*TB 9-4920-457-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR PITOT AND STATIC TESTERS BARFIELD, MODEL 1811 SERIES

Headquarters, Department of the Army, Washington, DC
17 September 2003

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual. For the World Wide Web, use https://amcom2028.redstone.army.mil.

*This technical bulletin supersedes TB 9-4920-457-35, dated 13 January 1997.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Pitot and Static Testers, Barfield, Model 1811 Series. The manufacturers' manuals were used as the prime sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Models 1811D, 1811E, 1811G, and 1811H are basically the same. All models have hand operated vacuum and pressure pumps. The 1811H has, additionally, an internal electric pump with a line cord, fuse, switch, and function switch. Differences in range are described in the text and table 1. Models 1811D and 1811E do not have vertical speed indicators.

b. Time and Technique. The time required for this calibration is approximately 3 hours, using the physical technique.

2. Forms, Records, and Reports

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Adjustments to be reported are designated (R) at the end of the sentence in which they appear. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 2.

Table 1. Model Code Designations

Model 1811D/E or		0	
Model 1811G/H			

	Airspeed indicator		Vertical speed indicator		Altimeter
		0	none		
1	50 to 650 knot range	1	---	1	50,000 ft range inHg baro scale
2	10 to 150 knot range	2	2000 ft/minute range	2	55,000 ft range inHg baro scale
3	10 to 200 knot range	3	3000 ft/minute range	3	---
4	60 to 420 knot range	4	4000 ft/minute range	4	35,000 ft range inHg baro scale
5	20 to 200 knot range	5	---	5	35,000 ft range inHg/mbar baro scale
6	20 to 250 knot range	6	6000 ft/minute range	6	50,000 ft range mbar baro scale
7	---	7	---	7	35,000 ft range mbar baro scale

Table 2. Calibration Description

Test instrument parameters	Performance specifications
Altitude	Refer to table 1 for range and table 4 for accuracy
Vertical speed (rate of climb)	Refer to table 1 for range and table 5 for accuracy
Airspeed	Refer to table 1 for range and table 6 for accuracy

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 3 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Sets AN/GSM-286, AN/GSM-287, or AN/GSM-705. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 3. The accuracies listed in table 3 provide a four-to-one ratio between the standard and TI.

5. Accessories Required. The accessories required for this calibration are common usage accessories, issued as indicated in paragraph **4** above, and are not listed in this calibration procedure.

Table 3. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
PNEUMATIC PRESSURE STANDARD		Druck, Model DPI 145/R (MIS-45842)
Airspeed	Range: 17.5 to 655 knots Accuracy: ±0.19% of reading	
Altitude	Range: 0 to 55,640 ft Accuracy: ±0.21% of reading	
Rate of climb	Range: 400 to 5500 ft/minute Accuracy: ±1.75% reading	

SECTION III
CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs **6** and **7** are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in table 3.

c. Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturers' manuals for this TI.

d. Unless otherwise specified, all controls and control settings refer to the TI.

7. Equipment Setup

a. Place TI on a level platform or bench with instruments face up.

b. Remove protective cover from TI.

NOTE

All performance checks can be performed with manual vacuum and pressure pumps. Both the manual pumps and the internal electric pump (for model 1811H) are capable of producing 25 in. Hg vacuum and 15 psi pressure. Also, external pressure and vacuum connections are provided for use of external sources.

c. Position TI controls as listed in (1) through (4) below:

NOTE

Close all ports with caps.

(1) PRESSURE CONTROL and VACUUM CONTROL valves fully closed.

(2) CROSSBLEED CONTROL, PRESSURE VENT, and VACUUM VENT valves fully closed.

(3) On model 1811H, INTERNAL PUMP switch to OFF.

(4) On model 1811H, connect TI to 115 V ac source.

CAUTION

When using a 115 V ac source, the TI power cord must be grounded to prevent electrical shock.

d. Pump pressure to 20 psi indication on **PRESSURE TANK** gage and vacuum to 20 in. Hg indication on **VACUUM TANK** gage using manual pumps (or internal electric pump on model 1811H).

e. Open **PRESSURE CONTROL** valve until TI airspeed indicates approximately 75 percent of full scale. Close valve and observe airspeed for 1 minute. Airspeed should not decrease more than 2 knots.

f. Open **PRESSURE VENT** valve slowly to return airspeed to ambient pressure, then close.

CAUTION

During all operations, ensure that the vacuum and pressure selector valves are not moved from their positions and that air lines are not disconnected while the pump motor is running, or while any indications other than zero can be observed on the instruments. (The indications will be zero on the vertical speed indicator, local ground level on the altimeter, and approximately 0 on the airspeed indicator.) Failure to observe this precaution will result in serious damage to the master instruments and any external instruments connected to the TI.

NOTE

Before making an accurate test, run each performance check through its complete range of pressure or vacuum twice. This exercising of the TI and standard will normalize a small amount of hysteresis in diaphragms of TI so that correction card errors will apply when values of function (altitude, airspeed, absolute pressure) are approached in an increasing direction. In addition, the operator can see if excessive friction has developed in instruments. This exercise will also reduce friction on subsequent test runs. Any leaks detected during this exercise must be corrected before continuing.

8. Altimeter

a. Performance Check

NOTE

Ensure that pneumatic pressure standard transducers have been zeroed within the last 8 hours.

NOTE

Ensure to cap shut **VAC PORT** on TI or altimeter will not operate properly.

(1) Connect pneumatic pressure standard **0-20 PSIA** inlet port to **TI PRESS PORT** using hose supplied with TI.

(2) Position controls on pneumatic pressure standard as indicated in (a) through (f) below:

(a) **POWER** switch to **ON** (allow 1 minute for warmup).

(b) **SOURCE** pushbutton to **INT**.

(c) **UNITS DISPLAYED** switch to **ALT FT**.

(d) **RANGE** pushbutton to **0-20**.

(e) **SENSITIVITY** pushbutton to **HIGH**.

(f) Press **RESET** pushbutton.

(3) Close **VERTICAL SPEED** control fully.

(4) Open **CROSSBLEED CONTROL** valve fully. This prevents airspeed indicator from increasing. Adjust barometric adjustment knob (on front of TI) for 29.92 (1013.3 mb) indication on barometric indicator.

(5) Slowly open **PRESSURE CONTROL** valve until pneumatic pressure standard indicates 0 (zero ft altitude); then close **PRESSURE CONTROL** valve. If TI altimeter does not indicate 0 ±50 ft (±30 ft for 55,000 ft altimeters), perform **b** below.

(6) Slowly open **PRESSURE CONTROL** valve until TI altimeter indicates -500 ft, then close. Pneumatic pressure standard will indicate between -450 and -550 ft (-470 and -530 ft for 55,000 ft altimeters).

(7) Slowly open **PRESSURE CONTROL** valve until TI altimeter indicates -1000 ft, then close. Pneumatic pressure standard will indicate between -950 and -1050 ft (-970 and -1030 ft for 55,000 ft altimeters). Record TI error.

(8) Slowly open **VACUUM VENT** to return system pressure to ambient. Close vent valve. Record indication on pneumatic pressure standard for hysteresis check.

(9) Slowly open **VACUUM CONTROL** valve until TI altimeter indicates 500 ft, then close valve. Pneumatic pressure standard will indicate between 450 and 550 ft (470 and 530 ft for 55,000 ft altimeters). Record TI error.

NOTE

Tap indicator gently to reduce effects of friction.

(10) Repeat technique of (9) above for TI altimeter indications listed in table 4. Record pneumatic pressure standard indications at 16,000 and 18,000 ft (20,000 and 25,000 ft for 50,000 ft altimeters) for hysteresis check. Also record TI error at each altitude listed in table 4.

Table 4. Altimeter Accuracy Check

Test instrument indications (ft)	Pneumatic pressure standard indications (ft)[1] [2]					
	Min			Max		
1000	925	(925)	[960]	1075	(1075)	[1040]
1500	1425	(1425)	[1450]	1575	(1575)	[1550]
2000	1900	(1900)	[1940]	2100	(2100)	[2060]

See footnotes at end of table.

Table 4. Altimeter Accuracy Check - Continued

Test instrument indications (ft)	Pneumatic pressure standard indications (ft)[1] [2]					
	Min			Max		
4000	3900	(3900)	[3930]	4100	(4100)	[4070]
5000	4900	(4900)	[4930]	5100	(5100)	[5070]
6000	5900	(5900)	[5930]	6100	(6100)	[6070]
8000	7850	(7825)	[7920]	8150	(8175)	[8080]
10,000	9850	(9825)	[9910]	10,150	(10,175)	[10,090]
12,000	11,800	(11,800)	[11,900]	12,200	(12,200)	[12,100]
14,000	13,800	(13,775)	[13,880]	14,200	(14,225)	[14,120]
16,000[3]	15,800	(15,760)	[15,860]	16,200	(16,240)	[16,140]
18,000[3]	17,800	(17,725)	[17,840]	18,200	(18,275)	[18,160]
20,000[3]	19,800	(19,700)	[19,820]	20,200	(20,300)	(20,180]
22,000	21,700	(21,660)	[21,800]	22,300	(22,340)	[22,200]
25,000[3]	24,700	(24,625)	[24,760]	25,300	(25,375)	[25,240]
30,000	29,700	(29,550)	[29,740]	30,300	(30,450)	[30,260]
35,000	34,700	(34,475)	[34,720]	35,300	(35,525)	[35,280]
40,000		(39,400)	[39,700]		(40,600)	[40,300]
45,000		(44,325)	[44,680]		(45,675)	[(45,320]
50,000		(49,250)	[49,660]		(50,750)	[50,340]
55,000			[54,640]			[55,360]

[1]Values in parenthesis are for TIs with 50,000 ft altimeters.

[2]Values in brackets are for TIs with 55,000 ft altimeters.

[3]Wait 5 minutes, then record pneumatic pressure standard indications at these points.

NOTE

No hysteresis check is specified for 55,000 ft altimeters.

(11) Slowly open **VACUUM VENT** valve until TI indicates 18,000 ft (25,000 ft for 50,000 ft altimeters). After 10 minutes pneumatic pressure standard indication will be within 70 ft (150 ft for 50,000 ft altimeters) of indication recorded in (10) above for 18,000 ft (25,000 ft for 50,000 ft altimeters).

(12) Slowly open **VACUUM VENT** valve until TI indicates 16,000 ft (20,000 ft for 50,000 ft altimeters). After 10 minutes pneumatic pressure standard indication will be within 70 ft (150 ft for 50,000 ft altimeters) of indication recorded in (10) above for 16,000 ft (20,000 ft for 50,000 ft altimeters).

(13) Slowly open **VACUUM VENT** valve until altimeter indicates lowest reading with valve open completely. After 5 minutes altimeter will indicate within 50 ft (60 ft for 50,000 ft altimeters) of indication recorded in (8) above.

(14) If all indications are within tolerance, annotate correction chart and place in holder on TI faceplate. The correction chart will show standard indications when TI indicates nominal values.

b. Adjustments

(1) Loosen locking screw, located left of barometric adjustment knob (screw may be covered with black paper dot).

(2) With pneumatic pressure standard indicating 0 ft altitude, adjust barometric adjustment knob until altimeter indicates 0 ft altitude.

(3) Pull adjustment knob out and adjust barometric indicator to 29.92 (1013.3 mb). Push knob down.

NOTE

It may be necessary to repeat (2) and (3) above until no further adjustments are required.

(4) Tighten locking screw and replace black paper dot (R).

9. Vertical Speed Indicator

a. Performance Check

(1) Press **RESET** pushbutton on pneumatic pressure standard.

(2) Adjust TI vertical speed zero adjustment screw for 0 indication.

(3) Verify that **PRESSURE CONTROL** and **VACUUM CONTROL** valves are closed.

NOTE

As the vertical speed indicator case pressure equalizes with the static system, the indicated rate will begin to decrease. Continue to open **VERTICAL SPEED** control slowly until indicator indicates 0, then open fully.

(4) Observe vertical speed indicator and slowly open **VERTICAL SPEED** control valve. Do not exceed full scale indication on vertical speed indicator.

(5) Slowly adjust **VACUUM CONTROL** until vertical speed indicator indicates 500 ft per minute.

(6) When altimeter indicates (passes) 2000 ft, press **RATE OF CLIMB** pushbutton on pneumatic pressure standard. After 1 minute, light will stop flashing. Record indication on pneumatic pressure standard.

(7) Slowly open **VACUUM VENT** valve until altimeter indicates less than 2000 ft, then close.

NOTE

Start each of the following checks at approximately 2000 ft indication on altimeter.

NOTE

The middle digit following the basic model number identifies the vertical speed indicator installed in the TI. Table 5 lists tolerances for each available model code. Select appropriate column in table 5 for the applicable model code shown in table 1.

(8) Repeat (6) and (7) above two times and average the three readings. The average reading will be within the tolerance listed in table 5 for the applicable model code. Record TI error.

(9) Repeat (5) through (8) above for remaining vertical speed indications listed in table 5 for the applicable model code. Record TI error at each indication.

(10) If all average indications recorded in (6) through (8) above are within tolerances listed in table 5, annotate correction chart and place in holder on faceplate of TI. The correction chart will show standard indications when TI indicates nominal values.

b. Adjustments. No further adjustments can be made.

Table 5. Vertical Speed Indicator Check

Test instrument indications (fpm)	Pneumatic pressure standard indications (fpm)							
	Min				Max			
	2[1]	3[1]	4[1]	6[1]	2[1]	3[1]	4[1]	6[1]
500	465	465	400	400	535	535	600	600
1000	925	925	800	800	1075	1075	1200	1200
1500	1350	1350	- - -	- - -	1650	1650	- - -	- - -
2000	- - -	1750	1700	1700	- - -	2250	2300	2300
3000	- - -	- - -	2700	2700	- - -	- - -	3300	3300
4000	- - -	- - -	- - -	3600	- - -	- - -	- - -	4400
5000[2]	- - -	- - -	- - -	4500	- - -	- - -	- - -	5500
-500	-465	-465	-400	-400	-535	-535	-600	-600
-1000	-925	-925	-800	-800	-1075	-1075	-1200	-1200
-1500	-1350	-1350	- - -	- - -	-1650	-1650	- - -	- - -
-2000	- - -	-1750	-1700	-1700	- - -	-2250	-2300	-2300
-3000	- - -	- - -	-2700	-2700	- - -	- - -	-3300	-3300
-4000	- - -	- - -	- - -	-3600	- - -	- - -	- - -	-4400
-5000	- - -	- - -	- - -	-4500	- - -	- - -	- - -	-5500

[1]Middle digit of 3 digit code following basic model number (see table 1).

[2]Maintain vertical speed indication at highest indication used for 3 minutes, close **VACUUM CONTROL** valve fully, and proceed to -500 fpm indication.

10. Airspeed Indicator

a. Performance Check

(1) Connect pneumatic pressure standard **0-120 InH_20** inlet port to TI **PRESS PORT**, using hose supplied with TI.

(2) On pneumatic pressure standard, connect BNC cable from **0-120 InH_20** signal output connector to **EXT INPUT** connector.

(3) Position controls on pneumatic pressure standard as listed in (a) through (e) below:

(a) UNITS DISPLAYED switch to AIRSPEED.

(b) SOURCE pushbutton to EXT.

(c) RANGE pushbutton to 0-20.

(d) SENSITIVITY pushbutton to HIGH.

(e) Press RESET pushbutton.

(4) Open TI **VACUUM VENT** valve and close all other valves fully.

(5) Slowly adjust **PRESSURE CONTROL** valve for each applicable TI airspeed indication listed in table 6 (low range) or table 7 (high range). Pneumatic pressure standard will indicate within the limits specified. Record TI error for each indication.

(6) If all indications are within tolerance, annotate correction chart and place in holder on TI faceplate. The correction chart will show standard indications when TI indicates nominal values.

b. Adjustments. No further adjustments can be made.

Table 6. Airspeed Indicator Check (Low Range)

Test instrument airspeed indications (knots)	Pneumatic pressure standard indications (knots)[1]			
	Min		Max	
20	17.5	(15)	22.5	(25)
30	27.5	(25)	32.5	(35)
40	38	(36.5)	42	(43.5)
50	48	(47)	52	(53)
60	58	(57)	62	(63)
70	68	(67)	72	(73)
80	78	(77)	82	(83)

Table 6. Airspeed Indicator Check (Low Range) - Continued

Test instrument airspeed indications (knots)	Pneumatic pressure standard indications (knots)[1]			
	Min		Max	
90	88	(87)	92	(93)
100	98	(97)	102	(103)
110	108	(107)	112	(113)
120	118	(115)	122	(125)
130	128	(125)	132	(135)
140	138	(135)	142	(145)
150	147.5	(145)	152.5	(155)
160	157.5	(155)	162.5	(165)
170	167	(165)	173	(175)
180	177	(175)	183	(185)
190	186	(185)	194	(195)
200	196	(195)	204	(205)

[1]Values outside parenthesis are for part numbers 336-00002 and 336-00003. Values inside parenthesis are for part number 336-00005.

Table 7. Airspeed Indicator Check (High Range)

Test instrument airspeed indications (knots)	Pneumatic pressure standard indications (knots)[1]			
	Min		Max	
50	47		53	
60	58	(57)	62	(63)
70	68	(67)	72	(73)
79	78	(77)	82	(83)
90	88	(87)	92	(93)
100	98	(97)	102	(103)
110	108	(107)	112	(113)
120	118	(117)	122	(123)
130	128	(127)	132	(133
140	137.5	(137)	142.5	(143)
150	147.5	(146.5)	152.5	(153.5)
160	157.5	(156.5)	162.5	(163.5)
170	167.5	(166.5)	172.5	(173.5)
180	177.5	(176)	182.5	(184)
190	187.5	(186)	192.5	(194)
200	197	(195)	203	(205)
220	217	(215)	223	(225)
240	237	(235)	243	(245)
260	256	(255)	264	(265)
280	276	(275)	284	(285)
300	296	(295)	304	(305)
320	316	(315)	324	(325)
340	336	(335)	344	(345)
360	356	(355)	364	(365)
380	376	(275)	384	(385)
400	396	(395)	404	(405)
420	416		424	
440	436		444	

Table 7. Airspeed Indicator Check (High Range) - Continued

Test instrument airspeed indications (knots)	Pneumatic pressure standard indications (knots)[1]	
	Min	Max
460	456	464
480	476	484
500	496	504
520	515	525
540	535	545
560	555	565
580	575	585
600	595	605
620	615	625
640	635	645
650	645	655

[1]Values outside parenthesis are for part numbers 336-00001. Values inside parenthesis are for part number 336-0004.

11. Final Procedure

a. Deenergize and disconnect all equipment.

b. Annotate and affix DA label/form in accordance with TB 750-25

By Order of the Secretary of the Army:

JOHN M. KEANE
General, United States Army
Acting Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army

0319816

Distribution:

To be distributed in accordance with IDN 343471, requirements for calibration procedure TB 9-4920-457-35.

Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil
To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From**: Joe Smith
2. Unit: home
3. **Address**: 4300 Park
4. **City**: Hometown
5. **St**: MO
6. **Zip**: 77777
7. **Date Sent**: 19-OCT –93
8. **Pub no:** 55-2840-229-23
9. **Pub Title**: TM
10. **Publication Date**: 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. **Submitter FName**: Joe
14. Submitter MName: T
15. **Submitter LName**: Smith
16. **Submitter Phone**: 123-123-1234
17. **Problem**: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. **Text**

This is the text for the problem below line 27.

PIN: 052309-000