TECHNICAL MANUAL

CALIBRATION PROCEDURE

FOR

FUEL QUANTITY TEST SET

PSD 60-1AF, PSD 60-2R

(BF GOODRICH, JcAIR, SIMMONS PRECISION)

This publication replaces T.O. 33K8-4-550-1 dated 30 May 2012.

Published under Authority of the Secretary of the Air Force

30 OCTOBER 2012

FUEL QUANTITY TEST SET

PSD 60-1AF, PSD 60-2R

(BF GOODRICH, JcAIR, SIMMONS PRECISION)

1 CALIBRATION DESCRIPTION:

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Capacitance Measurement	Range: 0.1 to 2000 pF and 1 to 20,000 pF Accuracy: ±0.1% rdg or 0.2 pF, whichever is greater	Compared to Standard Capacitors
Capacitance Simulation	Range: Tank Unit, 20 to 8000 pF; Compensator, 20 to 1000 pF Accuracy: ±0.1% rdg or 0.2 pF, whichever is greater	Measured with a Capacitance Bridge
Resistance Measurement	Range: PSD-60-1AF, Low Range, 0 to 10 MΩ; Mid Range, 10 to 100 MΩ; High Range, 100 to 1000 MΩ; Extended Range, 1000 to 10000 MΩ PSD60-2R, 100 kΩ to 2000 MΩ Accuracy: ±10% rdg	Compared to Standard Resistors

2 EQUIPMENT REQUIREMENTS:

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1	STANDARD CAPACITORS	Range: 0.0001 to 0.01 μF Accuracy: Measured	ARCO SS32	MD-1 Fuel Quantity Gage Tester
2.2	CAPACITANCE BRIDGE	Range: 0.0001 to 0.01 μF Accuracy: ±0.025% of ind	Andeen-Hagerling AH2700A	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.3 DECADE RESISTOR	Range: 0 to 10 MΩ Accuracy: ±2.5%	Electro Scientific Industries DB-62-11M	
2.4 HI MEG RESISTORS *	Range: 40 to 100 MΩ; 400 to 1000 MΩ; 4 to 10 GΩ; 1 to 1.5 GΩ, PSD60-2R Accuracy: ±2.5% of recorded value	Victoreen RX1 series	Fluke 5320A
2.5 ADAPTER	BNC to Reverse BNC Accuracy: N/A	JcAIR PSB 40-524A	Pasternack PE9529
2.6 LEAD	BNC to Unshielded BNC (Ref Figure 3-1 T.O. 33D2-3-119-1) Accuracy: N/A	Local Manufacture	

* Check 10, 50 and 90% of range. See step 3.6.

3 PRELIMINARY OPERATIONS:

3.1 Review and become familiar with entire procedure before beginning Calibration Process.

WARNING

Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) or turned off, where applicable. Ensure that all equipment switches are set to the proper position before making connections or applying power. If not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

3.2 Connect test equipment to 115 V/60 Hz power source. Set POWER switch to ON and allow 20 minutes warm-up.

3.3 Set the TI POWER to ON and allow 5 minutes warm-up.

3.4 Connect test leads and Adapters to the Capacitance Bridge. Ensure that the test leads and Adapters are placed about 4 inches apart. Measure and record zero capacitance at 1 kHz and the max voltage set to 10 V.

3.5 With the Capacitance Bridge, measure and record (minus zero capacitance of step 3.4, if applicable) the Standard Capacitor values for 0.0001 μF, 0.0009 μF and 0.009 μF. The same shielded test leads should be used that will be used during the calibration of the TI.

3.6 Calibrate the HI-Meg Resistor values 40 MΩ through 10 GΩ, at 10 VDC IAW T.O. 33K8-4-368-1. Verify T.O. 33K8-4-368-1 still meets required specifications.

3.7 Throughout the Calibration Process, use TI PF/EXTENDED RANGE and MΩ/TWO TERMINAL MEASUREMENT as required.

3.8 Connect TI green CHASSIS terminal to the Capacitance Bridge ground.

NOTE

All PSD60-2R TIs with MOD level 6 and above are capable of an optional extended resistance range. Optional range is controlled by a dip switch on the main board. The TI is shipped from the factory with the extended range turned off. Optional extended range is listed in the specifications but is an unwarranted specification.

4 CALIBRATION PROCESS:

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

4.1 CAPACITANCE MEASUREMENT CALIBRATION:

NOTE

When performing following test, if leads and connectors used to connect Standard Capacitors are not the same as step 3.4, connect these leads to TI in the position they will be used and record TI zero capacitance indication. Subtract this value from TI display to determine actual Standard Capacitor Measurement values.

NOTE

Do not use a standard coaxial lead to connect the LOZ terminal of the TI to the capacitance standard. Such practice can cause invalid readings due to connection of SHIELD ground to CHASSIS ground. Recommended correction: Terminate shield 0.5 in from LOZ BNC Connector.

4.1.1 Set TI controls as follows:

FUNCT	MEASURE EXT
SELECT	TU
FREQUENCY SELECT	1 kHz (on certain PSD60-2R models only). Push to enter.

4.1.2 Connect the first Standard Capacitor listed in the Applied column of Table 2 to the TI TANK UNITS LOZ and HIZ jacks.

4.1.3 The TI must indicate within the corresponding values listed in the Limits column of Table 2.

4.1.4 Repeat steps 4.1.2 and 4.1.3 for each remaining applied value listed in Table 2.

Table 2.

Applied (μF)	Limits (pF)
0.0001	±0.2 pF of measured value
0.0009	±0.1% of measured value
0.009 *	±0.1% of measured value

* Press and hold TI EXTENDED RANGE switch (on certain PSD60-1 models only).

4.1.5 Disconnect Standard Capacitor from TI TANK UNITS LOZ and connect to TANK UNITS COMP.

4.1.6 Set TI SELECT switch to COMP.

4.1.7 Repeat steps 4.1.2 through 4.1.4, use TANK UNITS COMP instead of TANK UNITS LOZ.

4.2 CAPACITANCE SIMULATION CALIBRATION:

4.2.1 Connect the TI INDICATOR COMP center conductor to the TI CHASSIS ground.

4.2.2 Set the TI controls as follows:

FUNCT	MEASURE INT
SELECT	TU

4.2.3 Connect the Capacitance Bridge rear panel UNKNOWN CAPACITANCE HIGH and LOW terminals to TI INDICATOR HIZ and LOZ terminals, respectively. Adjust the TI SIMULATOR TU capacitance decades to zero and VARIABLE control for the 20 pF on TI display.

4.2.4 Set the TI FUNCT switch to SIM TU ONLY and POWER to OFF.

4.2.5 Using the Capacitance Bridge, set to measure the TI simulated capacitance at 1 kHz and the max voltage set to 10 V.

4.2.6 The measured capacitance, minus zero capacitance (step 3.4, if applicable), must be within 19.8 to 20.2 pF. Disconnect test leads from the Capacitance Bridge.

4.2.7 Disconnect TI INDICATOR COMP center conductor from TI CHASSIS ground.

4.2.8 Set TI controls as follows:

POWER	ON
FUNCT	MEASURE INT
SELECT	COMP
FREQUENCY SELECT	1 kHz (on certain PSD60-2R models only). Push to enter.

NOTE

Short BNC cables of the same length have been found to yield the proper results when performing the calibration in the following steps.

4.2.9 Connect TI INDICATOR LOZ center conductor to the shell of TU LOZ terminal or CHASSIS ground.

4.2.10 Connect the Capacitance Bridge rear panel UNKNOWN CAPACITANCE HIGH and LOW terminals to TI INDICATOR HIZ and INDICATOR COMP terminals, respectively. Adjust the TI SIMULATOR COMP capacitance decades to zero and VARIABLE control for the 20 pF on TI display.

4.2.11 Set the TI FUNCT switch to SIM TU & COMP and POWER to OFF.

4.2.12 Using the Capacitance Bridge, measure the TI simulated capacitance.

4.2.13 The measured capacitance, minus zero capacitance (step 3.4, if applicable), must be within 19.8 to 20.2 pF.

4.2.14 Disconnect the test setup and set TI POWER to ON.

4.3 RESISTANCE MEASUREMENT CALIBRATION:

4.3.1 Set the TI FUNCT control to MEASURE EXT and FREQUENCY SELECT to 1 kHz (on certain PSD60-2R models only). Push to enter.

4.3.2 Use BNC Adapters and cables to connect the required Resistor (from the Applied column of Table 3) to the first TI connection listed in Table 3.

NOTE

Unless otherwise indicated, all connections in Table 3 are to the center conductor.

4.3.3 Set TI SELECT switch to the first position listed in TI Select column of Table 3.

4.3.4 The TI must indicate within the corresponding values listed in Limits column of Table 3.

4.3.5 Repeat steps 4.3.2 through 4.3.4 for each remaining applied value listed in Table 3.

Table 3.

TI Connection (TANK UNITS)	TI Select	Applied	Limits
LOZ, HIZ	LOZ-HIZ	100 kΩ	0.09 to 0.11 MΩ
		1 MΩ	0.9 to 1.1 MΩ
		10 MΩ	9 to 11 MΩ
		40 to 100 MΩ	±10% of applied value
		400 to 1000 MΩ	±10% of applied value

Table 3. (Cont.)

TI Connection (TANK UNITS)	TI Select	Applied	Limits
LOZ, HIZ	LOZ-HIZ	4 to 10 GΩ *	±10% of applied value
		1 to 1.5 GΩ **	±10% of applied value
HIZ, COMP	COMP-HIZ	1 MΩ	0.9 to 1.1 MΩ
LOZ, COMP	LOZ-COMP	1 MΩ	0.9 to 1.1 MΩ
LOZ, HIZ SHLD	LOZ-SHLD	1 MΩ	0.9 to 1.1 MΩ
HIZ SHLD, COMP	COMP-SHLD	1 MΩ	0.9 to 1.1 MΩ
HIZ, HIZ SHLD	HIZ-SHLD	1 MΩ	0.9 to 1.1 MΩ
HIZ SHLD, GND	SHLD-GND	1 MΩ	0.9 to 1.1 MΩ
LOZ, GND	LOZ-GND	1 MΩ	0.9 to 1.1 MΩ
COMP, GND	COMP-GND	1 MΩ	0.9 to 1.1 MΩ
HIZ, GND	HIZ-GND	1 MΩ	0.9 to 1.1 MΩ

* PSD60-1AF only.

** PSD60-2R only.

4.3.6 Set all POWER switches to OFF, disconnect and secure all equipment.

CALIBRATION PERFORMANCE TABLE

4.1 CAPACITANCE MEASUREMENT CALIBRATION:

Applied (μF)	Limits
0.0001	±0.2 pF of measured value
0.0009	±0.1% of measured value
0.009	±0.1% of measured value

4.2 CAPACITANCE SIMULATION CALIBRATION:

Applied (pF)	Limits (pF)
20	19.8 to 20.2

CALIBRATION PERFORMANCE TABLE *(Cont.)*

4.3 RESISTANCE MEASUREMENT CALIBRATION:

TI Connection (TANK UNITS)	TI Select	Limits
LOZ, HIZ	LOZ-HIZ	±10% of applied value
HIZ, COMP	COMP-HIZ	±10% of applied value
LOZ, COMP	LOZ-COMP	±10% of applied value
LOZ, HIZ SHLD	LOZ-SHLD	±10% of applied value
HIZ SHLD, COMP	COMP-SHLD	±10% of applied value
HIZ, HIZ SHLD	HIZ-SHLD	±10% of applied value
HIZ SHLD, LOZ	SHLD-GND	±10% of applied value
LOZ, GND	LOZ-GND	±10% of applied value
COMP, GND	COMP-GND	±10% of applied value
HIZ, GND	HIZ-GND	±10% of applied value
GND, GND	LOZ-HIZ	±10% of applied value