

BARFIELD FUEL QUANTITY EVENT

1. INTRODUCTION

This competition is designed to test the skills of each participating team in their understanding of and ability to troubleshoot an aircraft Fuel Quantity indicating System. To ensure that teams which have yet to compete in this competition do not gain an unfair advantage by observing the earlier competitors, Barfield may have unidentified members of our team monitoring spectators in the testing area. Any team members or associates to a team identified to be loitering in the Fuel Quantity event area may result in a 3 min penalty being assessed when the team actually completes the competition. This penalty may be done without a warning to the offending party found in the testing area and is at Barfield's, AMC and/or the judge's discretion.

2. PROBLEM REPORTED

The Fuel Quantity Indicating System reads approximately 1,000 LBS high at empty.

3. ITEMS KNOWN GOOD

A. The Test Set and Adapter Cables, the Aircraft Wiring and Replacement Components

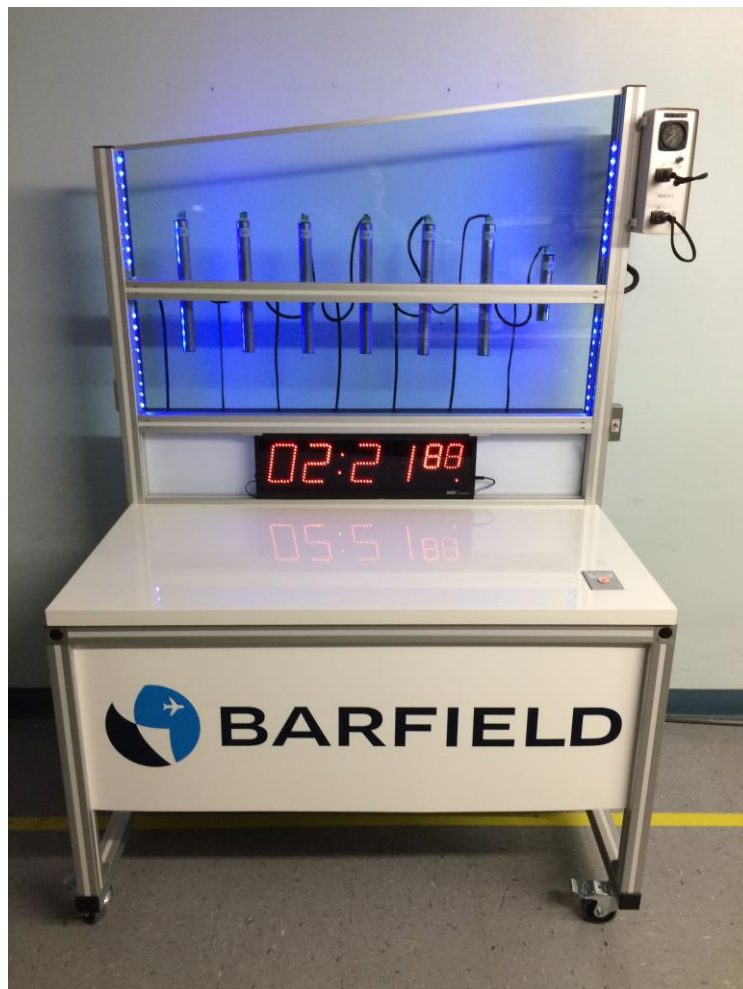


Figure 1 FUEL QUANTITY TEST BENCH

4. SYSTEM INSULATION TEST

A. Aircraft Preparation

- (1) Insure fuel quantity circuit breaker (CB) is open.
- (2) The system is already defueled and the probes dry.
- (3) Break connection between Indicator and aircraft wiring plug (J1 and J2).

B. Test Set Preparation

- (1) Test Set is already Powered On.
- (2) Initialization is already complete and the MAIN MENU is displayed.

C. Connecting Test Set

- (1) Connect Adapter Cable P/N 611-00050 as per Figure 2 and the following steps.

CAUTION: Never make or break connections with the CB closed.

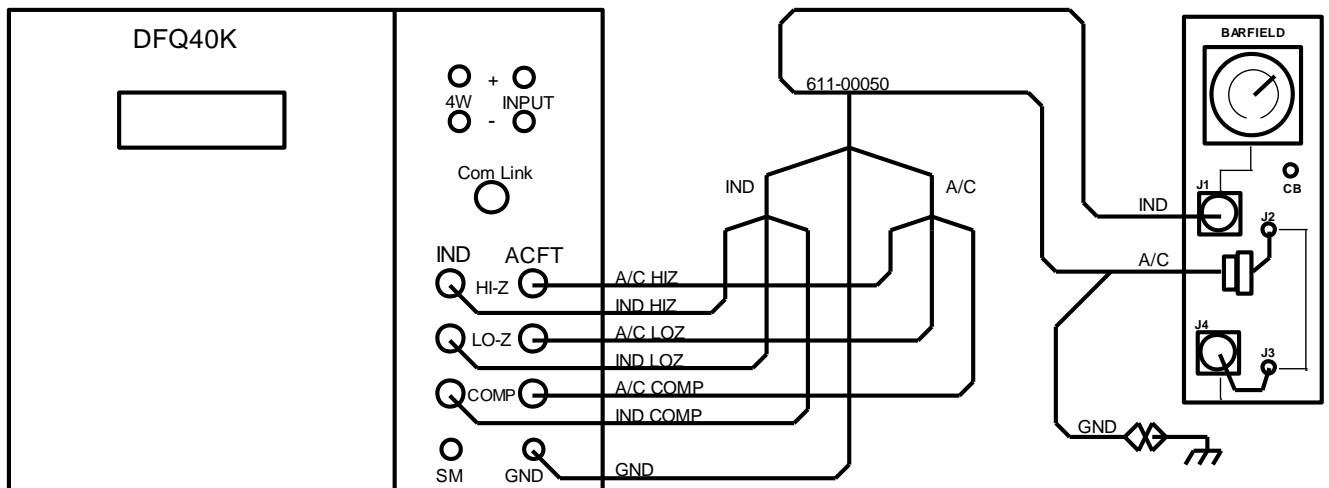


Figure 2 SYSTEM INSULATION CONFIGURATION

- (2) Connect Adapter IND connector to Indicator J1.
- (3) Connect Adapter A/C connector to aircraft wiring plug J2.
- (4) Connect Adapter IND HI-Z BNC to Test Set IND HI-Z receptacle.
- (5) Connect Adapter IND LO-Z BNC to Test Set IND TANK receptacle.
- (6) Connect Adapter IND COMP BNC to Test Set IND COMP receptacle.
- (7) Connect Adapter A/C HI-Z BNC to Test Set ACFT HI-Z receptacle.
- (8) Connect Adapter A/C LO-Z BNC to Test Set ACFT TANK receptacle.
- (9) Connect Adapter A/C COMP BNC to Test Set ACFT COMP receptacle.
- (10) Connect Adapter Ground plug to Test Set GND jack.
- (11) Connect Adapter Ground alligator clip to aircraft ground.

D. Test

- (1) Press F3 to select INSulation Measure.

AUTO	MON	INS	CAP	SIM	CAL
F1	F2	F3	F4	F5	F6

- (2) Insure MODE is set to 3T.
- (3) Insure RANGE is set for 400MΩ range.

- (4) Press F1 for L/H (default), if not already highlighted.

L/H	L/S	L/G	H/G	H/S	S/G
F1	F2	F3	F4	F5	F6

- (5) The test is considered satisfactory if reading is equal to or greater than the minimum specified in Table 1.
 (6) Record the test data on the worksheet 64-611-00049 at 4.D.6.
 (7) Repeat the process by pressing F2 for Test 2, then F3 for Test 3 and so forth.
 (8) Record the test data for each test on the worksheet at 4.D.8.

Table 1 SYSTEM INSULATION

TEST(s)	INS TEST POINTS	INSULATION MΩ
1	L/H = (LO-Z / HI-Z)	100
2	L/S = (LO-Z / SH)	5
3	L/G = (LO-Z / GND)	5
4	H/G = (HI-Z / GND)	5
5	H/S = (HI-Z / SH)	5
6	S/G = (SH / GND)	1
7	L/C = (LO-Z/COMP)	100
8	C/H = (COMP / HI-Z)	100
9	C/S = (COMP / SH)	5
10	C/G = (COMP / GND)	5

Press Next ... for test 7 and on

- (9) Press NEXT and F1 for Test 7, then F2 for Test 8 and so forth.
 (10) Record test data for each test on the worksheet at 4.D.10.

NOTE: If any discrepancies are found with the System Insulation Test then perform the Probe Insulation Test in Section 7 to locate failure after first completing sections 5 and 6.

5. SYSTEM CAPACITANCE TEST

- A. Aircraft Preparation
 (1) Same as section 4.A. above.
- B. Test Set Preparation
 (1) Press BACK to return to MAIN MENU.
- C. Connecting Test Set
 (1) Same as section 4.C.
- D. Test
 (1) Press F4 to select CAPacitance Measure.

AUTO	MON	INS	CAP	SIM	CAL
F1	F2	F3	F4	F5	F6

- (2) Insure RANGE is set for 4,000 pF range.
 (3) Press F1 to measure TANK capacitance, if not already highlighted.

TANK	COMP	DTF		ZERO	ST
F1	F2	F3	F4	F5	F6

- (4) Tank capacitance shall measure 303.5 ± 5.0 pF.
- (5) Record test data on the worksheet at 5.D.5.
- (6) Press F2 to measure COMP capacitance.
- (7) Compensator capacitance shall measure 39.0 ± 2.0 pF.
- (8) Record test data on the worksheet at 5.D.8.

NOTE: If any discrepancy is found with the Tank Capacitance of the System Capacitance Test then perform the Probe Capacitance Test in Section 8 after first completing Section 6 and Section 7 (if the System Insulation failed).

6. INDICATOR TEST

A. Aircraft Preparation

- (1) Same as 4.A.

B. Test Set Preparation

- (1) Press BACK to return to MAIN MENU.
- (2) Press F5 to select SIMulator Measure function.

AUTO	MON	INS	CAP	SIM	CAL
F1	F2	F3	F4	F5	F6

- (3) Press F2 to establish COMP simulator capacitance.

TANK	COMP				CAL
F1	F2	F3	F4	F5	F6

- (4) Using the numeric Keypad enter 81.0 pF.
- (5) Press ENTER key and wait for the value to be set and displayed with the larger font.
- (6) Press F1 to establish TANK simulator capacitance.

TANK	COMP				CAL
F1	F2	F3	F4	F5	F6

- (7) Insure RANGE is set for 4000pF range.
- (8) Using the numeric Keypad enter 303.5 pF.
- (9) Press ENTER key and wait for the value to be set and displayed with the larger font.
- (10) Insure MODE is set to IN.

C. Connecting Test Set

- (1) Same as section 4.C.

D. Test

- (1) Press F6 to select CAL function.

TANK	COMP				CAL
F1	F2	F3	F4	F5	F6

- (2) Press F1 to select SIM.

SIM	ACFT	A & S		TANK	
F1	F2	F3	F4	F5	F6

- (3) Insure MODE is to set to VDC.
- (4) Close circuit breaker.

- (5) Cockpit indicator shall indicate 0 ± 250 LBS.
- (6) Record indicator reading on the worksheet at 6.D.6.
- (7) Open the circuit breaker.
- (8) Press F5 to re-establish the Tank simulator.
- (9) Using the numeric Keypad enter 360.1 pF.
- (10) Press ENTER key and wait for the value to be set and displayed with the larger font.
- (11) Press F6 to re-select CAL/SIM function.
- (12) Close circuit breaker.
- (13) Cockpit indicator shall indicate $5,000 \pm 500$ LBS.
- (14) Record test data on the worksheet at 6.D.14.
- (15) Press F2 to select ACFT.
- (16) After Indicator returns, then open the circuit breaker.
- (17) Disconnect Adapter from Aircraft and Test Set (only if performing Section 7 or 8).

7. PROBE INSULATION MEASUREMENT

NOTE: Perform this procedure if any discrepancy was found in Section 4.

A. Aircraft Preparation

- (1) Insure circuit breaker is open.
- (2) Break connection between aircraft wiring plug and Tank Wall connector (J3 and J4).

B. Test Set Preparation

- (1) Press BACK to return to MAIN MENU.

C. Connecting Test Set

- (1) Connect Adapter Cable P/N 611-00051 as per Figure 3 and the following steps.

CAUTION: Never make or break connections with the CB closed.

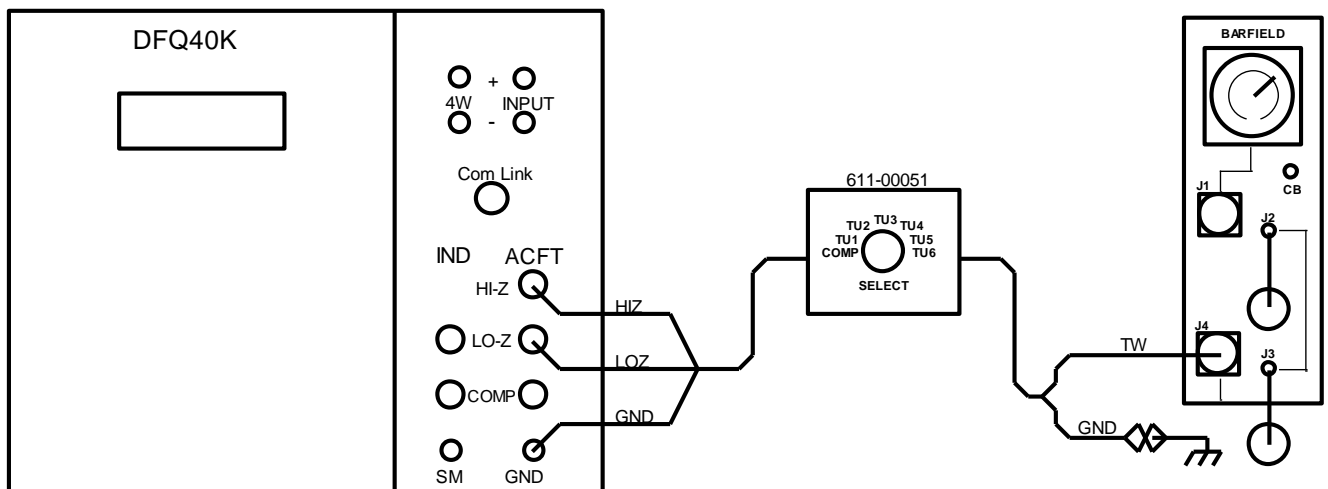


Figure 3 PROBE INSULATION CONFIGURATION

- (2) Connect Adapter HI-Z BNC to Test Set ACFT HI-Z receptacle.
- (3) Connect Adapter LO-Z BNC to Test Set ACFT TANK receptacle.
- (4) Connect Adapter Ground plug to Test Set GND jack.
- (5) Connect Adapter TW connector to aircraft Tank Wall wiring plug J4.
- (6) Connect Adapter Ground alligator clip to aircraft ground.

D. Test

- (1) Press F3 to select INSulation Measure.

AUTO	MON	INS	CAP	SIM	CAL
F1	F2	F3	F4	F5	F6

- (2) Insure MODE is set to 3T.
 (3) Insure RANGE is set for 400MΩ range.
 (4) Set Adapter Cable SELECT switch to COMP position.
 (5) Press NEXT and F1 for L/H, if not already highlighted.

L/H	L/S	L/G	H/G	H/S	S/G
F1	F2	F3	F4	F5	F6

- (6) The test is considered satisfactory if reading is equal to or greater than the minimum specified in Table 2.

Table 2 PROBE INSULATION

TEST	INS TEST POINTS	INSULATION MΩ
1	L/H = (LO-Z / HI-Z)	100
2	L/S = (LO-Z / SH)	5
3	L/G = (LO-Z / GND)	5
4	H/G = (HI-Z / GND)	5
5	H/S = (HI-Z / SH)	5
6	S/G = (SH / GND)	1

- (7) Record the test data on the worksheet at 7.D.7.
 (8) Repeat the process by pressing F2 for Test 2, then F3 for Test 3 and so forth.
 (9) Record test data for each test on the worksheet at 7.D.9.
 (10) Repeat the process for position TU1 of the SELECT switch repeating all 6 tests of Table 2 and record all test data at 7.D.10.
 (11) Repeat the process for position TU2 of the SELECT switch repeating all 6 tests of Table 2 and record all test data at 7.D.11.
 (12) Repeat the process for position TU3 of the SELECT switch repeating all 6 tests of Table 2 and record all test data at 7.D.12.
 (13) Repeat the process for position TU4 of the SELECT switch repeating all 6 tests of Table 2 and record all test data at 7.D.13.
 (14) Repeat the process for position TU5 of the SELECT switch repeating all 6 tests of Table 2 and record all test data at 7.D.14.
 (15) Repeat the process for position TU6 of the SELECT switch repeating all 6 tests of Table 2 and record all test data at 7.D.15.
 (16) Replace any probe found to have an Insulation problem.
 (17) Disconnect Adapter from aircraft wiring.
 (18) Disconnect Adapter from Test Set.
 (19) Reconnect J3 and J4.

8. PROBE CAPACITANCE MEASUREMENT

NOTE: Perform this procedure if any discrepancy was found with the Tank Capacitance in Section 5.

A. Aircraft Preparation

- (1) Insure circuit breaker is open.
 (2) Break connection between Aircraft Wiring and Tank Wall connector (J3 and J4).

- B. Test Set Preparation
 (1) Press BACK to return to MAIN MENU.

- C. Connecting Test Set
 (1) Same as section 7.C.

- D. Test
 (1) Press F4 to select CAPacitance Measure.

AUTO	MON	INS	CAP	SIM	CAL
F1	F2	F3	F4	F5	F6

- (2) Insure RANGE is set for 4000pF range.
 (3) Press F1 to measure TANK capacitance, if not already highlighted.

TANK	COMP	DTF		ZERO	ST
F1	F2	F3	F4	F5	F6

- (4) Set Adapter Cable SELECT switch to COMP position.
 (5) Capacitance shall measure 39.0 ± 2.0 pF as per Test 1 of Table 3.
 (6) Record the test data on the worksheet at 8.D.6.
 (7) Repeat the process for each position of the SELECT switch as per Table 3 and record all test data at 8.D.7.

Table 3 PROBE CAPACITANCE

TEST	PROBE	CAPACITANCE pF
1	Compensator	39.0 ± 2.0
2	TU1	78.5 ± 2.0
3	TU2	65.0 ± 2.0
4	TU3	55.0 ± 2.0
5	TU4	45.0 ± 2.0
6	TU5	35.0 ± 2.0
7	TU6	25.0 ± 2.0

- (8) Replace any probe found to have a Capacitance problem.
 (9) Disconnect Adapter from aircraft wiring.
 (10) Disconnect Adapter from Test Set.
 (11) Reconnect J3 and J4.

9. SYSTEM VERIFICATION

- A. System Preparation
 (1) Already done.
- B. Test Set Preparation
 (1) Press BACK to return to MAIN MENU.
 (2) Press F5 to select SIMulator Measure function.

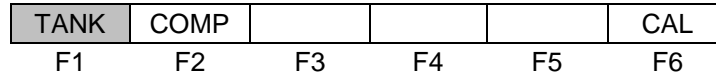
AUTO	MON	INS	CAP	SIM	CAL
F1	F2	F3	F4	F5	F6

- (3) Press F2 to establish COMP simulator capacitance.

TANK	COMP				CAL
F1	F2	F3	F4	F5	F6

- (4) Using the numeric Keypad enter 42.0 pF.

- (5) Press ENTER key and wait for the value to be set and displayed with the larger font.
- (6) Press F1 to establish TANK simulator capacitance.



- (7) Insure RANGE is set for 4000pF range.
- (8) Using the numeric Keypad enter 56.6pF.
- (9) Press ENTER key and wait for the value to be set and displayed with the larger font.

C. Connecting Test Set

- (1) Connect Adapter Cable P/N 611-00050 as per Figure 4 and the following steps.

CAUTION: Never make or break connections with the CB closed.

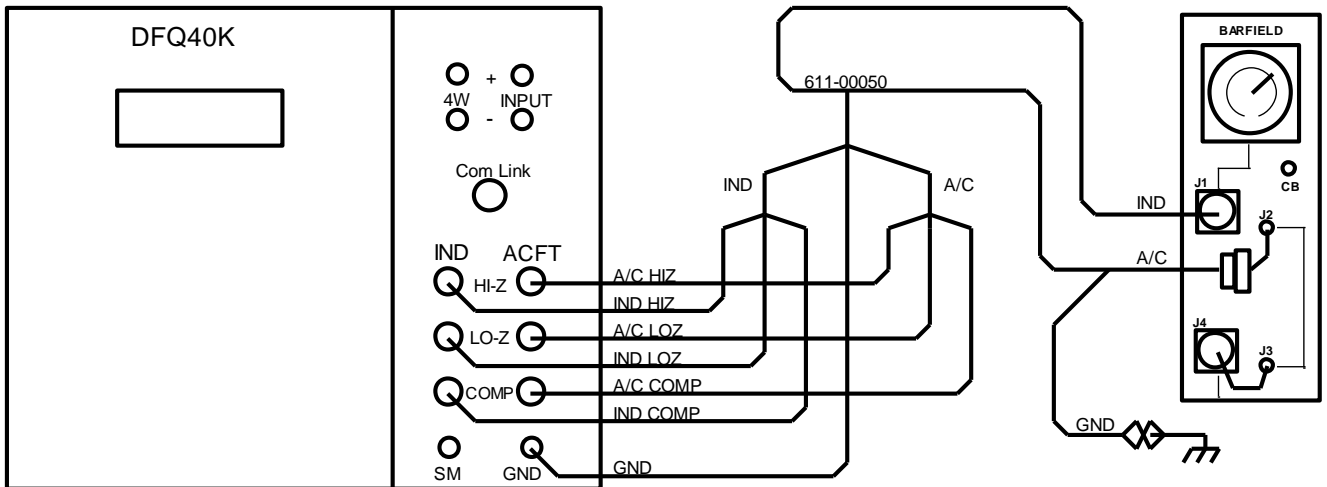
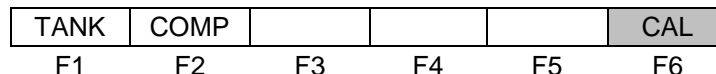


Figure 4 VERIFICATION CONFIGURATION

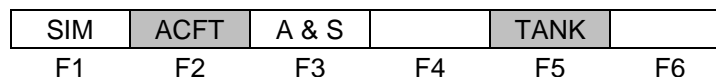
- (2) Connect Adapter IND connector to Indicator J1.
- (3) Connect Adapter A/C connector to aircraft wiring plug J2.
- (4) Connect Adapter IND HI-Z plug to Test Set IND HI-Z receptacle.
- (5) Connect Adapter IND LO-Z plug to Test Set IND TANK receptacle.
- (6) Connect Adapter IND COMP plug to Test Set IND COMP receptacle.
- (7) Connect Adapter A/C HI-Z plug to Test Set ACFT HI-Z receptacle.
- (8) Connect Adapter A/C LO-Z plug to Test Set ACFT TANK receptacle.
- (9) Connect Adapter A/C COMP plug to Test Set ACFT COMP receptacle.
- (10) Connect Adapter Ground plug to Test Set GND jack.
- (11) Connect Adapter Ground alligator clip to aircraft ground.

D. Test

- (1) Press F6 to select CAL function.



- (2) Press F2 to select ACFT.



- (3) Close applicable circuit breakers.

- (4) Cockpit indicator shall indicate 0 ± 250 LBS.
- (5) Record indicator reading on the worksheet at 9.D.5.
- (6) Press F3 to select A & S.

SIM	ACFT	A & S		TANK	COMP
F1	F2	F3	F4	F5	F6

- (7) Cockpit indicator shall indicate $5,000 \pm 500$ LBS.
- (8) Record indicator reading on the worksheet at 9.D.8.
- (9) Press F2 to reselect ACFT.
- (10) **Stop the Timer!**