TO 1-1-3

TECHNICAL MANUAL INSPECTION AND REPAIR OF AIRCRAFT INTEGRAL TANKS AND FUEL CELLS

(Extraits)

4.4 FUEL CELL LEAK EVALUATION.

Unless otherwise indicated by the applicable weapons system Technical Order (TO), fuel leaks from fuel cell cavities are not acceptable. Aircraft shall be grounded until the leak source is determined and permanently repaired. Fuel cells shall be repaired or replaced in accordance with Chapter 9.

4.5 LOCATING AND EVALUATING FUEL LEAK.

4.5.1 General.

Taking the time necessary to precisely evaluate and locate an exact fuel leak exit point prior to defueling the aircraft for repair can save valuable resources. Each fuel leak shall be thoroughly evaluated prior to classification. Carefully inspect the area around the suspect leak to ensure its not traveling from another location.

4.5.2 Approved Methods to Locate a Leak Exit Point.

The approved methods to locate fuel leak exit points are helium leak detection, leak detection powder (red talcum powder), torn paper and several variations of pressure/vacuum tests. The leak detection powder and torn paper methods have proven to be the quickest and most cost effective for detecting leak exit points. The procedures for these two methods are addressed in this chapter. The more technically involved helium leak detection, and pressure and vacuum leak detection methods are normally used to identify elusive external leak exit points and to isolate internal leak sources prior to application of a permanent repair. Those procedures are discussed further in Chapter 6. 4.5.2.1 Leak Detection Pow

4.5.2.1 Leak Detection Powder Method.

The leak detection powder method may be used to locate a fuel leak exit point. The powder will turn from light pink to dark red when it is contacted by fuel. It should be used after a leak has been detected, but before the tank has been defueled. TO 1-1-3

4-1 4.5.2.1.1 Required Materials.

Clean and static-free absorbent wiping cloths, non-waxed or grease pencil, leak detection powder and a thick bristle brush.

4.5.2.1.2 Procedures.

a. Strip exterior sealants from seams in suspected leak area.

b. Blow out the area using a maximum of 30 Pound-force per Square Inch (PSI) compressed air. Take special care to avoid blowing the fuel into surrounding seams as this may result in a false indication. Wipe off area, changing cloths as often as necessary, to ensure it is completely dry.

c. Immediately, and lightly, dust the area with leak detection powder. If necessary, spread the powder into seams using a bristle brush.

d. Carefully observe the powder to identify the exact leak exit point. Mark the exit point(s) with a non-waxed or grease pencil and continue with leak classification.

e. Allow 6 minutes for the fuel leak to develop. The size of the wetted area around the leak exit point will determine its classification.

f. Classify the fuel leak in accordance with Paragraph 4.6.

g. Completely wipe off the leak detection powder taking care not to remove the leak exit point mark.

4.5.2.2 Torn Paper Method.

The torn paper method is similar to the leak detection powder method. It should be used after a leak has been detected, but before the tank has been defueled.

4.5.2.2.1 Required Materials.

Clean and static-free absorbent wiping cloths, non-waxed or grease pencil, and a piece of writing/printer paper.

4.5.2.2.2 Procedures.

a. Strip exterior sealants from seams in suspected leak area.

b. Blow out the leak area using a maximum of 30 PSI compressed air. Take special care to avoid blowing the fuel into surrounding seams as this may result in a false indication. Wipe off area, changing cloths as often as necessary, to ensure it is completely dry.

c. Tear the paper to obtain a fuzzy edge.

d. Slowly move the fuzzy edge of the paper along the suspected leak area. The paper will readily absorb the fuel and provide a visual indication of the presence of a leak.

e. Carefully observe the area to identify the exact leak exit point. Mark the exit point(s) with a non-waxed or grease pencil and continue with leak classification.

f. Allow 6 minutes for the fuel leak to develop. The size of the wetted area around the leak exit point will determine its classification.

g. Classify the fuel leak in accordance with Paragraph 4.6.

4.5.2.3 Leak Detection Helium Method.

4.5.2.3.1 Integral Fuel Tank Pressurization Leak Test with Helium.

Helium is a small noble gas, which is able to easily pass through extremely small leak paths. Helium is detectable using a very sensitive device, which will allow precise leak exit point determination.

4.5.2.3.1.1 Required Materials.

HWK Helitest Wing Kit TPS/TPS2 Tank Pressurization System/Tank Pressurization System 2 Helium Bottle with Pressure Reducer Set of aircraft specific tooling/plugs to be used with the TPS/TPS2

4.5.2.3.1.2 Procedures.

a. Ensure tank with leak has been defueled.

b. Pressurize tank in accordance with Tank Pressurization System (TPS)/TPS2 TO 33D2-3-56-21.

c. Perform leak detection in accordance with Helitest Wing Kit (HWK) TO 33D2-3-56-11.

9.6.5 Chemical Test.

9.6.5.1 Required Materials.

Non-waxed pencil, cover plates, air source, manometer, ammonium hydroxide, alcohol, authorized cleaning solvent, absorbent cloth or sponge, white cloth (cheese cloth or sheet), 100 cubic centimeters (cc) and 200 cc measures, two-quart measure, 15-gram measure, water and phenolphthalein crystals.

NOTE Manometer used to measure the cell test pressure during test may be either digital (intrinsically safe/Canadian Standard Association (CSA) for approved use in Class 1, Division 1, Groups A, B, C, D environments) or water type with a readout/calibrated accuracy of no less than ±0.5 inches of Water (H_2O) of reading.

9.6.5.2 Procedures.

a. If required, support the fuel cell in a suitable fixture or jig.

b. Ensure fuel cell has been cleaned in accordance with Paragraph 9.5.2 prior to testing.

c. Air purge the fuel cell until excessive fuel or oily residue has evaporated.

d. Install locally-fabricated plate with two air fittings. One fitting is used for applying air pressure; the other is for the water manometer.

e. Install cover plates on all remaining fittings except for one large enough to insert absorbent cloth or sponge. If applicable, torque mounting hardware in accordance with the weapons system TO or TO 1-1A-8.

f. Place absorbent cloth or sponge in remaining open fitting.

g. Pour ammonium hydroxide on absorbent cloth or sponge (100 cc for fuel cells less than 1000 gallons, 200 cc for all other capacity cells).

h. Install cover plate on last open fitting. If applicable, torque mounting hardware in accordance with the weapons system TO or TO 1-1A-8.

WARNING

Failure to ensure proper manometer fluid levels and applicable caps are removed prior to starting a positive or negative pressure test may cause serious damage to the aircraft or personnel injury/death. Ensure that no portions of the manometer are blocked by any FOD nor deposits. See Chapter 8 for a blockage test. The water manometer shall be inspected prior to starting a positive or negative pressure test to ensure it is serviced to the correct fluid level.

i. Connect air source and manometer to the locally-fabricated plate. Inflate cell to applicable pressure in accordance with Table 9-1. Maintain appropriate air pressure in the fuel cell for 1 to 2 hours before testing.

j. Prepare leak detection solution.

Mix 15 grams phenolphthalein crystals into two quarts of water and then add two quarts of alcohol.

k. Soak a large clean white cloth in the solution and wring out the excess. Verify cloth turns red when contacted by ammonium hydroxide.

l. Verify cover plates are not providing false indication of a leak by temporarily placing cloth around each plate.

m. Spread the cloth over an area of the fuel cell and smooth it out. Leave it in place long enough to verify no red spots appear. The appearance of a red spot indicates a possible leak.

n. If a leak is indicated, clean the cloth by re-soaking it in the solution and then place it over the suspect area again to verify the leak.

o. Mark leaks with a non-waxed pencil.

p. Move cloth and repeat Step l through Step n until the entire surface of the fuel cell has been tested

9.6.6 Soap Suds Test.

9.6.6.1 Required Materials.

Non-waxed pencil, cover plates, air source, manometer, water and general purpose liquid detergent.

WARNING

Failure to ensure proper manometer fluid levels and applicable caps are removed prior to starting a positive or negative pressure test may cause serious damage to the aircraft or personnel injury/death. Ensure that no portions of the manometer are blocked by any FOD nor deposits. See Chapter 8 for a blockage test. The water manometer shall be inspected prior to starting a positive or negative pressure test to ensure it is serviced to the correct fluid level.

NOTE Manometer used to measure the cell test pressure during test may be either digital (intrinsically safe/CSA for approved use in Class 1, Division 1, Groups A, B, C, D environments) or water type with a readout/calibrated accuracy of no less than ±0.5 inches of H2O of reading.

9.6.6.2 Procedures.

a. Ensure fuel cell has been cleaned in accordance with Paragraph 9.5.2 prior to testing.

b. Install locally-fabricated plate with two air fittings. One fitting is used for applying air pressure; the other is for the water manometer.

c. Install cover plates on all remaining fittings. If applicable, torque mounting hardware in accordance with the weapons system TO or TO 1-1A-8.

d. Connect air source and manometer to the locally-fabricated plate. Inflate cell to applicable pressure in accordance with Table 9-1. Maintain appropriate air pressure in the fuel cell for 1 to 2 hours before testing.

e. Mix one cup of general purpose liquid detergent and one gallon of water.

f. Apply solution to entire fuel cell, specific repair area or suspect leak, as required. Check for bubbles.

g. Verify repair or mark leaks with a non-waxed pencil.

h. Deflate fuel cell and remove cover plates. Rinse soap residue from cell using clean water.