accuracy over a wide range of viscosities.

PNEUMATIC METER USES & OPERATION

Rugged, high pressure, pneumatic meters are designed for permanent installation in compressed gas systems. These products provide a low cost means to measure compressor volumetric outputs, pneumatic tool consumptions and other industrial gas flow rates.

Flow meters operate using the variable annular orifice method with compression spring return –the identical method used in our field proven liquid flow rate meters. The product's follower, where the measurement is indicated, is magnetically coupled through a high pressure casing to the meter's internal orifice assembly.

Benefits of these design features are:

- high operating pressure
- linear displacement of the follower with respect to flow rate
- high turn-down ratios
- measuring accuracy within ±4% of full-scale
- operation in any mounting orientation

Flow meters are offered in three standard materials of construction:

- aluminum for standard monitoring applications to 600 PSIG
- brass for media/material compatibility
- stainless steel for compatibility and operation to 1000 PSIG.

Measuring ranges cover 1.5-12 SCFM through 150-1300 SCFM. Twenty-four port sizes from 1/8" through 2" in NPT, SAE and BSP can be ordered to meet specific plumbing requirements. Pneumatic meters are also available in alarm and transmitter configurations for electronic monitoring applications.

Standard Cubic Feet

Flow meters are calibrated to measure the flow of compressible media (gases) in SCFM – standard cubic feet per minute. A "standard" cubic foot is defined as a cubic foot of dry air at standard atmospheric conditions: 70ºF and 14.7 PSIA (0 PSIG) measured at sea level.

When a standard cubic foot of air is compressed, its actual volume will decrease proportionally as absolute pressure increases. For example, a standard cubic foot of air's actual volume will decrease by 50% and density will increase by 100% as the air is compressed from atmospheric pressure 14.7 PSIA (0 PSIG) to 29.4 PSIA (14.7 PSIG). **See Illustration 2.**

There are three factors that affect the Flow Meter Calibration: specific gravity, pressure and temperature. Flow meters are calibrated for air (specific gravity of 1.0) at 70ºF and 100 PSIG. Most low pressure rotameters are calibrated at 0 PSIG and require corrections for use at any other pressure.

Flow meters are designed for pneumatic systems where pressures between 90 - 110 PSIG are used. In these common applications, a flow meter with a standard calibration can be read directly without applying corrections.

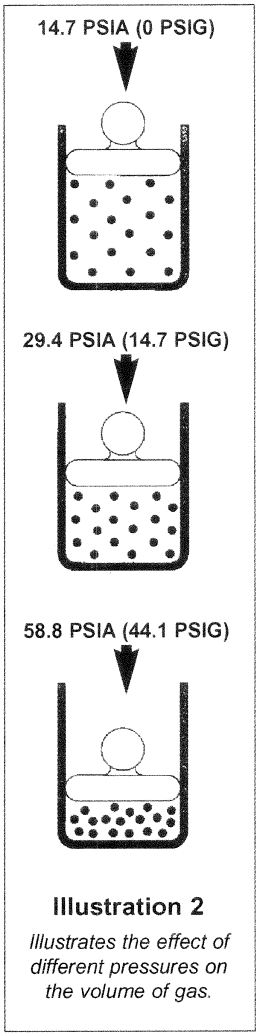


Illustration 2

Illustrates the effect of different pressures on the volume of gas.

DENSITY CORRECTION FACTORS

SCFM (indicated) x (CF) = SCFM (Actual) $CF = (f_1) \times (f_2) \times (f_3)$

Note: all correction factors need not be used.

Table 1. (f_1) PRESSURE CORRECTION FACTORS (inlet pressure)

psig	25	50	75	100	125	150	175	200
f_1	.56	.75	.88	1.0	1.11	1.2	1.29	1.37

$$f_1 = \sqrt{\frac{14.7 + psig}{114.7}}$$

Table 2. (f_2) TEMPERATURE CORRECTION FACTORS

°F	10°	30°	50°	70°	90°	110°	130°	150°
f_2	1.08	1.04	1.02	1.0	.98	.96	.95	.93

$$f_2 = \sqrt{\frac{530}{460 + °F}}$$

Table 3. (f_3) SPECIFIC GRAVITY CORRECTION FACTOR

$$f_3 = \sqrt{\frac{1}{Sp.\ Gr.}}$$

f_1= correction factor for other than 100 PSI inlet.

f_2= correction factor for other than 70°F.

f_3= correction factor for other than air at 1.0 Sp. Gr.

Correction Factors

If a flow meter is installed in a system where conditions differ from the standard listed above, correction factors will need to be applied to retain the design accuracy of the meter. The appropriate correction factor equations are detailed above. To assure the best monitoring accuracy, pressure and temperature measurements should be taken directly at the meter's inlet port.

Special Scales

Special calibrations can be performed to correct for the following system characteristics:

- system pressure
- system temperature
- media specific gravity
- various measuring units (i.e. LPM, LPS, m3/hr, etc.)
- any combination of the above

Consult factory or your distributor for details and prices.

Selecting the Proper Meters

To order a pneumatic flow meter the following information is required:

- pipe size and port style
- media (air, nitrogen, argon,etc.) – for material compatibility and specific gravity considerations
- approximate flow range required[1]
- system pressure: nominal, maximum, minimum
- system temperature

Flow Range[1]

Estimating the flow rate in a compressed gas system may seem complicated, but with some research and a few simple equations an educated guess can be made.

Two suggested methods are:

Method 1

A compressor is typically rated in SCFM output at a certain pressure and efficiency. If the rating cannot be located or is unknown, an estimate of compressor output can be obtained by the following formulas:

- **1-stage compressors:**
  motor HP/0.179 = SCFM @ 100 PSIG
- **2-stage compressors:**
  motor HP/0.164 = SCFM @ 100 PSIG
- **3-stage compressors:**
  motor HP/0.159 = SCFM @ 100 PSIG

Method 2

If all of the potential of a compressor is not being used (the unit cycles on and off) or if flow rate in excess of compressor capacity is being consumed (the compressor cannot meet the demand), a summation of machine usages can be totaled to determine the maximum flow rate. Most machine tools that use compressed air specify the maximum consumption of the tool.

TROUBLESHOOTING & MAINTENANCE

TROUBLESHOOTING CHART	
Malfunction:	**Magnet follower sticks in mid-scale and will not return to the "no flow" position.**
Possible Cause:	**Corrective Action:**
Horizontal/Vertical Mount Particulate, Teflon tape, rust or other foreign matter is holding the internal parts form returning. **Horizontal/Vertical Mount** A surge or shock in the fluid flow moved the internal magnet faster that the external follower could follow, thus separating the follower from the magnet.	Disassemble and inspect meter for contamination. Install proper filtration or problem may reoccur.
Warning: **Shut down systems before removing meter from flow line. Remove meter from system. Tip the meter so the arrow on the flow scale points upward. This should return the magnet follower to the "no flow" position. Add some type of surge protection, or problem my reoccur.**	
Malfunction:	**Meter scale reading is off an equal amount at all points and the magnet follower still moves freely.**
Possible Cause:	**Corrective Action:**
Reading the scale using the top or bottom edge of the magnet follower.	Be sure to read the scale using the black reference line which runs around the magnet follower.
Possible Cause:	**Corrective Action:**
Fluid being monitored may not be compatible with standard meter scale.	Standard meters are calibrated for .873 SP. Gr. oil at 110° (43°C) using Mobile DTE 25 Medium fluid. Check your fluid data for a variance, or call the factory for assistance.
Possible Cause:	**Corrective Action:**
All meters are calibrated in the vertical position.	Check with the factory for a correction factor or for a replacement scale corrected for horizontal use.

TROUBLESHOOTING CHART (CONTINUED)	
Malfunction: Window tube is cracking or crazing.	
Possible Cause: Using incompatible cleaning solution on Lexan window tube.	**Corrective Action:** Use soap & water or a mild degreaser (Stoddard or Naptha) to clean Lexan tube. To check the compatibility of your cleaning fluid, call General Electric's Lexan Compatibility Reference line at 800-845-0600.
Malfunction: Scale is fogging or coming loose.	
Possible Cause: Ambient or fluid temperature is too high.	**Corrective Action:** Relocate meter in another area where temperature specifications are not being exceeded.
Possible Cause: Using incompatible cleaning solvents on scale.	**Corrective Action:** Use soap and water.

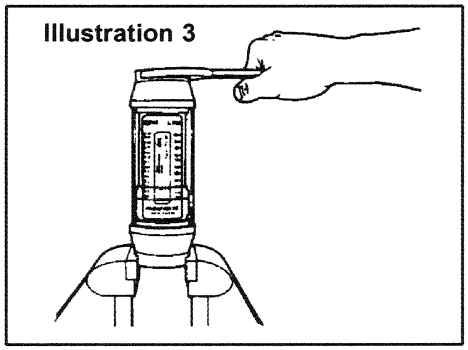
Disassembly

Important: It is not necessary to remove window tube or window seals to clean the meter. Note also how the meter disassembles for easy of reassembly.

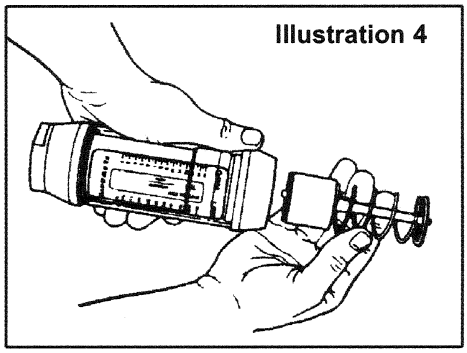
Warning: Shut down system before removing meter from flow line.

1. Use a clean dry cloth to remove all foreign material from exterior of meter, especially around threaded ends.
2. Remove meter from the flow line.
3. With the arrow on the scale pointing upward, mount the meter in a vice. **See Illustration 3.** Use the flats of the inlet end porting when securing the meter in the vice.

   Important: DO NOT wrench or tighten vice on Lexan tube.



4. Install a wrench across the flats of the outlet end porting and turn counterclockwise to loosen assembly. Do not remove end porting at this time.
5. Remove meter from vice. Hold the meter so the end port that is loose, is on top. Remove loose end porting.
6. Tilt the open end of meter over a clean cloth to expose inner cartridge. **See Illustration 4.** Remove inner cartridge assembly from body casing. **Note**: Because the transfer magnet is magnetically coupled to the magnetic follower, you will notice a slight resistance when removing cartridge. If cartridge does not slide out, insert a wooden dowel in opposite end of meter and push or lightly tap on dowel until cartridge comes loose.



IMPORTANT: If inner cartridge does not slide out freely, it may be sign of contamination. The transfer magnet is a powerful ALNICO magnet. Keep it away from metal chips and fillings. They may be hard to remove when reassembling and will cause premature failure.

7. Examine inner cartridge or level of contamination.
   A. If inner cartridge has a low level of contamination and is functioning properly, no further disassembly is required. Proceed to "Cleaning and Inspection." **See Illustration 5.**
   B. If inner cartridge appears to be highly contaminated or damaged, it should be completely disassembled for cleaning and inspection. Proceed with Step 8.

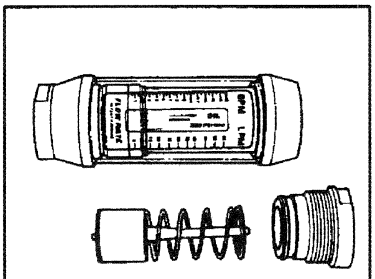


Illustration 5

8. Remove outlet side (spring end) retainer clip, **See Illustration 6**, which secured pilot disk to tapered center shaft.

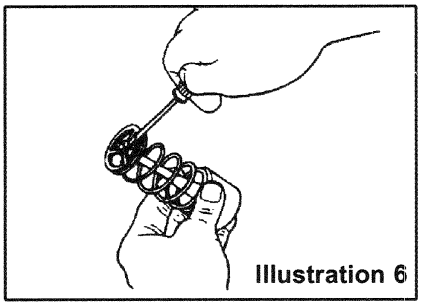


Illustration 6

9. Remove return spring, transfer magnet and floating orifice disk. **See Illustration 7**.
10. Proceed to "Cleaning and Inspection." After the meter is cleaned reassemble parts in reverse order of disassembly.

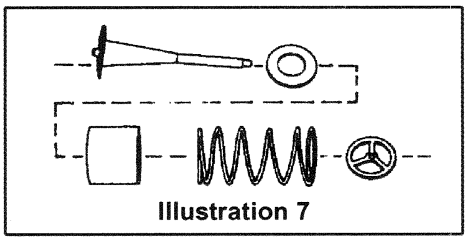


Illustration 7

IMPORTANT:
Always use new retainer clips for reassembly. 3/8" and 1/2" = Waldes No. 5105-12H. 3/4 and 1" and 1-1/4" and 1-1/2" = Waldes No. 5105-18H, or obtain at no charge from the factory.

Cleaning and Inspection

Note: If the inner cartridge is damaged or contaminated beyond repair, the complete meter can be sent to the manufacturer for evaluation. The manufacturer will inspect, repair, and/or replace parts as needed according to the warranty.

1. Inspect inner cartridge and body casing for contamination. If the inner cartridge did not slide out freely, it may be a sign of contamination. Locate and eliminate the source of contamination before reconnecting meter to the system or the same problem will reoccur. It may be necessary to install finer filtration or a magnetic filter in the system.

2. Soak inner cartridge assembly (or individual parts, depending on level of disassembly) in a suitable cleaning solvent. Naptha or Stoddard is recommended.

   CAUTION: When using an air hose wear proper eye protection.

3. Remove parts from solvent. Use an air hose and/or scrub with a light brush to remove any remaining contaminants. Remove any magnetized particles from transfer magnet.

4. Inspect inner cartridge for scored or worn parts. Replace parts as needed. (Parts are available from your local distributor.)

5. Remove any contaminants from inside body casing.

6. Clean Lexan widow tube with soap and water, or a compatible cleaning solvent. **IMPORTANT**: Some solvents may cause damage to Lexan tube, check compatibility of solvent being used.

7. Clean and inspect seal assemblies (O-rings and seals) for nicks or cuts. Replace as needed.

8. Clean and inspect the meter every six months.

Properly filtered meters will provide years of trouble-free service. If the meter is not properly filtered, it may be damaged and malfunction. Meter damage caused by excessive contamination in not covered under warranty.

FILTRATION AND CONTAMINATION

Recommended Filtration

The manufacturer recommends system filtration of at least 74 micron filter or a 200 mesh screen. It has been found that if inadequate filtration has caused meter failure, it will normally fail in the open position. Some systems may require a magnetic filter. **IMPORTANT**: Meter damage caused by excessive contamination is not covered under warranty.

Stabilized Contamination

The goal of filtration is to create effective protection from system contamination. Proper filtration stabilizes contamination to allow fluid components to function properly. A fluid system is considered stabilized when, "contamination in" equals "contamination out". Proper filtration must reduce initial contamination to a stabilized level within an acceptable time period. the system should be stabilized in time to prevent premature wear or damage to meter components.

Contamination Sources

Fresh Fluid

When fresh fluid is stored in holding tanks, it may be contaminated with scale or metal flakes from inside the tank. To prevent this type of contamination, be sure to filter fresh fluid before adding to the system.

New Machinery Contamination

When building new machines, a certain amount of built-in contamination is unavoidable. Typical built-in contamination consists of dust, dirt, chips, fibre, sand, flushing solutions, moisture, weld splatters and pipe sealants. Flushing the system before operation can reduce contamination, but cannot eliminate it totally. Unless the system is flushed at a high velocity, some contamination will not be dislodged until the system is in operation. System contamination can cause fluid component malfunction.

Environmental Contamination

When performing routine maintenance, the system's fluid is commonly exposed to environmental contamination. Exercise caution during routine maintenance to prevent this type of contamination. Be sure to change breather filter and systems air filter regularly.

Self-Generation Contamination

Self-generated contamination is a product of wear, cavitation, fluid breakdown and corrosion. Systems that are carefully flushed, maintained, and have fresh fluid added, mainly have self-generated contamination. In this case, proper filtration can prevent fluid component malfunction.

INTERCHANGEABLE FLOW CARTRIDGE

Basic Application Information

This unique design permits the exchange of many different cartridges within the same meter, thus allowing the conversion to other flow ranges at minimal cost. The substitute cartridge offers different flow ranges at the same low pressure drop as the original. Each cartridge comes with a new cartridge, scale and installation instructions. Check with your meter distributor for prices and delivery.

APPENDIX X

Instrument Certification Notice

INSTRUMENT CERTIFICATION NOTICE

The gauge Certificates of Calibration supplied for the gauge(s) on this unit contain the calibration data for the actual instrument calibrated, along with the calibration date of the **STANDARD** used to perform the calibration check.

The due date for re-calibration of the instrument should be based upon the date the instrument was placed in service in your facility. Re-calibration should be done on a periodic basis as dictated by the end user's quality system or other overriding requirements.

Note that Tronair, Inc. does not supply certificates of calibration on flow meters or pyrometers unless requested at the time of placed order. These instruments are considered reference indicators only and are not critical to the test(s) being performed on the aircraft.

Tronair, Inc.
1 Air Cargo Pkwy East
Swanton, OH 43558

Phone: (419) 866-6301 | 800-426-6301
Web: www.tronair.com
Email: sales@tronair.com