BARFIELD

1811HA (SERIES) PITOT-STATIC TEST SET
1811GA (SERIES) PITOT-STATIC TEST SET

USER INSTRUCTION MANUAL

M/N: 1811HA, P/N: 101-00184-SERIES
M/N: 1811GA, P/N: 101-00185-SERIES

Doc. P/N: 56-101-00184/00185
Revision I
September 24, 2014

BARFIELD, INC.

Corporate Headquarters

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SAFETY INFORMATION

The manufacturer has designed this equipment to be safe when operated using the procedures detailed in this manual. Do not use this equipment for any other purpose than that stated.

- **INPUT POWER (1811HA MODEL ONLY)**

  100 - 240VAC / 50 - 60 Hz / 60W

- **FUSE PROTECTION**

  Operating at 120VAC: 2 fuses (5mm x 20mm), 1A

  Operating at 240VAC: 2 fuses (5mm x 20mm), 0.5A

  Note: The 1811HA Test Set is shipped with 2 fuses (5mm x 20mm), 1A, installed.

  Caution: Always replace blown fuses with properly rated fuses.

- **OPERATING TEMPERATURE RANGE**

  0° to 50° C (32° to 122° F)

CONTACT INFORMATION

Users are requested to notify the manufacturer of any discrepancy, omission, or error found in this manual. Inquiries should include specific questions and reference the publication title, number, chapter, page, figure, paragraph, and effective date.

Please send comments to:

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(800) 321-1039

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ATTENTION

Although every effort has been made to provide the end user of this equipment with the most current and accurate information, it may be necessary to revise this manual in the future. Please be sure to complete and return the enclosed **OWNER WARRANTY REGISTRATION CARD** to Barfield in order to validate the warranty and to ensure that you will receive updated information when published. You MUST have your name and address on file at Barfield as a registered user of this equipment, to be able to obtain the service covered by the warranty.

Visit the company website, http://barfieldinc.com/, for publication updates.

Please send the Registration Card to:

Barfield, Inc.
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REVISION RECORD

REV.	ECO #	REV. DATE	DESCRIPTION OF CHANGE
-	N/A	August 1, 1997	Initial Release
A	N/A	January 30, 1998	N/A
B	260-00453	June 4, 1999	Manual revised to show new 1811HA wiring diagram as per ECO
C	N/A	September 2, 2003	Revised to newest format; added section 4 (Valve Leak Test); also, included temporary revision changes as follows: - Section 1-1: Part Number Variations DAS650 & DALT55 indicator descriptions in Table 2 - Part Number for power entry module: 17752 revised to refer to Barfield Sales.
D	260-00698	May 17, 2007	Manual revised to show an additional step in the Static Pretest procedures (Section 1-3, Page 5): - (1) Open Crossbleed Valve (#8) fully.
E	260-00746	December 17, 2008	A numeric code was added at the end of the former P/Ns, to identify the instruments configuration supplied with a particular unit. Updated Logo, page numbering, and format.
F	260-00773	March 26, 2010	Added Safety page to front of manual. Changed Input power to 100 - 240VAC / 50 - 60Hz / 60W, 400Hz operational but not UL certified, added Figure 5 for Power Entry Module switch operation, re-titled Appendix, updated Chapter 5 Inspection Recommendations, updated chapter 2 specifications.
G	260-00828	March 25, 2011	Updated warranty information; added 12 month required inspection steps to Table 5.
H	260-00968	April 19, 2013	Updated Inspection Recommendations
I	260-01031	Sept 24, 2014	Updated Barfield logo & warranty information

1811 SERIES
PITOT-STATIC TEST SET

INFORMATIONAL LETTER

The *Barfield 1811 series Pitot-Static Testers* are not advertised for use to comply with FAR 91.411. The Test Sets do fully meet the requirements of DOT Advisory Circular 43-203B for performing Altimeter and Static System Tests and Inspections. However, the personnel requirements and some of the technical aspects of actual testing put a sizeable burden on the person or persons performing the test.

Barfield advertises its 1811 series Test Sets as general-purpose trouble-shooting testers. With respect to compliance with FAR 91.411, we feel that the customer should first be aware of **all** requirements for performing test tests in the field. With this in mind, Barfield stands ready to offer advice and assistance to its customers for accomplishing the required tests.

In conclusion, the Barfield 1811 Series Pitot-Static Testers meet the requirements for compliance with FAR 91.411, but it is important that the customer be sure that the use of the test set will be in compliance with the regulations.

Please note that a *Barfield Altimeter and Static Test Procedure* (Document number 60-101-00150) is available to use in compliance with FAR 91.411.

MAINTENANCE AND REPAIR INFORMATION

The manufacturer of this equipment does not recommend the user to attempt any maintenance or repair. In case of malfunction, contact the manufacturer, to obtain the list of approved repair facilities worldwide, ensuring that this equipment will be serviced using proper procedures and certified instruments. A Return Maintenance Authorization (RMA) number will be assigned during this call, to keep track of the shipment and the service.

BARFIELD PRODUCT SUPPORT DIVISION

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INTRODUCTION

1. PUBLICATION BREAKDOWN

This instruction manual establishes the operation standards for the 1811HA / GA Pitot-Static Test Set.

Its purpose is to provide sufficient information for the personnel unfamiliar with this unit to understand this equipment, identify its parts, and operate it in accordance with proper procedures, operating techniques, precautions and limitations.

2. INFORMATION PROVIDED WITH THE UNIT

Besides this User Instruction Manual, the 1811HA / GA Test Set is provided with the items described below.

A. An identification label similar to Figure 1 and located on the front bulkhead of the Test Set, provides the following information:

Manufacturer Name
Designation of Equipment
Equipment Part Number
Equipment Model Number — Equipment Serial Number
Equipment Modification (if applicable) — Equipment Options (if applicable)

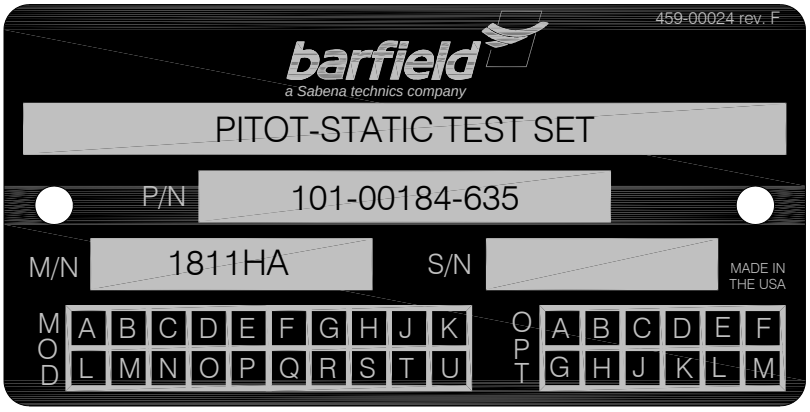

Figure 1 IDENTIFICATION LABEL

B. Each new or re-certified unit is delivered with a Certificate that shows the date when the unit was tested by the manufacturer, its serial number, and when the next certification is due. This certificate confirms that the unit performed according to its design specifications.

C. The one year limited warranty for this unit (Figure 2).

3. RECERTIFICATION

The Test Sets P/N 101-00184 and P/N 101-00185 have a 6-month recertification period when analog instruments are installed. However, when digital instruments are installed the recertification period is typically one year. For complete specifications on digital instruments, refer to documents 61-101-02184 and 61-101-02194.

It is strongly recommended that the manufacturer, Barfield Inc., service the Test Set. This will ensure that all applicable engineering change orders are incorporated during the required maintenance or recertification procedure. Additionally, at this time only Barfield technicians are qualified to service the digital instruments.

Note: It is important that the customer ensures the Test Set is in compliance with the Recertification requirement.

Note: If the Test Set is to be used in compliance with F.A.R. 91.170 and Part 43, Appendix E, "Altimeter System Tests and Inspections," refer to FAA Advisory Circular AC43-6B (or subsequent) for approved inspection intervals and procedures.

LIMITED ONE YEAR WARRANTY

BARFIELD INC. ("BARFIELD") warrants only to the original Purchaser of this product from BARFIELD or an authorized distributor that this product will be free from defects in material and workmanship under normal use and service for one year after date of purchase. BARFIELD reserves the right, before having any obligation under this limited warranty, to inspect the damaged BARFIELD product, and all costs of shipping the BARFIELD product to BARFIELD for inspection shall be borne solely by the Purchaser. In order to recover under this limited warranty, Purchaser must make claim to BARFIELD within 60 days of occurrence, and must present acceptable proof of original ownership (such as a purchase order, invoice, warranty card registration, or other documentation BARFIELD deems acceptable) for the product. BARFIELD, at its option, shall repair or replace the defective unit covered by this warranty. Please retain the dated sales receipt as evidence of the original purchaser's date of purchase. You will need it for any warranty service. In order to keep this limited warranty in effect, the product must have been handled and used as prescribed in the instructions accompanying this product. This limited warranty does not cover any damage due to accident, misuse, abuse or negligence. This limited warranty is non-transferable and does not apply to any purchaser who bought the product from a reseller or distributor not authorized by BARFIELD, including but not limited to purchases from internet sites. This warranty does not affect any other legal rights you may have by operation of law. Contact BARFIELD at www.Barfieldinc.com or customer service at (305) 894-5506 for warranty service procedures.

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BARFIELD INC.
4101 NW 29th Street
Miami, Florida 33142, USA

Form 7.5.3-13
Dated 09/01/2014, Rev. 1

Figure 2 LIMITED ONE YEAR WARRANTY

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CHAPTER 1: GENERAL INFORMATION

1. TEST SETS DESCRIPTION

The *BARFIELD INC.* ***1811HA / GA*** (Figure 3) is a Pitot-Static Test Set, intended to test aircraft Pitot and Static Systems for leaks and to test the operation and calibration of airspeed, altimeter, rate of climb, and other vacuum or low pressure units. The Test Set is a portable unit enclosed in a fiberglass carrying case.

Note: The pitot and static port adapters fit many aircraft universally but, in some cases, these adapters are not recommended or are inadequate. ***Barfield Inc.*** distributes high quality custom-made pitot and static adapters for use on all general aviation, airline, helicopter and military aircraft. Visit our web site at www.barfieldinc.com or contact the Barfield GSTE – Sales Department at (305) 871-3900 for more information.

1811HA Test Set (P/N 101-00184-SERIES) **1811GA Test Set (P/N 101-00185-SERIES)**

Figure 3 Overview of the Test Sets

The ***1811HA / GA*** Test Set is equipped with reference master instruments with appropriate correction cards. (See Appendixes). Panel mounted hand pumps are equipped with reservoir tanks to supply pressure and vacuum. Metering valves are provided for control of all pneumatic functions. Ports are provided for external connections**.** The ***1811HA*** model also contains an integral electric pressure / vacuum pump.

2. PHYSICAL DESCRIPTION

A. Carrying Case

The Tester comes with a fiberglass carrying case that contains upper and lower sections: The lower section supports the panel assembly. The upper section has sliding pin hinges for easy removal and is fitted with a shelf suitable for storing the manual, hoses and the power cable.

B. Part Number Variations

There are two basic model numbers: **1811GA** which has manually operated pumps, and the **1811HA,** which has all the features of the **1811GA** in addition to an internal electrical pump to supply vacuum or pressure. The three-character code at the end of the part number identifies the various indicator combinations which are available. The three-character code at the end of **101-00184-635,** for example, specifies the Airspeed indicator range, Vertical Speed indicator range, and the Altimeter range. The **"6"** indicates an Airspeed indicator with a **20-250 knot range**. The **"3"** indicates a Vertical Speed indicator with a **3000 ft / min range**. The **"5"** indicates an altimeter with a 3 pointer, **35,000 ft**, in-Hg / mb Baro Scale. Refer to **Table 1** for available indicator combinations**.**

Table 1 Code Numbers for Available Indicators

101-00184- 635

AIRSPEED		VERTICAL SPEED (CLIMB)		ALTIMETER	
Code	**Range**	**Code**	**Range**	**Code**	**Range**
1	650 Knots (50 - 650 kts)	2	2000 ft / min (max.)	2	Precision, Dual Diaphragm, 3 ptr, 80K ft. range cal to 55K, in-Hg baro scale.
4	420 Knots (60 - 420 kts)	3	3000 ft / min (max.)	3	Sensitive, 3 ptr, 50K ft, in-Hg / mb Baro scale
6	250 Knots (20 - 250 kts)	4	4000 ft / min (max.)	5	Sensitive, 3 ptr, 35K ft, in-Hg / mb Baro scale
9	Special	6	6000 ft / min (max.)	9	Special
A	DAS650, Digital 650 kts	9	Special	A	DALT55, Digital 55k ft
		0	Vert. Speed Indicator included in DALT55		

C. Front Panel

Figure 5 identifies the components of the Test Set Front Panel, as listed in Table 2.

Figure 4 1811GA/HA Front Panel

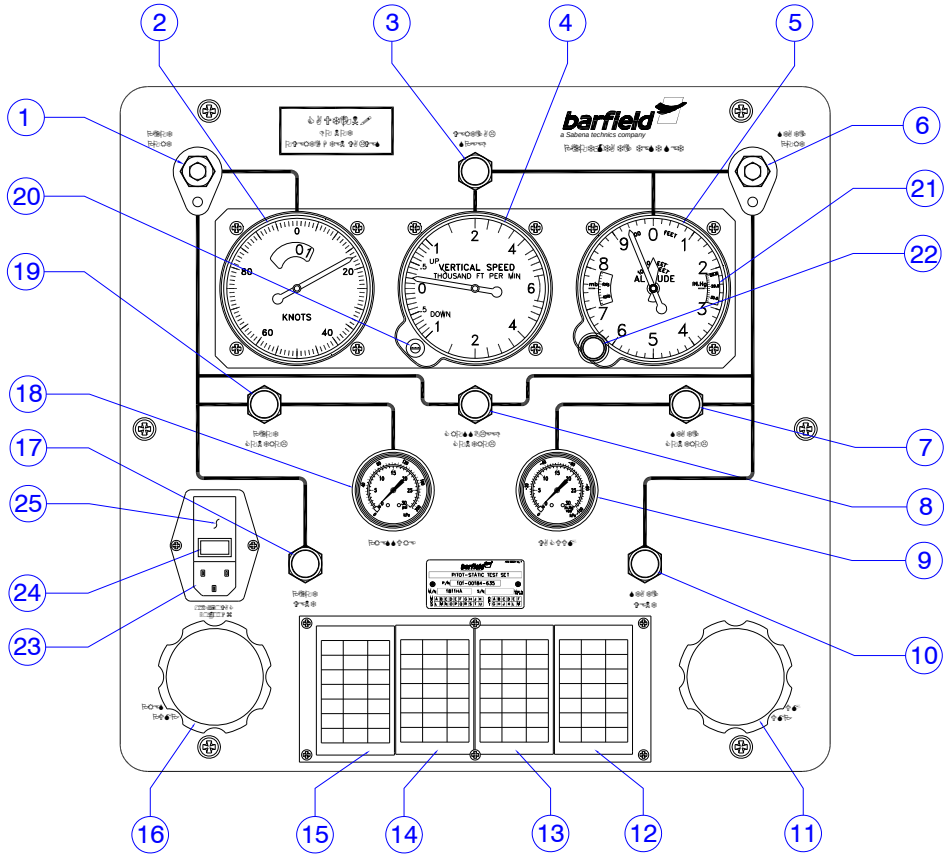


Table 2 1811GA/HA Front Panel Items

ITEM	DESIGNATION	DESCRIPTION	FUNCTION
1	PITOT PORT	1/8-27 NPT Female Bulkhead Fitting	Port for connection to aircraft Pitot System or other application.
2	- - - - -	Airspeed Indicator	Monitor differential pressure in terms of airspeed between pitot and static.
3	VERTICAL SPEED	Isolation Needle Valve	To isolate and / or control connection of the vertical speed indicator with the static side of T/S.
4	- - - - -	Vertical Speed Indicator	Monitor rate of change of vacuum static side of T/S.

Table 2 1811GA/HA Front Panel Items (Continuation)

ITEM	DESIGNATION	DESCRIPTION	FUNCTION
5	- - - - -	Altimeter	Monitor pressure altitude at vacuum-static side of T/S.
6	STATIC PORT	1/8-27 NPT Female Bulkhead Fitting	Port for connection to aircraft Static System or other application
7	STATIC CONTROL	Vacuum Source Needle Valve	To control vacuum source.
8	CROSSBLEED CONTROL	Crossbleed Needle Valve	To control pressure difference between pitot and static.
9	VACUUM	0-30 Inches of Mercury Vacuum Gauge	Monitor vacuum available in vacuum reservoir tank.
10	STATIC VENT	Vacuum Vent Needle Valve	To release vacuum to ambient atmosphere.
11	VACUUM PUMP	Hand Operated Piston Pump	Integral vacuum source for all tests.
12	(ALTIMETER)	Calibration Card	Provides altimeter calibration correction (Only for Analog Indicators).
13	(HYSTERESIS)	Calibration Card	Lists altimeter hysteresis (Only for Analog Indicators)
14	(VERTICAL SPEED)	Calibration Card	Provides vertical speed calibration correction (Only for Analog Indicators).
15	(AIRSPEED)	Calibration Card	Provides airspeed calibration correction (Only for Analog Indicators).
16	PRESSURE PUMP	Hand Operated Piston Pump	Integral pressure source for all tests.
17	PITOT VENT	Pressure Vent Needle Valve	To release pressure to ambient atmosphere.
18	PRESSURE	0-30 PSI Pressure Gauge	Monitor pressure available from pressure reservoir tank.
19	PITOT CONTROL	Pressure Source Needle valve	To control pressure source
20	ZERO SET	Adjusting screw	Adjust zero settings
21	BARO WINDOW	In-Hg scale	Baro reading
22	BARO SET	Baro set knob	Adjust Baro setting

1811HA ONLY

23	POWER ENTRY MODULE	IEC Power Line Connector	Provides electrical connection to a 100 – 240VAC, 50 - 60Hz source.
24		Electric Pump Switch	Turns pump ON (|) or OFF (**O**)
25		Fuses Holder	Holds fuses for electrical protection.

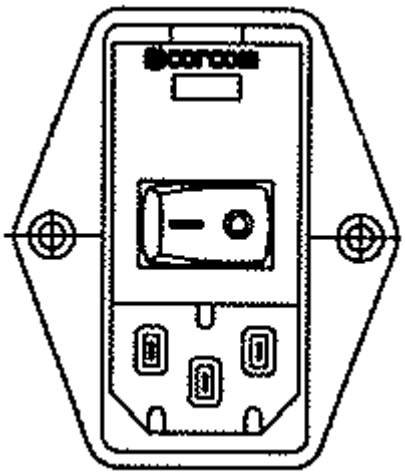
D. Power Information (1811HA Only)

The Power Entry Module fulfills three user functions (from top to bottom in Figure 5):

- Allows easy replacement of blown fuses (refer to page 12 for fuses specifications).
- Allows turning power for pump ON (|) or OFF (**O**).

  Note: The end of the switch that is pressed inward, indicates which position is selected. For example, in Figure 6, the pump is not energized.

Figure 5 Power Entry Module



- Allows connection of external power to the tester. This unit is shipped with a power cord for North America having a standard 120VAC plug.

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CHAPTER 2: SPECIFICATIONS AND CAPABILITIES

1. PHYSICAL DATA

A.	Height:	11.5 in	(29.2 cm)
B.	Width	15.5 in	(39.4 cm)
C.	Depth:	15.5 in	(39.4 cm)
D.	Weight *	26 lbs	(12.0 kg) 1811GA
		34 lbs	(15.5 kg) 1811HA

* (shipping weight)

2. SPECIFICATIONS

Refer to Sections 1, 2, and 3 of the Appendix for Engineering Specifications.

3. ACCURACY

For analog instruments, refer to Sections 1, 2, and 3 of the Appendix. For accuracy specifications applicable to digital instruments (1811HA-A0A or 1811GA-A0A Test Sets), refer to documents 61-101-02184 and 61-101-02194.

4. OPERATING TEMPERATURE RANGE

0° to 50° C (32° to 122° F)

5. PRESSURE / VACUUM SOURCES

Suitable for Oxygen enriched systems and has capacity for multiple Pitot / Static systems.

Note: Pressure and vacuum are generated by one internal electric pump in the **1811HA** model.

6. PNEUMATIC CONNECTIONS

A. Pitot
B. Static

Fittings conform to JIC (AN) standards. Quick-disconnect are optional.

7. INPUT POWER (1811HA MODEL ONLY)

100 - 240VAC / 50 - 60 Hz / 60W

Note: Input power functional at 400Hz, but not UL certified

8. FUSE PROTECTION (1811HA MODEL ONLY)

Operating at 120VAC: 2 fuses, 1A each

Operating at 240VAC: 2 fuses, 0.5A each

Note: The 1811HA Test Set ships with 2 each, 1A (5mmx20mm) fuses installed.

Caution: Always replace blown fuses with properly rated fuses:
For 120VAC power input, use 2 fuses, 1.0A Slo-Blo each.
For 240VAC power input, use 2 fuses, 0.5A Slo-Blo each.

CHAPTER 3. OPERATION

1. THEORY OF OPERATION

The **1811HA / GA** Pitot-Static Test Sets (T/S) test the aircraft Pitot and Static Systems for leaks. The Tester is also used to operate and calibrate airspeed, altimeter, rate of climb, engine pressure ratio, manifold pressure indicators, and other vacuum or low pressure units.

Panel mounted hand pumps are equipped with reservoir tanks to supply pressure and vacuum. Metering valves are provided for control of all pneumatic functions, and ports are provided for external connections.

With the crossbleed and vent valves closed, the pressure source control needle valve admits pressure from the tank into the system and causes a reaction in both the tester master instrument and the instrument being tested through the pitot connection. The vacuum source control valve similarly controls the vacuum system of the tester. Two vent valves equalize their individual systems with atmospheric pressure. A crossbleed valve controls the pressure difference in the pressure and vacuum lines of the tester.

By operating the appropriate valve, controllable-pressure can be set up in the Pitot (pressure) and / or Static (vacuum) lines. These pressures appear as readings on the master indicators. By applying the values listed on the correction cards, the operator creates a known correct pressure condition with which to compare the unit under test.

A. Pressure / Vacuum Requirements

The ***1811HA*** has an internal electric pump to supply vacuum and pressure capable of achieving 55k ft and 6000 ft / min on a wide body aircraft. The ***Test Set*** operational input A/C power requirement is 100 - 240VAC / 50 - 60 Hz / 60W. Use of the internal electric pump of the HA model does not affect the operation of the test set. However, the electric pump eliminates the need for repeated hand pumping as the tank supply decreases.

B. Control Valve Operation

As discussed above with the CROSSBLEED CONTROL, PITOT and STATIC VENT valves closed, the PITOT CONTROL needle valve admits pressure from the tank into the system and causes a reaction in both the tester airspeed display and the instrument under test through the pitot connection. (Refer to Appendixes A, B and C for Specifications and Accuracy).

The 1811HA / GA STATIC CONTROL valve similarly controls the vacuum system of the tester. The two VENT valves equalize their respective systems with atmospheric pressure. The CROSSBLEED CONTROL valve controls the pressure difference in the pressure and vacuum lines of the tester. By operating the appropriate valve, controllable-pressure can be established in the Pitot (pressure) and / or Static (vacuum) lines. These pressures appear as readings on the 1811HA / GA Altimeter, Airspeed, and Vertical Speed Indicators as well as electric pump vacuum and pressure gauges on the instrument front panel.

C. Power Supply Circuits

The *1811HA* can be powered from 100 - 240VAC / 50 - 60 Hz. The internal power supply automatically detects input voltage applied of 100 - 240VAC.

2. 1811GA PNEUMATIC SCHEMATIC DIAGRAM

The 1811GA internal pneumatic connections are shown in Figure 6.

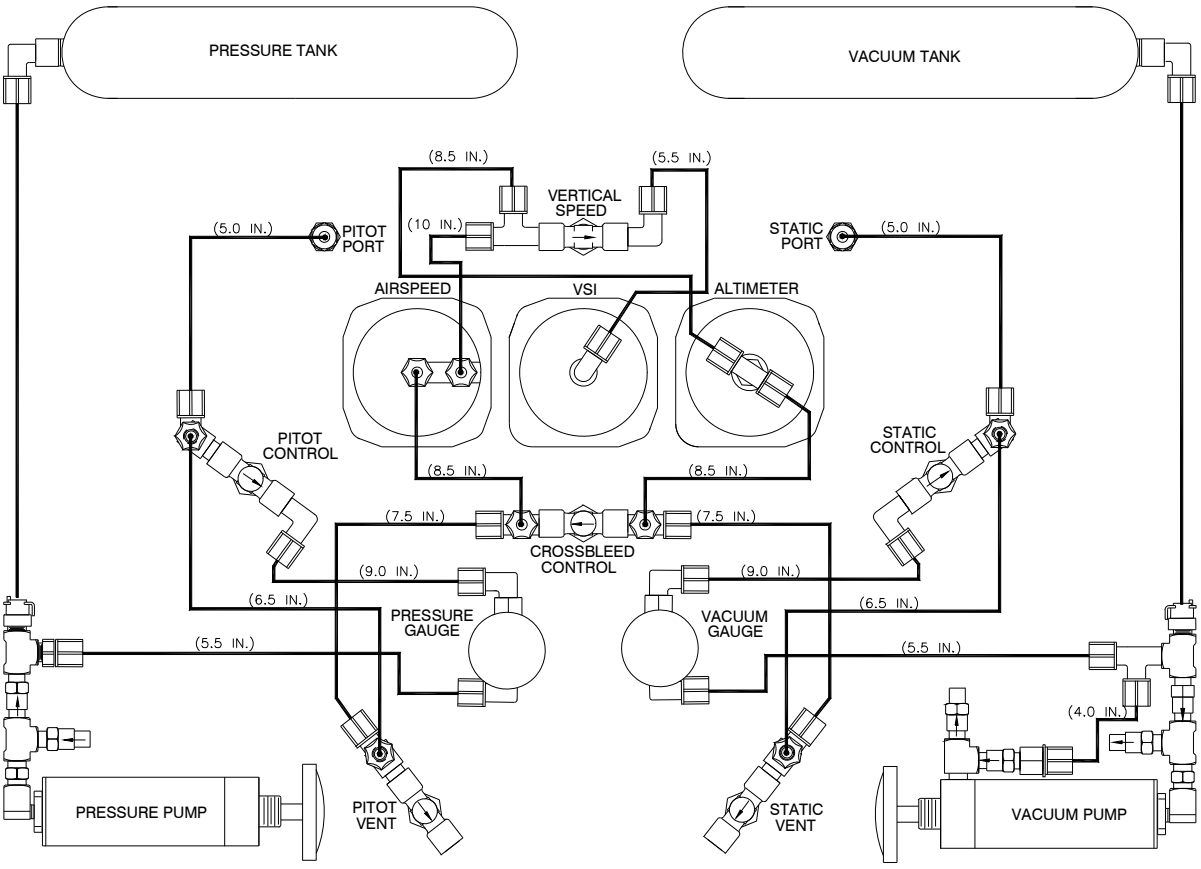

Figure 6 1811GA PNEUMATIC SCHEMATIC DIAGRAM

3. 1811HA PNEUMATIC SCHEMATIC DIAGRAM

The 1811HA internal pneumatic connections are shown in Figure 7.

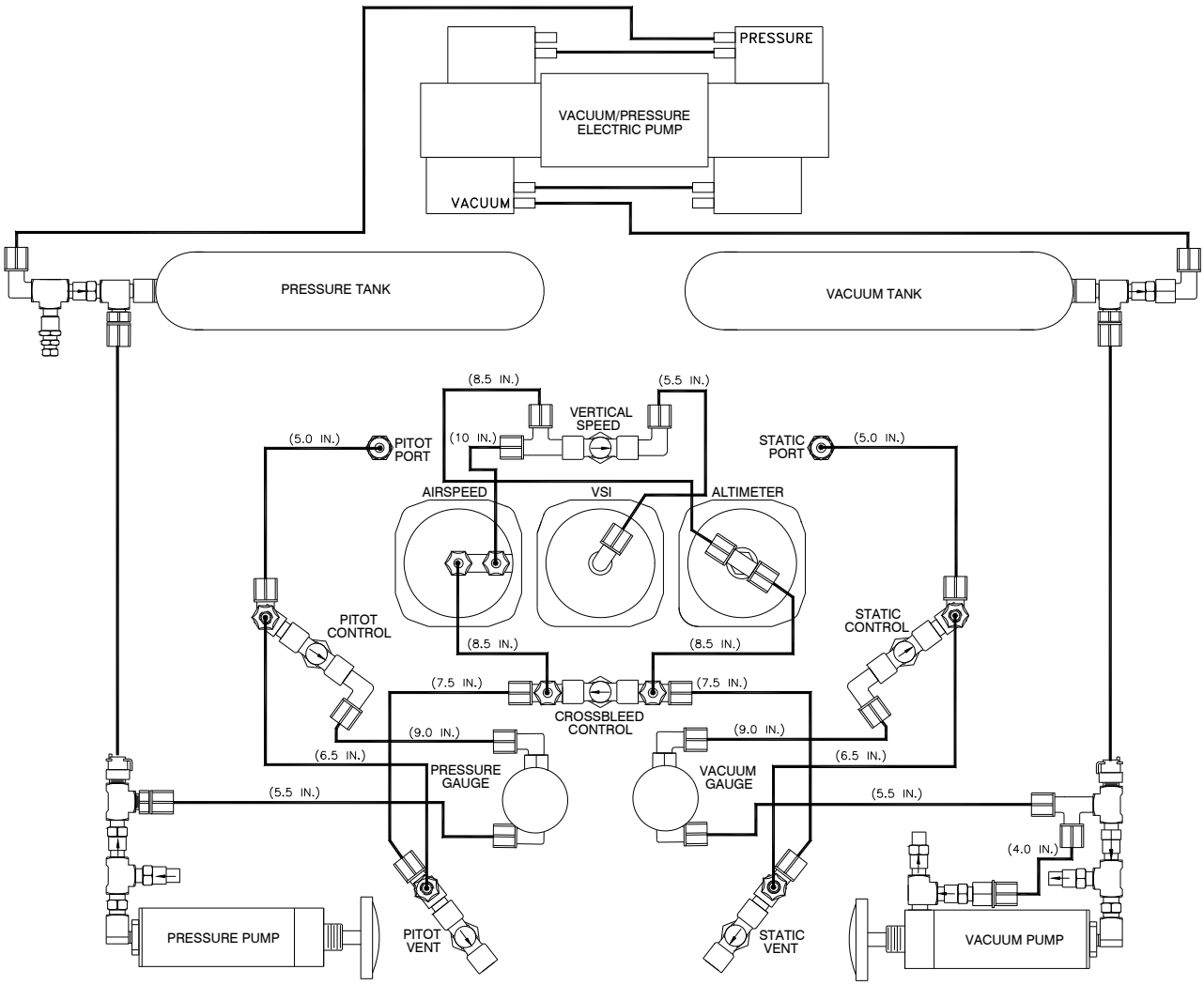

Figure 7 1811HA PNEUMATIC SCHEMATIC DIAGRAM

4. PRELIMINARY

A. General

The 1811HA / GA consists of a hand-operated vacuum pump and a hand-operated pressure pump. The pressure pump is single action developing pressure on the down stroke only while the vacuum pump is double action developing vacuum on both the up and down stroke. Vacuum and pressure gauges, six control valves, an altimeter, a vertical speed indicator, and an airspeed indicator are also included in the individual test sets. There are fittings and accessories to allow connecting the aircraft pitot and static lines. The **1811HA** has an internal electric pump with a line cord, fuse protection, and power **ON/OFF** switch.

B. Operation

The following test procedures can be performed manually. The hand-operated pressure pump is capable of producing a pressure of 15 psi and the hand vacuum pump can supply 25 inHg. The electric internal pump on the 1811HA can produce 27 inHg of vacuum and 15 PSI of pressure.

Note: The user should become familiar with the **1811HA/GA** Test Set (T/S) before attempting any tests. To avoid erroneous test results and damaging aircraft components or the T/S instruments, particular attention should be given to preliminary procedures.

C. Performing the Tests

Various tests, beginning with Section 5 (PRETESTS), describe the correct method of performing the tests using the 1811HA / GA T/S in the manual mode, i.e., hand pump operation. Tests are NOT dependent on the source of pressure or vacuum.

D. Internal Pressure Vacuum Source

Note: Number references given in parentheses refer to Figure 4 and Table 2.

If using the 1811HA internal electric pump, do the following:

(1) Verify that the internal PUMP SWITCH (#24) is in the OFF position and the PITOT CONTROL (#19) and STATIC CONTROL (#7) are fully closed (clockwise).
(2) Connect the LINE CORD to the POWER ENTRY MODULE (#23), 115 / 230 volt, 50-400 Hz supply.
(3) Turn internal electric PUMP SWITCH (#24) to ON position.
(4) The PRESSURE GAUGE (#18) will show the pressure available for the pitot pressure source.

Note: The pressure relief of the internal pump setting will be approximately 5 to 15 psi but will depend on the AIRSPEED INDICATOR (#2) range.

(5) The VACUUM GAUGE (#9) will show the available vacuum (minimum 25 inHg) for the static vacuum source.
(6) After completing the test, return the internal electric PUMP SWITCH (#24) to OFF.

5. PRETESTS

Note: To avoid incorrect results or damage to the aircraft or Test Set (T/S) instruments, the manufacturer recommends that the user pay particular attention to the following preliminary procedures. Each T/S is completely calibrated and tested before shipment. However, to ensure the integrity of sensitive tests to be made, the pitot and static system pretests should be done immediately before **each** use. For user convenience, the T/S front panel decal also details these referenced tests

Caution: Do not use unnecessary force to close a Test Set (T/S) valve. New units and units returned to the manufacturer for servicing have been fitted with positive stop spacers on all needle valves to permit the valve to firmly close without damage. However, excessive force may overpower the knob set screw causing valve damage.

A. Pitot Pretest

(1) Close PORTS (#1) and (#6) with caps and VALVES (#3, #7, #8, #10, #17 and #19) fully clockwise (CW).
(2) Pump pressure to 15 psi and vacuum to 20 inHg with hand PUMPS (#16 and #11).
(3) Open the PITOT CONTROL (#19) turning counterclockwise (CCW) until AIRSPEED (#2) indicates 75% of full scale. Close PITOT CONTROL (CW) and monitor AIRSPEED for one (1) minute. (Airspeed should not fall more than 2 knots.)
(4) Record leak rate.
(5) Open PITOT VENT (#17) CCW to return airspeed to ambient pressure. Close fully CW.

Note: The term “ambient” refers to the existing atmospheric pressure in the area where tests are performed.

B. Static Pretest

Caution: Opening the STATIC VENT (#10) could cause damage to the Airspeed indicator.

(1) Open CROSSBLEED VALVE (#8) fully.
(2) Open STATIC CONTROL (#7) CCW to bring ALTIMETER (#5) to 20,000 ft. (If necessary, pump additional vacuum. Ensure STATIC CONTROL (#7) is fully closed before pumping.)
(3) Close STATIC CONTROL (#7) fully CW. Monitor ALTIMETER (#5) for one (1) minute. (Altimeter should not fall more than 100 ft.)
(4) Record leak rate.
(5) Open PITOT VENT (#17) to return altimeter to ambient.

C. Applying Leak Correction

(1) If the leak rate does not exceed 2 knots or 100 feet in 1 minute, determine the actual aircraft system leak rate by adding the observed rate obtained from a previous aircraft leak test to the recorded rate.

D. Instrument Calibration Correction

Before attempting calibration tests of aircraft instruments, ensure that instrument correction card calibration dates are within the approved recertification periods.

Note: Calibration cards are based on tests performed with instruments vertically mounted (i.e., face up) and at a 75° F (25° C) temperature. An attitude change of more than 30° from level, and / or a temperature difference of more than 15° F (90°C), could affect the precise calibration accuracy.

6. PITOT SYSTEM TEST

Note: If the aircraft is non-pressurized, the Pitot System and Pitot Leak Tests may be omitted and the Static System Test performed.

A. Pitot System Connection

Using the specific aircraft-plumbing diagram, connect the PITOT PORT (#1) to the aircraft pitot system. Ensure that the test will not harm aircraft components.

Caution: Ensure the connections between the T/S and the aircraft are secure since a sudden break or leak could cause severe instrument damage.

B. Pitot Leak Test

(1) Open the PITOT VENT (#17) and STATIC VENT (#10) fully CCW.
(2) Close PITOT CONTROL (#19), CROSSBLEED (#8) and STATIC CONTROL (#7) values fully CW.
(3) Operate PRESSURE PUMP (#16) to develop 10 psi on PRESSURE GAUGE (#18).
(4) Close PITOT VENT (#17) fully.

Note: If any of the following steps fail, close the PITOT CONTROL (#19) fully CW. Gently open the PITOT VENT (#17) CCW to return the system to ambient atmosphere before disconnecting the T/S.

(5) Monitor aircraft and T/S AIRSPEED (#2) while gently opening the PITOT CONTROL CCW (#19) until aircraft airspeed reaches approximately 75% of full range.

Note: The user may compare the aircraft airspeed with the T/S airspeed for calibration by applying T/S calibration card corrections when applicable.

(6) Close PITOT CONTROL (#19) fully CW. After the instrument indications stabilize, monitor the airspeed (#2) for one minute. The airspeed (value shown on the indicator) must not decrease by a value greater than 2 kts plus the leak rate (determined previously in the Pitot Pretest) of the Test Set. (See paragraph 5. A.)
(7) Gently open PITOT VENT (#17) CCW, the T/S airspeed returns to its normal resting position, until open fully.
(8) Slowly open PITOT CONTROL (#19) to bleed off supply.

Note: The optional pressure supply may remain without harming the T/S.

7. STATIC SYSTEM TEST

Caution: If an excessive Pitot Leak rate was detected in the previous test, do not continue until aircraft pitot leak is corrected.

A. Static System Connection

Using the specific aircraft plumbing schematic as a guide, connect the STATIC PORT (#6) to the aircraft Static System.

Note: Ensure that the test will not harm aircraft component(s).

(1) Open both PITOT VENT (#17) and STATIC VENT (#10) valves fully CCW.
(2) Close VERTICAL SPEED (#3), CROSSBLEED CONTROL (#8), PITOT CONTROL (#19), and STATIC CONTROL (#7) fully CW.
(3) Operate VACUUM PUMP (#11) to develop 20 inHg or more on the VACUUM GAUGE (#9).

Note: If the system needs additional vacuum, close the valve (#7) before operating the hand pump.

(4) Close STATIC VENT (#10) fully CW.
(5) Set both T/S BARO SET (#22) and aircraft altimeter barometric scales to 29.92 inHg (1013.3 mb). Note the altimeter reading after setting barometric scales.

Note: Monitor the altitude rate of change during the Static System test when necessary. (Refer to section on Vertical Speed Indicator Operation)

B. Static Leak Test (for non-pressurized aircraft only)

Note: When performing the Static Leak Test or if the aircraft airspeed indicator has a range of 150 knots (175 MPH) or less, do not exceed 1,000 ft increase above field level ambient. *(*During the test, both the aircraft and the T/S airspeed indicators increase as the altitude increases.)

Caution: Do not allow the aircraft airspeed to exceed full-scale travel. If a step fails during testing, close the STATIC CONTROL (#7) fully CW. Then, gently, open the CROSSBLEED VALVE (#8) and return the system to ambient before disconnecting the T/S.

(1) Do not exceed range of aircraft vertical speed indicator (VSI) while gently opening STATIC CONTROL (#7) (CCW) to produce an altimeter reading 1,000 feet above original reading obtain in section 7A (Static System Connection), paragraph (5). Close valve fully (CW).
(2) After instrument indications stabilized, monitor ALTIMETER (#5) for one minute. Ensure that the altimeter decreases no more than 100 feet plus the leak rate (determined from section 5. PRETESTS, in the Static Pretest).
(3) After test is complete and taking care not to exceed vertical speed range, gradually open (CCW) the CROSSBLEED CONTROL (#8) to ambient.
(4) Once the system returns to ambient pressure, open the CROSSBLEED CONTROL (#8) and STATIC VENT (#10) fully (CCW). Disconnect the aircraft line from the STATIC PORT (#6).
(5) Gradually open (CCW) the STATIC CONTROL (#7) to bleed off vacuum supply. Once the VACUUM GAUGE (#9) returns to zero, close the STATIC CONTROL (#7) fully (CW).

Note: The vacuum supply may remain without causing an adverse effect to the T/S.

C. Static Leak Test (for Pressurized Aircraft or for altitude indication test more than 1,000 feet above field level ambient)

(1) Open the STATIC VENT (#10) and CROSSBLEED CONTROL (#8) valves fully (CCW).
(2) Close all other valves (#3, #7, #17, and #19) fully (CW).
(3) Operate the VACUUM PUMP (#11) to develop 20 inHg or more on the VACUUM GAUGE (#9).

Note: If the system needs additional vacuum, close the STATIC CONTROL (#7) before operating the hand pump.

(4) Close the STATIC VENT (#10) fully (CW).

Caution: If one of the following steps fails, close the STATIC CONTROL (#7) fully (CW). Gently, open the PITOT VENT (#17) to return system to ambient before disconnecting the T/S.

Caution: If the T/S is used outside of the aircraft, monitor the VERTICAL SPEED INDICATOR (VSI) so that the aircraft VSI range is not exceeded. (Refer to the section on VSI Operation.) Aircraft altimeter accuracy may be verified in the following procedure by comparing readings with the T/S altimeter (#5) with the calibration card corrections applied.

D. Negative Altitude Tests

If the test to be done needs altitude readings below field elevation (above ambient pressure), do the following:

Caution: Do not exceed –1000 feet on the ALTIMETER (#5).

(1) Gently open the PITOT CONTROL (#19) (CCW) until the ALTIMETER (#5) reaches the desired test point. Close (CW) the PITOT CONTROL (#19).
(2) Once the negative altitude test is complete, gently open (CCW) the STATIC VENT (#10) to return the system to ambient.
(3) Close the STATIC VENT (#10) fully (CW).

E. Leak Test

Caution: Do not exceed aircraft vertical speed indicator (VSI) full scale range while performing the following test.

(1) Gently open STATIC CONTROL (#7) until altimeter reaches the desired reading. Close valve fully.

Note: If the system needs additional vacuum, close the STATIC CONTROL (#7) before operating the hand pump.

(2) Allow the instrument indications to stabilize. Monitor the altimeter (#5) for one minute to ensure that the altimeter decreases no more than 100 feet or 2% of the indicated altitude (whichever is greater).

Note: If the system shows a leak, carefully monitor the T/S AIRSPEED (#2) and open (CCW) the CROSSBLEED CONTROL (#8) when movement of the airspeed is seen.

Caution: Do not allow the airspeed to go down more than 10 knots. Severe damage could result.

Note: If the airspeed pointer indication increases, the leak is in the pitot system. If the pointer decreases, the leak is in the static system.

(3) After the test completes, gradually open CROSSBLEED CONTROL (#8) CCW fully.
(4) Return system to ambient, by gradually opening the PITOT VENT (#17). Take care not to exceed vertical speed indicator range.
(5) Once system has returned to ambient, open the PITOT VENT (#17) and the STATIC VENT (#10) fully CCW. Disconnect the aircraft lines from the PITOT (#1) and the STATIC T (#6) ports.
(6) Gradually open (CCW) the STATIC (#7) and PITOT (#19) controls to bleed off supply tanks.

Note: Vacuum or pressure supply may remain without causing adverse effect to the T/S.

(7) When PRESSURE GAUGE (#18) and VACUUM GAUGE (#9) have returned to zero, close the PITOT (#19) and STATIC (#7) controls fully (CW).

F. Vertical Speed Indicator (VSI) Operation

Caution: The VERTICAL SPEED INDICATOR is very delicate. When in use, always monitor the indication and operate the T/S valves carefully so that the full scale reading of the T/S or the aircraft VSI (i.e., the climb indicator) is not exceeded.

Note: The VERTICAL SPEED (#3) control is closed normally to separate the VSI (#4) from the STATIC system. The VSI function can be paired with the Static system at any time by following these instructions. If the VSI is paired with the Static system when the system is at a pressure other than ambient (i.e., static system vented), a temporary altitude reading results until the VSI case pressure equalizes with the static system pressure.

(1) Verify that the PITOT (#19) and STATIC (#7) controls are closed (CW).
(2) While monitoring the VSI (#4), gently open (CCW) the VERTICAL SPEED (#3) control.

Note: *Do not exceed full-scale reading*.

(3) As the VSI case pressure equalizes wit the static system, the indicated rate will begin to decrease. Continue to gently open (CCW) the VERTICAL SPEED (#3) control without exceeding the full-scale reading until VSI (#4) returns to zero reading. Open the VERTICAL SPEED (#3) control fully (CCW). (The VSI (#4) readings indicate the rate of change in the static system when the VERTICAL SPEED (#3) control is fully open.)
(4) Verify the aircraft vertical speed (climb) indicator accuracy by comparing the readings with the T/S VSI (#4) with corrections applied.

(5) When the vertical speed reference is no longer needed, close the VERTICAL SPEED (#3) control fully (CW).

Note: Isolating the VSI at a pressure other than ambient, causes pressure to be "trapped". As a result in later tests the T/S VSI (#4) could show descent (when paired with the Static System) even though the altitude is actually increasing. Following steps (1) thru (4) listed in this section will ensure there are no adverse effects to the T/S units.

8. COMBINED PITOT (AIRSPEED) / STATIC (ALTITUDE) TEST

The following procedure is valid for equipment such as machmeters, engine pressure ratio indicators, and flight recorders, etc.

Note: Perform tests referenced in sections 5.PRETESTS, 6. PITOT SYSTEM TEST, 7. STATIC SYSTEM TEST, and Static Leak Test (for non-pressurized aircraft only). Correct any leaks found. Perform the following test in exact order given.

A. Combined Pitot / Static System Connection

(1) Using the specific aircraft-plumbing diagram, connect the PITOT PORT (#1) to the aircraft pitot system (Hi port) and the STATIC PORT (#6) to the aircraft static system (Lo port).

Caution Ensure the test will not harm components in the aircraft system.

(2) Close all T/S valves. Operate the PRESSURE PUMP (#16) to develop 10 psi. Operate the VACUUM PUMP (#11) to develop approximately 20 inHg.

(3) Verify that the T/S and the aircraft altimeters have baro's set to 29.92 inHg (1013.3 mb).

B. Below Field Elevation Test

Note: If there are no altitude tests below field elevation, this test may be omitted.

(1) Open the CROSSBLEED (#8) valve fully CCW. While ensuring not to exceed the aircraft VSI full-scale range, gently open the PITOT CONTROL (#19) to reach the desired downscale altimeter test point. Once reaching the test point, close the PITOT CONTROL (#19) CW and CROSSBLEED CONTROL (#8) valves fully.

Note: The airspeed test point may only be set above the normal resting position of the pointer.

(2) Taking care not to exceed the test point, carefully open the PITOT CONTROL (#19) valve until the airspeed (#2) increases to the desired test point.

(3) If an airspeed test point is accidentally, exceeded do the following:

(a) Gently open the CROSSBLEED (#8) valve until the airspeed is 10 knots below the desired test value. (Some altitude change occurs.)
(b) Gently open the STATIC CONTROL (#7) valve to restore the altitude (#5) to a correct test point.
(c) Raise the airspeed to the test point by carefully opening the PITOT CONTROL (#19) valve until reaching desired airspeed.
(d) Repeat procedure to complete the higher airspeed test points.
(e) Gently open the CROSSBLEED CONTROL (#8) valve and return the airspeed (#2) to its normal pointer rest position of 20 to 40 knots.
(f) Close CROSSBLEED (#8) CONTROL.

C. Above Field Elevation Tests

Caution: Perform test in the exact order and method given. Avoid instrument damage or exceeding a test point by operating valves gently and going from one test point to the other gradually. *Do not exceed the VSI range while performing test*.

Note: User skill is necessary for the following tests to adjust the metering valve settings and to maintain the desired instrument readings.

(1) Open the STATIC CONTROL (#7) valve and increase the airspeed to approximately 10 knots below the desired test point.
(2) Open the CROSSBLEED CONTROL (#8) CCW to maintain airspeed below test point until desired altitude is reached. Close both valves CW.

Note: If the altitude will no longer increase, close the STATIC CONTROL (#7) and CROSSBLEED CONTROL (#8) and operate the VACUUM PUMP (#11) to create more vacuum.

(3) Once reaching the test altitude with valves closed, gently open the PITOT CONTROL (#19) CCW to take the airspeed (#2) to the test point.
(4) Gently open the PITOT CONTROL (#19) so that the airspeed goes to 10 knots below the next higher airspeed test point.

Note: To correct altitude upward, operate STATIC CONTROL (#7). To lower altitude, operate STATIC VENT (#10).

(5) Using the PITOT CONTROL (#19), bring airspeed to exact test point.
(6) Repeat steps (4) and (5) for each higher airspeed test point until reaching the highest desired airspeed test at this altitude.
(7) Once the highest airspeed test at this altitude is done, select the lowest airspeed to be tested at the next higher altitude.
(8) Open CROSSBLEED CONTROL (#8) CCW to reduce airspeed to 10 kts below this lower airspeed.

(9) Open STATIC CONTROL (#7) to raise the altitude to the next test point. (Use the CROSSBLEED CONTROL (#8) to maintain airspeed below the test point.) Once reaching the desired altitude, close both controls.
(10) Repeat steps (3) through (9) until completing all airspeed tests at each desired altitude.
(11) Follow steps listed in section 10 D to return system to ambient.

D. Returning the Pitot / Static Test Set to Ambient

Caution: Perform the following test in exact order presented.

(1) Gently open the CROSSBLEED CONTROL CCW (#8) until AIRSPEED (#2) returns to normal rest position, then open control fully.
(2) Monitor VSI and gently open the PITOT VENT (#17). Do not exceed the VSI scale range.

Caution: Do not use the STATIC VENT (#10) to bleed system or severe instrument damage may result.

(3) Once the altimeter (#5) reaches ambient pressure and there is no further decrease in the altitude indication, open the PITOT VENT (#17) and STATIC VENT (#10) fully CCW.
(4) Open the PITOT CONTROL (#19) and STATIC CONTROL (#7) to bleed pressure and vacuum as indicated by the PRESSURE GAUGE (#18) and VACUUM GAUGES (#9).

9. MACHMETER TEST

A. Test Procedure

Using the methods described in 8. COMBINED PITOT (AIRSPEED) / STATIC (ALTITUDE) TEST, set an altitude (in feet) listed in the following table. Set the corresponding airspeed (in knots). Verify t`hat the MACH value obtained is the same as listed in the table for the settings. (For example, an altitude set to *10k* with airspeed of *277 kts* would give a MACH reading of .50.)

Table 3 Airspeed vs. MACH Number Test Table

	MACH NUMBER								
	.50	**.60**	**.70**	**.75**	**.80**	**.82**	**.85**	**.90**	Altitude (In feet)
Airspeed (In kts)	277	334	391	420	449	---	---	---	10k
	247	298	350	376	403	414	429	---	15k
	228	275	324	348	373	383	398	424	20k
	205	248	292	315	338	347	361	384	25k
	188	228	269	289	311	319	332	354	29k
	172	207	246	265	285	292	304	324	33k
	157	190	224	242	260	267	278	297	37k
	142	173	204	220	237	243	253	277	41k
	---	157	186	201	216	222	231	246	45k
	---	143	169	183	196	202	210	225	49k
	---	---	161	174	187	193	201	214	51k

10. ENGINE PRESSURE RATIO (EPR) TEST

A. Test Procedure

(1) Connect the PITOT PORT (#1) to the Pt7 (Hi) port of EPR to be tested.
(2) Connect the STATIC PORT (#6) to Pt2 (Lo) port of EPR to be tested.
(3) Using the methods described 8. COMBINED PITOT (AIRSPEED) / STATIC (ALTITUDE) TEST, refer to Table 4 and set up altitude and airspeed combinations.

Table 4 Engine Pressure Ratio Test Table

AIRSPEED (knots) Pt7 (Hi) Port	ALTITUDE (feet) Pt2 (Lo) Port	EPR (Engine Pressure Ratio)
650	25, 870	3.4
546	35,000	3.4
650	21,650	3.0
504	35,000	3.0
650	14,690	2.5
534	25,870	2.5
444	35,000	2.5
650	4,210	2.0
500	20,000	2.0
369	35,000	2.0
478	5,000	1.5
365	20,000	1.5
265	35,000	1.5

11. MANIFOLD PRESSURE GAUGE TEST

A. Test Procedure

(1) Plug or cap PITOT PORT (#1).
(2) Connect STATIC PORT (#6) to manifold gauge to be tested.
(3) Close all T/S valves (#3, #7, #8, #10, #17, #19). Open the CROSSBLEED CONTROL (#8) fully and maintain it open.
(4) Verify that the ALTIMETER (#5) is set at 29.92 inHg (1013.3 mb).
(5) Operate the VACUUM PUMP (#11) and the PRESSURE PUMP (#16) as necessary.
(6) Refer to the following table for the appropriate altitude and in-Hg manifold pressure readings.

Table 5 Altitude vs. Manifold Pressure

ALTITUDE (feet)	MANIFOLD PRESSURE (in-Hg)
-985	31
-75	30
860	29
1,825	28
2,815	27
3,835	26
4,890	25
10,730	20
17,905	15
27,375	10

Note: For test points below field elevation, gradually open PITOT CONTROL (#19) for test points above field elevation open STATIC CONTROL (#7).

(7) Close PITOT CONTROL (#19) CW AND STATIC CONTROL (#7) and bleed system using PITOT VENT (#17) to return system to ambient.

12. LOW PRESSURE TESTS

Note: The following test uses 0-12 PSI, 0-25 in-Hg or 1-340 in-H_20 ranges and is limited by T/S airspeed range. Refer to Table 6 for equivalent airspeed readings.

A. Test Procedure

(1) Connect PITOT PORT (#1) to pressure unit to be tested.
(2) Close all T/S valves (#3, #7, #8, #10, #17, #19) CW. Open STATIC VENT (#10) CWW fully and maintain open for remainder of procedure.
(3) Operate PRESSURE PUMP (#16) as needed.

Table 6 Airspeed Equivalent (knots) for Differential Pressure / Vacuum

Airspeed	Inches Water	Inches Mercury	Pounds Sq. In.
39	1.000	0.073	0.036
55	2.000	0.146	0.072
68	3.000	0.220	0.108
78	4.000	0.294	0.144
87	5.000	0.367	0.180
96	6.000	0.441	0.216
103	7.000	0.514	0.252
110	8.000	0.587	0.289
117	9.000	0.661	0.325
123	10.000	0.734	0.361
135	12.000	0.881	0.433
144	13.609	1.000	0.481
146	14.000	1.028	0.505
155	16.000	1.175	0.577
165	18.000	1.322	0.649
174	20.000	1.468	0.721
194	25.000	1.836	0.901
203	27.218	2.000	0.982
204	27.707	2.036	1.000
212	30.000	2.202	1.082
229	35.000	2.570	1.262
244	40.000	2.937	1.443
246	40.827	3.000	1.473
258	45.000	3.304	1.623
271	50.000	3.671	1.803
283	54.436	4.000	1.965

Airspeed	Inches Water	Inches Mercury	Pounds Sq. In.
285	55.416	4.072	2.000
314	68.045	5.000	2.466
342	81.654	6.000	2.947
355	83.124	6.108	3.000
368	95.263	7.000	3.438
391	108.872	8.000	3.929
395	110.832	8.144	4.000
413	122.481	9.000	4.420
433	136.090	10.000	4.912
437	138.540	10.180	5.000
470	163.308	12.000	5.894
474	166.248	12.216	6.000
504	190.526	14.000	6.876
508	193.955	14.252	7.000
534	217.744	16.000	7.859
538	221.663	16.288	8.000
561	244.962	18.000	8.841
565	249.371	18.324	9.000
587	272.180	20.000	9.823
591	277.079	20.360	10.000
611	299.398	22.000	10.806
615	304.787	22.396	11.000
633	326.616	24.000	11.788
638	332.495	24.432	12.000
644	340.225	25.000	12.279

(4) Open PITOT CONTROL (#19) to establish desired reading on AIRSPEED (#2) for equivalent pressure as listed in Table 6.
(5) Gradually open PITOT VENT (#17) CCW to lower airspeed reading or to return system to ambient.

13. VACUUM TESTS

Note: The following test uses 0-12 PSI, 0-25 inHg or 1-340 inH_20 ranges and is limited by T/S airspeed and altimeter ranges. Refer to Table 6 for equivalent airspeed readings.

A. Test Procedure

(1) Connect STATIC PORT (#6) to vacuum unit to be tested.
(2) Close T/S valves (#3, #7, #8, #10, #17, #19). Open PITOT VENT (#17) fully CW and maintain open for remainder of this procedure.
(3) Operate VACUUM PUMP (#11) as necessary.
(4) Open PITOT VENT (#17) fully and maintain open for remainder of this procedure.
(5) Operate VACUUM PUMP as necessary.

Note: The altimeter (#5) operates during this test, but the readings are not used. Also, test sets with a 35,000 ft altimeter range have a slightly reduced test range.

Caution: For Test Sets with 35,000 ft altimeter ranges, do not exceed the 35,000 ft reading.

(6) Open STATIC CONTROL (#7) CCW to set up airspeed equivalents for the desired reading on AIRSPEED (#2) for equivalent vacuum in Table 6.
(7) Open STATIC VENT (#10) CCW to lower airspeed reading or to return system to ambient.

CHAPTER 4. VALVE LEAK TEST

1. METERING VALVE ADJUSTMENT PROCEDURE

Note: The following procedure is also released as IM150 (dated 7/6/88.)

A. Valve Leak Test

Caution: Before performing the Valve Leak test, inspect for system or instrument leakage. (Refer to the appropriate Aircraft Maintenance Manual for information and proper procedure.)

Note: Read sections “A” and “B” before performing test since steps listed in sections must be done in combination when performing valve adjustments.

B. Pressure Valve Test

(1) Close all valves except "VACUUM VENT".
(2) Plug "PRESSURE" and "VACUUM PORTS". (Single action pumps only.)
(3) Pressurize "PRESSURE TANK" to 15 psi.
(4) Monitor AIRSPEED INDICATOR for one (1) minute.
(5) If there is an increase in airspeed seen, continue to monitor for an additional five (5) minutes.

Note: If during the monitoring period the increase exceeds five (5) knots, a leak exists at the "PRESSURE" valve.

(6) Correct leak before continuing (Refer to this section 2. RESETTING NEEDLE VALVE POSITIVE STOP).

C. Pressure Vent and Crossbleed Valve Test

(1) Close all valves except "VACUUM VENT".
(2) For single action pumps, plug the "PRESSURE" and "VACUUM " ports.

Caution: Do not over pressurize airspeed.

(3) Apply enough pressure to the "PRESSURE TANK" to provide FULL SCALE AIRSPEED INDICATOR TRAVEL.
(4) Gently open the "PRESSURE" valve. Increase the airspeed to FULL SCALE.
(5) Close "PRESSURE" valve.
(6) Monitor the AIRSPEED INDICATOR for one (1) minute.

Note: If there is a decrease of more than two (2) knots, a leak exists at the "PRESSURE VENT" or "CROSSBLEED" valve.

(7) Fully close the "VACUUM VENT" and monitor both AIRSPEED INDICATOR and ALTIMETER:

Note: If the ALTIMETER moves down scale, the leak is located at the "CROSSBLEED" valve. If the ALTIMETER does not move but the AIRSPEED continues to decrease, the leak is located at the "PRESSURE VENT" valve.

(8) Correct leak(s) before continuing. (Refer to this section, 2. RESETTING NEEDLE VALVE POSITIVE STOP.)

D. Vacuum Vent Test

(1) Close all valves except "CROSSBLEED".
(2) If using single action pumps, plug the "PRESSURE" and "VACUUM" ports.
(3) Empty the "VACUUM TANK" to at least 20 inches.
(4) Monitor the ALTIMETER for one (1) minute.

Note: An increase in the ALTITUDE means the leak is located at the "VACUUM" valve.

(5) Correct the leak before continuing. (Refer to section 2. RESETTING NEEDLE VALVE POSITIVE STOP).

E. Vertical Speed Valve Test

(1) Close all valves except "CROSSBLEED".
(2) If using single action pumps, plug the "PRESSURE" and "VACUUM" ports.
(3) Empty and maintain the "VACUUM TANK" at 20 inches.
(4) Gently open the "VACUUM" valve.
(5) Increase the altitude to 20,000 ft while monitoring the VERTICAL SPEED indicator.

Note: An increase in the VERTICAL SPEED means the leak is located at the "VERTICAL SPEED" valve.

(6) Correct the leak before continuing (Refer to 2. RESETTING NEEDLE VALVE POSITIVE STOP.)

F. Vacuum Vent Valve Test

(1) Close all valves except "CROSSBLEED".
(2) If using single action pumps, plug "PRESSURE" and "VACUUM PORTS".
(3) Empty and maintain "VACUUM TANK" at 20 inches.
(4) Gently open the "VACUUM" valve.
(5) Increase the altitude to 20,000 ft.
(6) Close "VACUUM" valve.

(7) Monitor ALTIMETER for one (1) minute.

Note: An increase of altitude of more then 100 ft. means the leak is located at the "VACUUM" valve.

(8) Repair leak before continuing.

2. RESETTING NEEDLE VALVE POSITIVE STOP

Note: Before performing Valve Leak Test or Resetting the Needle Valve Positive Stop, inspect the entire system for leaks at locations other than valve seats, i.e., connections, general plumbing and instruments.

Positive stop spacers are installed on some models to provide a “positive stop” which allows a firm closing of the valves without damaging the valve needles or their seats. On other models, the valve body provides this stop. The positive shut-off is carefully set and adjusted during the manufacturer or factory recalibration. If valves develop a slight leak from repeated use, do the following steps to reset:

Caution: Except for the pressure and vacuum control valves, any leak seen could be from a source other than the valves. Do not tighten any valve beyond the closing point described below. When it is determined that a valve is leaking, correct the leak before continuing.

A. Firmly close the valve against its positive stop.

(1) With a 5/64" (.078") hex wrench, loosen the knob setscrew.
(2) Raise the knob approximately 1/32" above the valve body or spacer. Retighten the setscrew.
(3) Gently turn the knob clockwise while ensuring not to exceed one quarter (1/4) rotation, or until positive resistance is felt.

Caution: Do not exceed one half (1/2) rotation. If the leak persists, the leak is located elsewhere or the valve is defective.

(4) If doing step (2) above stopped the leakage, loosen the knob setscrew and remove the knob.

Note: If spacers are installed, do not remove them.

(5) Locate the setscrew mark, on the valve stem.
(6) Align the setscrew to a new location.
(7) Push the knob firmly down against the valve body or spacer and hold down while tightening the setscrew.
(8) Open valve one quarter (1/4) rotation, and then close firmly. (A “positive shut” off should now exist.)

B. If a leak persists, continue tests for remaining valves or until no leakage occurs.

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CHAPTER 5: INSPECTION RECOMMENDATIONS

The manufacturer recommends that inspection be performed in the periods shown in Table 7.

Table 7 Required Periodic Inspections / Recertification Intervals

TIME PERIOD	INSPECTION REQUIRED
With Each Use	Leak Test. Refer to "Pretest" Section on pages 17 and 18.
6 Months	For **analog instrument** configuration(s), refer to Analog Instrument Specifications included in the Appendix of this manual. Rewrite calibration cards at each recertification interval.
12 Months	For **digital instrument** (-A0A) configuration, refer to documents 61-101-02184 (DALT55) and 61-101-02194 (DAS650), for specifications and recertification intervals.
12 Months	All of the preceding, plus: Check Pressure and Vacuum gauges for friction and leaks. Regarding leaks, ensure the pressure gauge and related internal plumbing can maintain 15 psi for 5 minutes with losing more than 1 psi and the vacuum gauge should maintain 20 inHg vacuum for 5 minutes without losing more than 1 inHg of vacuum. Regarding friction, ensure both the pressure gauge and vacuum gauge pointers transition smoothly without sticking. Check vacuum and pressure hand pumps for capacity. The pressure hand pump should be able to achieve a minimum of 15 psi and the vacuum hand pump should be able to achieve a minimum of 20 inHg of vacuum.

Note: If the Test Set is to be used in compliance with F.A.R. 91.170 and Part 43, Appendix E, "Altimeter System Tests and Inspections," refer to FAA Advisory Circular AC43-6B (or subsequent) for approved inspection intervals and procedures.

CHAPTER 6: SHIPPING

Use standard delicate electronic equipment packaging procedure when packing the Test Set for reshipment.

To prevent damage from extreme atmospheric changes to the Test Set instruments, it is recommended that the STATIC VENT, CROSSBLEED CONTROL, AND PITOT VENT VALVES be in open position. VERTICAL SPEED, PITOT CONTROL, AND STATIC CONTROL VALVES should be closed.

CHAPTER 7: STORAGE

A. Place a four ounce bag of desiccant inside the container
B. Close and latch the cover.
C. Store in a cool dry place.

Note: Should the Test Set become exposed to moisture or very high humidity, dry as soon as possible and temporarily store in dehumidified area.

D. To prevent damage from extreme atmospheric changes to the Test Set instruments, it is recommended that the STATIC VENT, CROSSBLEED CONTROL, AND PITOT VENT VALVES be open. VERTICAL SPEED, PITOT CONTROL, AND STATIC CONTROL VALVES should be closed.

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APPENDIX

ANALOG INSTRUMENT SPECIFICATIONS

Note: *For information on compliance with FAR 91-411, refer to Barfield document, 60-101-00150*.

SECTION 1: ALTIMETER

SECTION 2: AIRSPEED

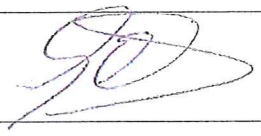
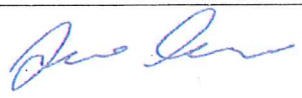
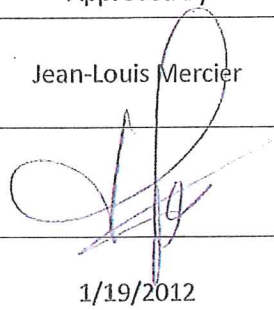
SECTION 3: VERTICAL SPEED INDICATOR

SECTION 1: ALTIMETER

The following engineering specification (Document # 23-338-00001) details the performance requirements of the pressure sensitive altimeters used in Barfield Inc. manufactured ground test equipment.

Engineering Specification	
Title: Altimeter, Ground Support Equipment	Barfield, Inc 4101 NW 29 Street Miami Florida 33142
Drawing No: 23-338-00001	Page 1 of 5

REV.	ECO #	REV. DATE	DESCRIPTION OF CHANGE
A	N/A	Dec/19/1989	Initial Release
B	260-00780	July/24/1991	Addition of Dual Baro 35k & 50k Ft United Altimeter, P/N 59TD & 5934AD-1 respectively
C	260-00885	Jan/19/2012	Document reformatted to MS Word. Section 3 Updated.

	Created By	Checked By	Approved By
Name	Guillermo Echarri	Jesus Armas	Jean-Louis Mercier
Signature			
Date	1/19/2012	1/19/2012	1/19/2012

1. Purpose:
   To specify performance requirements for Pressure Sensitive Altimeters for use in B.I.C. manufactured ground support test equipment.

2. Scope:
   This PRODUCT STANDARD SPECIFICATION covers two basic types of instruments as follows:

   TYPE I - Range 35,000 ft. Barometric Pressure. Scale range at least 28.1 - 30.99 inches of Mercury (946-1049 millibars). May include markers working in conjunction with the Barometric Pressure Scale to indicate pressure - altitude.

   TYPE II - Range 50,000 ft. Barometric Pressure. Scale range at least 28.1 - 30.99 inches of Mercury (946-1049 millibars). May include markers working in conjunction with Barometric Pressure Scale to indicate pressure - altitude.

3. Identification:
   All units regardless of origin of manufacture are to be identified by B.I.C. assigned part numbers as follows:

B.I.C. P/N	Baro. Units	TYPE NO.	RANGE
124-00001 *	in.Hg Baro	II	50,000 FT
124-00002	in.Hg Baro	II	55,000 FT
124-00003	Dual Baro	II	50,000 FT
124-00004	in.Hg Baro	I	35,000 FT
124-00005	Dual Baro in.Hg/mb	I	35,000 FT
124-00006 *	mb Baro	II	50,000 FT
124-00007 *	mb Baro	I	35,000 FT
124-00008 *	in.Hg Baro	II	50,000 FT (OXYGEN ONLY)

Note: "*" indicates service only, not available.

4. Test Conditions:
   Unless otherwise specified, all tests shall be made with the instrument mounted in the horizontal (Face UP) position.

5. Performance Requirements:
All units are required to meet the following performance requirements before installation in any ground support test equipment.

5.1 Case Leak:
A pressure equivalent to 18,000 ft. within the case shall not result in leakage exceeding 20 ft (100 ft when installed in Test Set) per minute.

5.2 Friction:
The instrument shall be tested for friction at varied readings of the scale. The instrument shall be subjected to a steady rate of decreasing pressure equivalent to about 750 ft per minute. The change in reading of the pointers due to vibrating the instrument at each of the altitudes specified in table-1 is to be recorded as friction and shall not exceed the tolerances listed.

ALTITUDE (FEET)	**TOLERANCE (FEET ±)**
1,000	70
2,000	70
3,000	70
5,000	80
10,000	90
15,000	100
20,000	125
25,000	150
30,000	175
35,000	200
40,000	250
50,000	400

TABLE 1 FRICTION

5.3 Hysteresis:
Not more than 15 minutes after the altimeter has been first subjected to the pressure corresponding to the upper limit of the scale (ref. table-2 or 3 as applicable), test point -2- , the pressure shall be increased at a rate corresponding to a decrease in altitude of approximately 3,000 feet per minute until the pressure corresponding to test point -3- is reached. Within 10 seconds the instrument shall indicate within 100 feet of the test reading. The altimeter shall remain at this pressure for at least 5 minutes but not more than 15 minutes before the test reading is taken. After the reading has been taken, the pressure shall be further increased at the above rate until the pressure corresponding to test point -4- is reached. The altimeter shall remain at this pressure for at least one minute but not more than 10 minutes before

the test reading is taken. After the reading has been taken, the pressure shall be further increased at the above rate until atmospheric pressure is reached. The reading of the altimeter at either of the two test points shall not differ from the reading of the altimeter for the corresponding altitude in the scale error test by more than the tolerance specified in the corresponding table. For a TYPE-I instrument use Table-2, TYPE-II use Table-3.

TEST POINT	ELEVATION (FEET)	TIME Min/Max	ALLOWABLE ERROR (FT)
1	0	- - -	- - -
2	35,000	- - /15	- - -
3	18,000	5/15	70
4	14,000	1/10	70
* 5	0	- / 5	50

TABLE 2 HYSTERESIS / - TYPE – I

TEST POINT	ELEVATION (FEET)	TIME Min/Max	ALLOWABLE ERROR (FT)
1	0	- - -	- - -
2	50,000	- - /15	- - -
3	25,000	5/15	150 {100}
4	20,000	1/10	150 {100}
* 5	0	- / 5	60 { 50}

TABLE 3 HYSTERESIS - TYPE – II

Note: a) * Test point 5 is the "After Effect" specification.
b) The values in Table-3 enclosed in "{ }" are applicable against the 124-00002 instrument.

5.4 After Effect:
Not more than 5 minutes after the completion of the hysteresis test, the pointers shall have returned to their original reading, corrected for any change in atmospheric pressure to within the tolerance specified by test point -5- in the corresponding table. For a TYPE-I instrument use Table-2, TYPE-II use Table-3.

5.5 Scale Error:
For a period of not less than twelve hours prior to this test the altimeter shall not have been operated at pressures other than ambient. The barometric scale shall be set at 29.92 inches of mercury and the scale error recorded. Without changing the baro setting, the altimeter shall be subject successively to the pressure specified in Table-4. The reduction in pressure shall be made at a rate not in excess of 20,000 feet per minute to within approximately 2,000 feet of the test point. The test point shall be approached at a rate compatible with the test equipment. The altimeter shall remain at the pressure corresponding to each test point for at least 1 minute but no more than 10 minutes before a reading is taken. The error at all test points shall not exceed the tolerances specified in Table-4 or Table-5 as applicable.

ALTITUDE (FEET)	ALTIMETER ERROR ±
-1,000	40
0	40
500	40
1,000	40
1,500	50
2,000	60
3,000	60
4,000	70
6,000	80
8,000	120
10,000	160
12,000	200
14,000	225
16,000	240
18,000	275
20,000	300
22,000	340
25,000	375
30,000	450
35,000	525
40,000	600
45,000	675
50,000	750

TABLE 4 Scale Error

ALTITUDE (FEET)	ALTIMETER ERROR ±
-1,000	20
0	20
500	20
1,000	20
1,500	25
2,000	30
3,000	30
4,000	35
6,000	40
8,000	60
10,000	80
12,000	90
14,000	100
16,000	110
18,000	120
20,000	130
22,000	140
25,000	155
30,000	180
35,000	205
40,000	230
45,000	255
50,000	280
55,000	600

TABLE 5 Scale Error

Note: Table 4 Applicable against: 124-00001, 124-00003, 124-00004, 124-00005, 124-00006, 124-00007, 124-00008

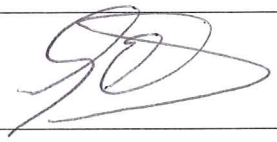
Table 5 Applicable against: 124-00002

SECTION 2: AIRSPEED

The following engineering specification (*Barfield Document No. 23-336-00025*) details the performance requirements of the pitot static pressure type airspeed indicators for use in Barfield Inc. manufactured ground support test equipment.

Engineering Specification	
Title: Airspeed, Ground Support Equipment	Barfield, Inc 4101 NW 29 Street Miami Florida 33142
Drawing No: 23-336-00025	Page 1 of 5

REV.	ECO #	REV. DATE	DESCRIPTION OF CHANGE
A	N/A	Jan/8/1990	Initial Release
B	260-00885	Jan/20/2012	Document reformatted to MS Word. Section 3 Updated.

	Created By	Checked By	Approved By
Name	Guillermo Echarri	Jesus Armas	Jean-Louis Mercier
Signature			
Date	1/19/2012	1/19/2012	1/19/2012

1. Purpose:
   To specify performance requirements for Pitot Static Pressure Type of Airspeed Indicators for use in B.I.C. Manufactured ground support test equipment.

2. Scope:
   This Product STANDARD SPECIFICATION covers two (2) basic types of airspeed indicators with indication range essentially as follows:

   TYPE I - 1 Revolution
   TYPE II - 7 Revolutions

3. Identification:
   All units regardless of origin of manufacture are to be identified by B.I.C. assigned part numbers as follows:

B.I.C. P/N	TYPE NO.	RANGE
336-00001R	II	50 - 650 Knots
336-00001	II	50 - 650 Knots
336-00004	I	60 - 420 Knots
336-00005	I	40 - 200 Knots
336-00006	I	20 - 250 Knots

4. Test Conditions:
   Unless otherwise specified, all tests shall be made with the instrument mounted in the horizontal (Face UP) position.

5. Performance Requirements:
   All units are required to meet the following performance requirements before installation in any ground support test equipment.

   5.1 Friction:
   The instrument shall be tested for friction at approximately four essentially equal scale intervals. The pressure shall be brought up to the desired reading and then held constant while two readings are taken. The first reading being taken before the instrument is vibrated, and the second one after the instrument is vibrated. The difference between any two readings shall not exceed any of the tolerances listed in the calibration specifications.

   5.2 Leak:
   With both the pitot pressure and static pressure connections simultaneously evacuated to 15 inches of Mercury, the leakage shall not cause more than 0.4 inch of mercury pressure drop during a 10 second period.

5.3 Vibration:
With pressure applied, sufficient to give half scale deflection, the instrument shall be subjected to vibrations of all frequencies within the appropriate ranges specified.

5.4 Pointer Position:
The position of the pointer without any pressure applied shall rest on the lowest airspeed on the dial with the exception of P/N's 336-00001,336-00001R and 336-00004. The 336-00001 & ..1R units pointer should rest between 15-45 knots. The 336-00004 unit pointer position should rest at $350^{o} \pm 5^{o}.0$ position; (12 o'clock being the 360^{o} position.)

6. Scale Error Test:
All units shall be tested to the following specifications.

6.1 P/N 336-00001&1R:

READING (Knots)	TOLERANCE (Knots)	READING (Knots)	TOLERANCE (Knots)
50	± 5.0	220	± 4.0
60	± 3.0	240	± 4.0
70	± 3.0	260	± 4.0
80	± 3.0	280	± 4.0
90	± 3.0	300	± 4.0
100	± 3.0	320	± 4.0
110	± 3.0	340	± 4.0
120	± 3.0	360	± 5.0
130	± 3.0	380	± 5.0
140	± 3.0	400	± 5.0
150	± 3.5	450	± 5.0
160	± 3.5	500	± 5.0
170	± 3.5	550	± 5.0
180	± 4.0	600	± 5.0
190	± 4.0	650	± 5.0
200	± 4.0	700	± 5.0

6.2 P/N 336-00004:

READING (Knots)	TOLERANCE (Knots)	READING (Knots)	TOLERANCE (Knots)
60	± 3.0	180	± 4.0
70	± 3.0	190	± 4.0
80	± 3.0	200	± 5.0
90	± 3.0	220	± 5.0
100	± 3.0	240	± 5.0
110	± 3.0	260	± 5.0
120	± 3.0	280	± 5.0
130	± 3.0	300	± 5.0
140	± 3.0	320	± 5.0
150	± 3.5	340	± 5.0
160	± 3.5	360	± 5.0
170	± 3.5	400	± 5.0
		420	± 5.0

6.3 P/N 336-00005:

READING (Knots)	TOLERANCE (Knots)
20	± 5.0
30	± 5.0
40	± 3.5
50	± 3.0
60	± 3.0
70	± 3.0
80	± 3.0
90	± 3.0
100	± 3.0
110	± 3.0
120	± 5.0
130	± 5.0
140	± 5.0
150	± 5.0
160	± 5.0
170	± 5.0
180	± 5.0
190	± 5.0
200	± 5.0

6.4 P/N 336-00006:

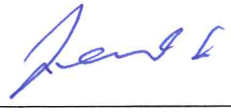
READING (Knots)	TOLERANCE (Knots)	READING (Knots)	TOLERANCE (Knots)
20	± 5.0	140	± 4.0
30	± 5.0	150	± 4.0
40	± 3.5	160	± 4.0
50	± 3.0	170	± 4.0
60	± 3.0	180	± 4.0
70	± 3.0	190	± 4.0
80	± 3.0	200	± 4.0
90	± 3.0	210	± 4.0
100	± 3.0	220	± 4.0
110	± 3.0	230	± 4.0
120	± 3.0	240	± 4.0
130	± 3.0	250	± 4.0

SECTION 3: VERTICAL SPEED INDICATOR

The following engineering specification (Document 23-337-00025) details performance requirements of the pressure actuated vertical speed indicators used in Barfield manufactured ground support test equipment test equipment.

Engineering Specification	
Title: Vertical Speed Indicator, Ground Support Equipment	Barfield, Inc 4101 NW 29 Street Miami Florida 33142
Drawing No: 23-337-00025	Page 1 of 4

REV.	ECO #	REV. DATE	DESCRIPTION OF CHANGE
A	N/A	Jan/8/1990	Initial Release
B	260-00885	Jan/19/2012	Document reformatted to MS Word.

	Created By	Checked By	Approved By
Name	Guillermo Echarri	Jesus Armas	Jean-Louis Mercier
Signature			
Date	1/19/2012	1/19/2012	1/19/2012

1. Purpose:
   To specify performance requirements for pressure actuated vertical speed indicators for use in B.I.C. manufactured ground support test equipment.

2. Scope:
   This engineering specification covers four (4) basic types of direct indicating instruments as follows:

   TYPE I - Range 0-2000 feet per minute climb and descent.
   TYPE II - Range 0-3000 feet per minute climb and descent.
   TYPE III - Range 0-4000 feet per minute climb and descent.
   TYPE IV - Range 0-6000 feet per minute climb and descent.

3. Identification:
   All units regardless of origin of manufacture are to be identified by B.I.C. assigned part numbers as follows:

   TYPE I - to be identified as part number 337-00001.
   TYPE II - to be identified as part number 337-00002.
   TYPE III - to be identified as part number 337-00003.
   TYPE IV - to be identified as part number 337-00004.

4. Test Conditions:
   Unless otherwise specified, all tests shall be made with the instrument mounted in the horizontal (Face UP) position.

5. Performance Requirements:
   All units are required to meet the following performance requirements before installation in any ground support test equipment.

   5.1 Zero Setting Range:
   The range of movement of the pointer by means of the zero adjustment shall not be less than 400 feet per minute for the "UP" and "DOWN" position.

   5.2 Scale Error:
   When subjected to the rates of changes of pressure indicated in Table 1 for the altitude intervals shown, the errors shall not exceed the tolerances specified.

   5.3 Lag:
   The natural lag of the instrument when timed between the following points shall be between 3 and 15 seconds:

   TYPE I and II - 1800 - 200 feet per minute.
   TYPE III and IV - 2000 - 200 feet per minute.

5.4 Friction:
A test shall be performed to ascertain friction. In the time intervals at which the lag time is measured, the pointer shall move smoothly towards zero (while no vibration is applied) and shall return to zero within 300 feet

5.5 Leak:
With a vacuum of 15 inches of mercury applied to the static pressure connection, the leakage shall not cause more than 0.05 inches of mercury pressure drop during a 1 minute period. With a pressure of 10 inches of mercury applied to the static connection, the leakage shall not cause more than 0.05 inches of mercury pressure drop during a 1 minute period.

5.6 Position Error:
With atmospheric pressure applied to the instrument, the difference between pointer indication when the instrument is in horizontal (Face UP) operating position and when it is in any other position shall not exceed 50 feet per minute.

6. Qualification Tests:
All instruments shall comply with the requirements of this section.

6.1 Vibration:
The instrument shall be subjected to vibration during testing. While the instrument is being vibrated, the drift of the pointer shall not exceed 50 feet per minute and it shall not oscillate more than 50 feet per minute.

TABLE 1

SCALE ERROR TOLERANCE

TYPES I AND II

(Ranges: 0-2,000 and 0-3,000 feet per minute)

Test Rate Ascent and Descent Feet Per Minute	Tolerance Feet Per Minute
500	35
1,000	75
1,500**	150
2,000	250
1,500**	200
2,000	250
1,500**	200
2,000	250

** Maximum test point for Type I.

SCALE ERROR TOLERANCE

TYPES III AND IV

(Ranges: 0-4,000 and 0-6,000 feet per minute)

Test Rate Ascent and Descent Feet Per Minute	Tolerance Feet Per Minute
500	100
1,000	200
2,000	300
3,000**	300
4,000	400
5,000	500
2,000**	300
4,000	400
2,000**	300
4,000	400

** Maximum test point for Type III.