BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 13.08

PRODUCTION PROCESS STANDARD

Air Leak Testing DASH 8 Fuselage Structures

Issue 8
- This standard supersedes PPS 13.08, Issue 7.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to PPS.Group@aero.bombardier.com or (416) 375-4365.
- This PPS is effective as of the distribution date.

Prepared By:	(Michael Wright)	April 23, 2014
	Production Process Standards (PPS)	
Approved By:	(L.K. John)	April 24, 2014
	Materials Technology	
	(Adam Gordon)	April 25, 2014
	Quality	

Table of Contents

Sections **Page**

Figures

Flow Charts

1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for air leak testing of DASH 8 Series 100, 200 & 300 aircraft and sealant repair of leaks in pressurized DASH 8 Series 100, 200, 300 & 400 aircraft fuselage structures. For air leak testing of DASH 8 Series 400 aircraft, refer to the applicable Functional Test Procedure (FTP).

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS must be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. **do not** supersede the procedure or requirements specified in this PPS.

2 Hazardous Materials

2.1 Before receipt at Bombardier Toronto (de Havilland), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto (de Havilland) Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact the Bombardier Toronto (de Havilland) Environment, Health and Safety Department.

3 References

3.1 PPS 10.32 - Application of Devcon Putty.

3.2 PPS 13.26 - General Subcontractor Provisions.

3.3 PPS 21.20 - Mixing and Handling of Two-part Sealants.

3.4 PPS 21.21 - General Sealing Practices.

3.5 PPS 21.22 - Installation of Atite Seals.

3.6 PPS 31.17 - Solvent Usage.

4 Materials and Equipment

4.1 Materials

4.1.1 Sealant, PR 1435 Polysulphide, Quick-Setting, two part.

4.1.2 Leak detector solution (e.g., MIL-L-25567, Sigma-Aldrich Leak-Tec, Turco Leak Detector, etc.). When using Turco leak detector solution mix 5 oz. with water to make up 1 imp. gallon of solution. Use Leak-Tec leak detector solution as received (i.e., do not thin with water).

4.2 Equipment

4.2.1 Air compressor test cart (e.g., SD7553).

4.2.2 Sealant spatulas (e.g., SD9164).

4.2.3 Plastic sealant scrapers (e.g., SD9265).

4.2.4 82120003-001-141 duct plug assembly.

4.2.5 82120017-001-141 duct plug assembly.

4.2.6 85310021-002-141 dummy access panel.

4.2.7 Sprayers, compressed air (e.g., Superspray 60).

4.2.8 Pressure test rig (e.g., SD5454).

4.2.9 Hand operated air pump.

5 Procedure

5.1 General

5.1.1 Pressurization of an aircraft structure is a critical operation and it is imperative that all personnel involved in carrying out such testing are familiar with the use and handling of the pressure testing equipment and the safety precautions listed in section 7 of this standard.

5.1.2 Carry out air leak testing and repairs as specified herein to ensure that air leakage has been minimized at all seals and sealed joints included in the aircraft pressurized structure and is within functionally acceptable limits. If possible, carry out air leak testing before the installation of equipment, assembly of structures or application of coatings which could interfere with pressure testing or sealant repair (e.g., external aerodynamic sealing, additional primer or paint to interior or exterior of pressurized structure, etc.).

5.1.3 Before pressure testing, ensure pressure test rig gauge and relief valve calibration stickers are valid and have not expired. Do not use a pressure test rig if the gauge and/or relief valve calibration stickers are not valid or have expired.

5.1.4 Refer to Flow Chart 1 for the air leak test sequence.

5.1.5 Carry out preliminary pressure testing only after the following:

- All drilling, fitting and attachment of details and structural members to the fuselage skin, pressure bulkheads, centre wing lower section, and nose wheel well area.
- All pressurized structure sealing shall be complete and according to the engineering drawings.
- All cockpit windows, cabin windows, emergency escape hatches, cargo door, airstair door, emergency door and pressurized access panels shall be structurally complete and functionally installed.
- Control cables and dynamic seals installed.
- Electrical wires and cables passing through pressure structure installed including pressure seals according to PPS 21.22.

5.1.6 Apply leak detector solution only to pressurized aircraft and thoroughly rinse it off the aircraft **before** releasing the pressure.

5.1.7 One operator must be responsible for operating and monitoring the air compressor test cart **at all times** when pressure is applied to the aircraft.

5.2 Preparation of Aircraft

5.2.1 Pressure test the aircraft indoors in an area closed off to unauthorized personnel by means of a rope fence or equivalent, with warning signs placed around the aircraft at regular intervals, not exceeding 25 feet, stating "PRESSURE TEST IN PROGRESS - KEEP CLEAR".

5.2.2 Ensure that the aircraft is electrically grounded at all times during pressure testing.

5.2.3 Detach fairings which would obstruct the leak detection process before testing.

5.2.4 Install slave bilge drain valves (P/N 140N2022S1) at all drain valve locations in the lower fuselage.

5.2.5 If installed, ensure fluid line fittings and pitot static lines are not connected to instruments, they shall be capped and other openings shall be blanked or plugged as required. Do not blank or plug outflow valves, control cable dynamic seals or other openings which are normally to atmosphere in flight in any manner during pressure testing. If it is necessary to blank off any of the systems or structures listed in paragraph 5.1.2, or other openings which could present an air leak path after installation, record these items as being outstanding for AIR LEAK TESTING and do not pass off the aircraft until such items have been installed and the completed structure successfully pressure tested.

5.2.6 Remove the access cover from the R.H. fuselage side below the cockpit window (Stn. 159.70 and STR. 25) and replace with the dummy access panel (see Equipment section, paragraph 4.2.6) as shown in Figure 1.

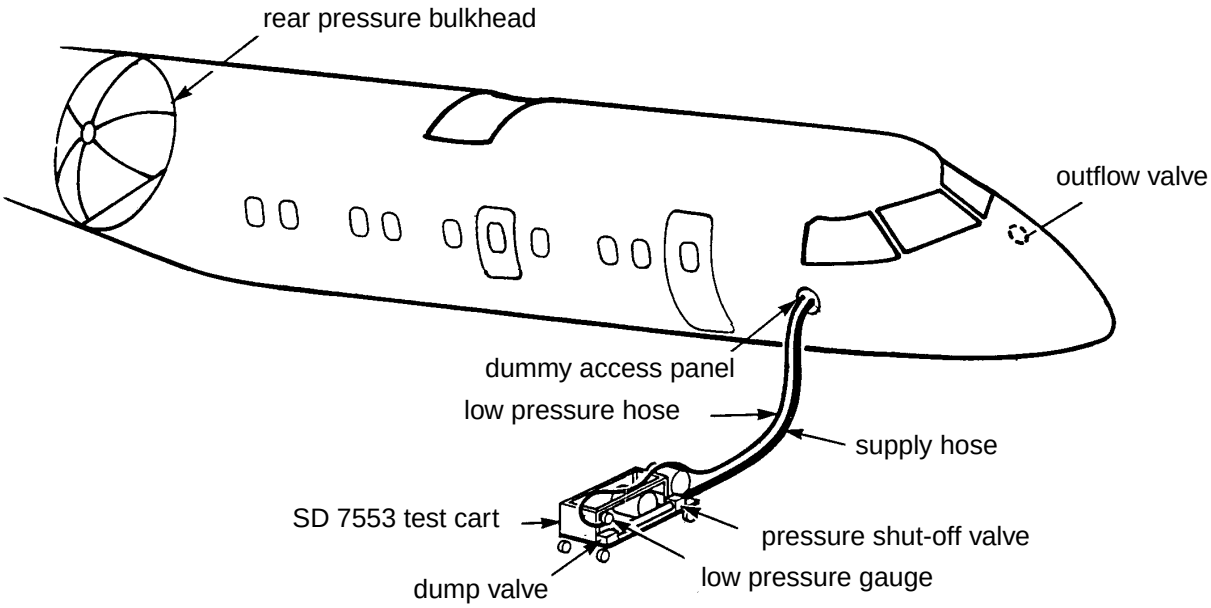

Figure 1 - Pressure Testing

5.2.7 For Dash 8 Series 100 A/C, disconnect the supply and recirculation duct connectors, aft of the rear pressure bulkhead and blank off with the duct plugs (see Equipment section, paragraph 4.2.4) as shown in Figure 2.

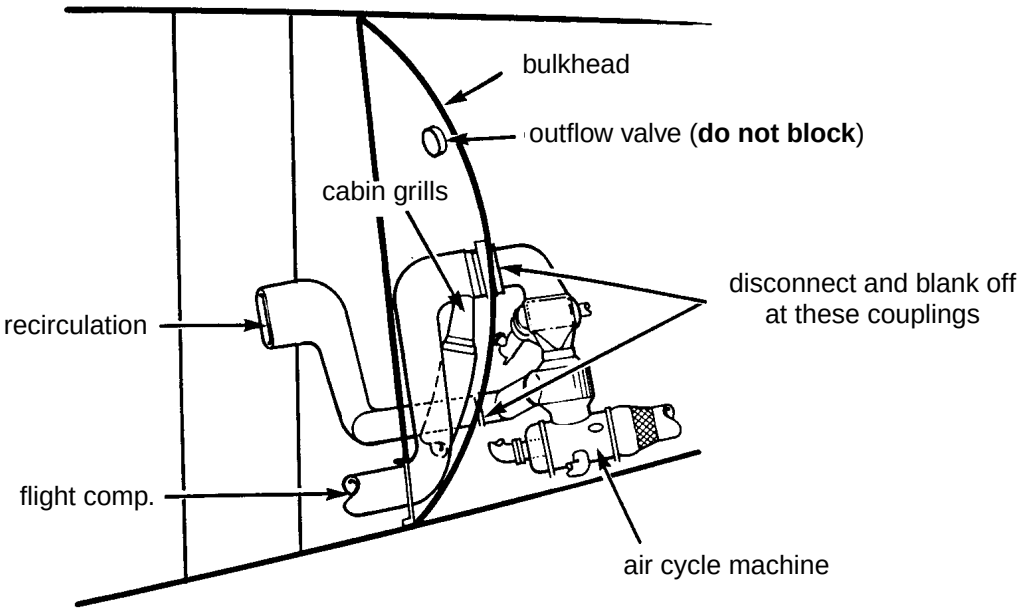

Figure 2 - Rear Pressure Bulkhead

5.2.8 For Dash 8 Series 300 A/C disconnect the supply and recirculation duct connectors, aft of the rear pressure bulkhead and blank off with the Duct Plugs (see Equipment section, paragraph 4.2.5) as shown in Figure 2.

5.2.9 Connect the air pressure hose from the pressure test cart to the air inlet fitting on the dummy access panel and connect the return line to the low pressure gauge as shown in Figure 1.

5.2.10 Check that low pressure and supply pressure lines run free and clear without kinks or other obstructions to air flow.

5.2.11 Check that the following windows, doors and escape hatches are secured and locked:

- Flight Compartment escape hatch
- Emergency exit hatches in cabin
- Airstair door
- Emergency door
- Baggage door

5.2.12 Using the pressure test rig or an air pump (see Equipment section, paragraph 4.2.9) with suitable air pressure adapters, inflate the airstair door seal to 16-18 psig. Close the air pressure adapter shut-off valves to maintain pressure during leak testing. Connect the pressure test rig to the de-icing system. If the air pump is used, inflate the seal at the door.

5.2.13 Ensure all remaining personnel exit the aircraft via the baggage compartment door which shall then be secured and locked.

5.3 Preliminary Air Leak Testing

5.3.1 Perform preliminary air leak testing as follows:

Step 1. Set the valves on the air compressor test cart as follows:

- Test cart dump valve fully open.
- Test cart pressure shut-off valve fully closed.

Step 2. Start both test cart air compressor motors and open the pressure shut-off valve.

Step 3. Slowly close the dump valve to apply pressure to the aircraft.and closely observe the test cart low pressure gauge for a pressure indication. If, after 30 seconds, no pressure rise is indicated, shut off the test cart and determine the cause of failure before resuming the test from Step 1. Pressurize the fuselage to 1 psig, close the pressure shut-off valve and shut down the test cart compressors.

Step 4. Check fuselage for unplugged openings and audible air leaks.

Step 5. Open the test cart dump valve and shut-off valve fully to depressurize the aircraft.

Step 6. Plug all openings and repair the observed leaks according to section 5.4.

Step 7. After curing of sealant according to section 5.4.6, re-set the valves on the test cart as follows:

- Test cart dump valve fully open.
- Test cart pressure shut-off valve fully closed.

Step 8. Start both test cart air compressor motors and open the pressure shut-off valve.

Step 9. Slowly close the dump valve to apply pressure to the aircraft. Closely observe the test cart low pressure gauge for a pressure indication; if, after 30 seconds, no pressure rise is indicated, shut off the test cart and determine the cause of failure before resuming the test from Step 7.

Step 10. Adjust the dump valve to stabilize the pressure at 1 psig.

Step 11. Using compressed air sprayers, apply leak detector solution to the entire pressurized surface of the aircraft, including pressure bulkheads, window surrounds, door seals, wing root and nose wheel well areas. Maintain a pressure of 1 psig during the entire length of time that leak detector solution is on the pressurized surfaces.

Step 12. Record the location of all observed leaks. Continuously monitor to maintain a pressure at 1 psig.

Step 13. Use clean tap water to thoroughly rinse off all traces of leak detector solution. Continuously monitor to maintain a pressure at 1 psig.

Step 14. Shut off the test cart compressor and open the dump valve to completely de-pressurize the aircraft. Do not attempt to open any of the aircraft doors or hatches until the internal pressure has dropped to 0 psig as indicated on the test cart gauge.

Step 15. Repair all observed leaks according to section 5.4.

5.4 Repair of Leaks

5.4.1 General

5.4.1.1 Utilize the procedure specified herein for repairing leaks on Dash 8 Series 100, 200, 300 and 400 aircraft.

5.4.2 Repair Procedures

5.4.2.1 Check leaking door seals for correct door fit, seal attachment and integrity. Check the door surround sealing face for smoothness. Fill low areas, gaps and voids in the surround with Devcon putty according to PPS 10.32.

5.4.2.2 Check leaking windows for correct installation and structural integrity, replace or repair suspect window assemblies, as necessary.

5.4.2.3 Control cable dynamic seals are not designed to be air tight and no action need be taken to correct such leaks unless an individual seal indicates a comparatively excessive leak rate.

5.4.2.4 Repair all recorded leaks in the pressure structure from the pressure side using PR1435 fast curing sealant as follows:

Step 1. Fill small gaps and voids in the structure (max. 1/16") with sealant so as to overlap onto adjacent structure by approximately 1/4" (see Figure 3). Report gaps or voids larger than 1/16" to Liaison Engineering.

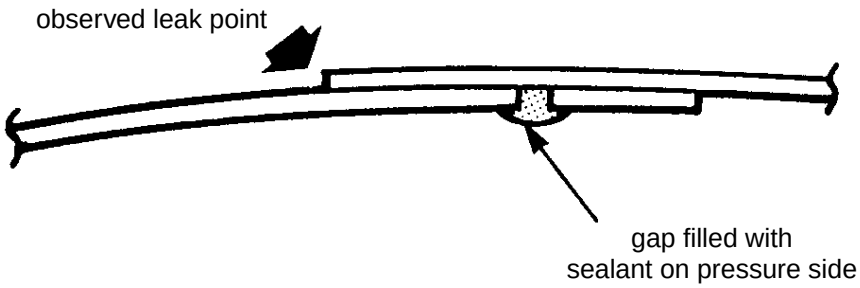

Figure 3 - Sealing Repair Procedure for Small Structural Gaps and Voids

Step 2. Fillet seal leaking skin laps or joints on the sub-structure for approximately 12" on either side of the observed leak (see Figure 4).

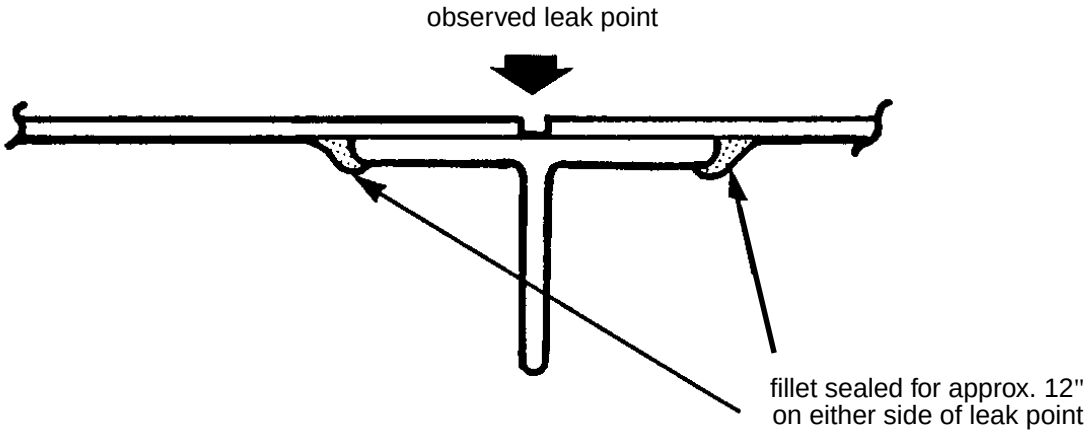

Figure 4 - Fillet Sealing Repair Procedure for Skin Laps or Joints

Step 3. Repair leaks in the areas of doublers or stiffeners by fillet sealing the entire perimeter of the attachment (see Figure 5).

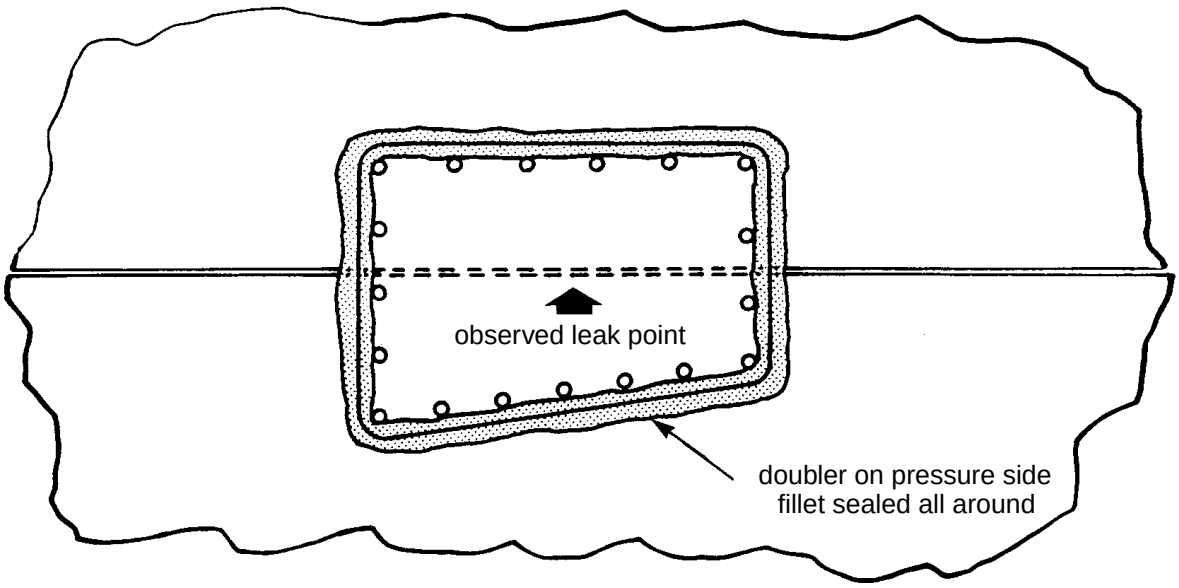

Figure 5 - Sealing Repair Procedure for Doublers

Step 4. Except for rivets, fillet or dome seal leaking fasteners as shown in Figure 6. Remove rivets exhibiting excessive leakage, check the hole size and either re-install the same size rivet or, if required, the next larger size rivet as shown in Figure 7.

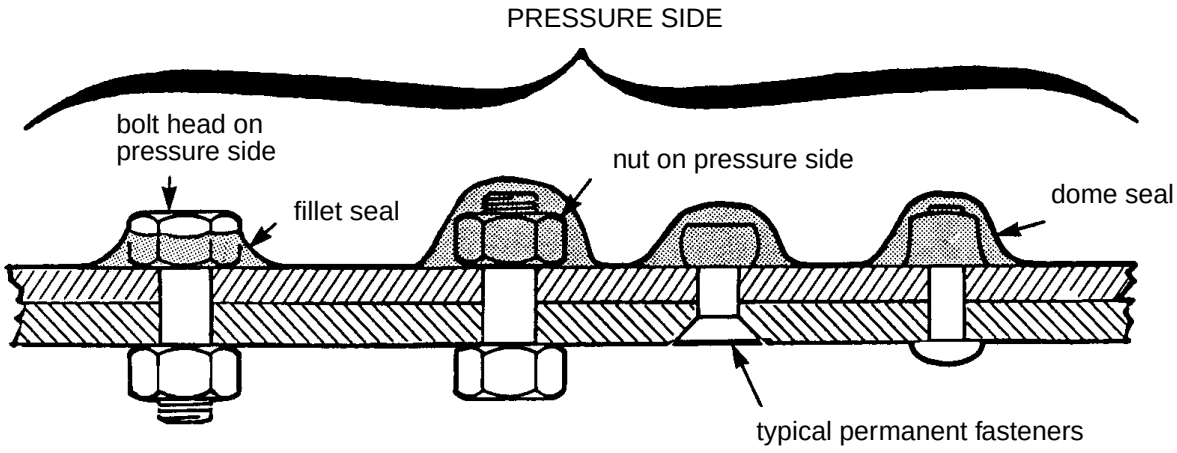

Figure 6 - Sealing Repair Procedure for Fasteners

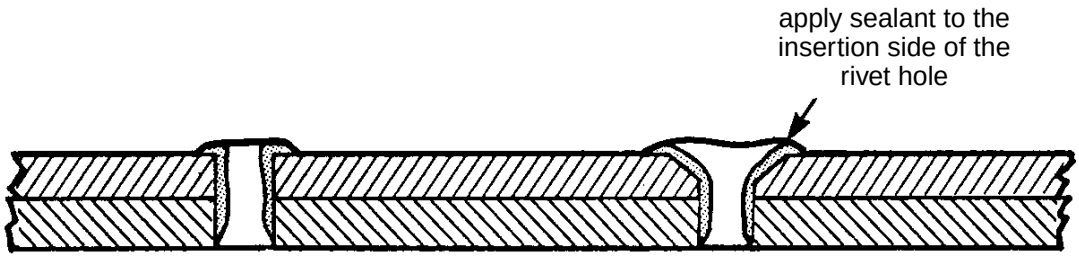

Figure 7 - Sealing Repair Procedure for Rivets

Step 5. Cut out defective areas of fillet seals using a plastic sealant scraper so as to leave the ends bevelled at approximately 45° (see Figure 8) and then apply a new fillet.

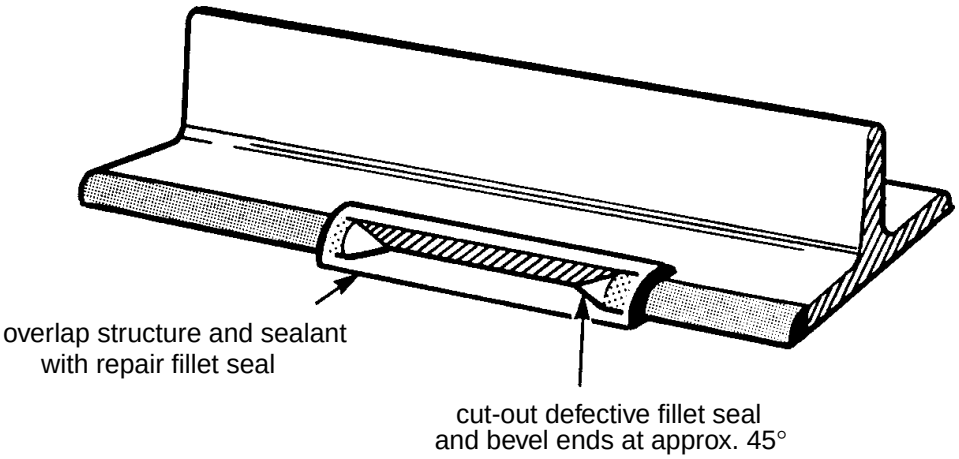

Figure 8 - Sealing Repair Procedure for Fillet Seals

5.4.3 Preparation of Parts

5.4.3.1 Clean parts and areas to which sealant repair is to be applied according to PPS 21.21.

5.4.4 Preparation of Sealant

5.4.4.1 Mix PR1435 sealant as a kit according to PPS 21.20. Hand mixing only is permitted for this sealant as mechanical agitation would shorten the working life. If it is necessary to prepare only a portion of a kit, mix the 2 parts together according to PPS 21.20 in the ratio of 7.5 parts by weight base compound to 1 part by weight catalyst.

5.4.4.2 As PR1435 has only a brief application time (15 minutes at 75°F (24°C)), it is imperative that application is pre-planned and areas to be sealed are cleaned before mixing.

5.4.5 Application of Sealant

5.4.5.1 Apply sealant directly from the mixing container to the areas to be repair sealed using a clean paint brush or a sealant spatula.

5.4.5.2 Sealant shall be applied so as to be smooth in appearance and without inclusion of air bubbles or voids.

5.4.5.3 Sealant shall overlap onto existing sealant when repairing a fillet seal (see Figure 8).

5.4.6 Curing of Sealant

5.4.6.1 Allow PR1435 sealant to cure for a minimum of 1 hour before pressure testing the aircraft. Full cure of the sealant requires approximately 24 hours at 75°F (24°C).

5.4.7 Clean-Up

5.4.7.1 Remove excess sealant from parts and tools using sealant scrapers and by solvent cleaning according to PPS 31.17 before the sealant has cured.

5.5 Acceptance Pressure Testing

5.5.1 Acceptance pressure test as follows:

Step 1. Prepare the aircraft for pressure testing according to section 5.2.

Step 2. Set the valves on the air compressor test cart as follows:

- Test cart dump valve fully open.
- Test cart pressure shut-off valve fully closed.

Step 3. Start both test cart air compressor motors and open the pressure shut-off valve.

Step 4. Slowly close the dump valve to apply pressure to the aircraft.and closely observe the test cart low pressure gauge for a pressure indication. If, after 30 seconds, no pressure rise is indicated, immediately shut off the test cart and determine the cause of failure before resuming the test from Step 1.

Step 5. Pressurize the aircraft to 1 psig and adjust the dump valve to stabilize the pressure at 1 psig.

Step 6. Allow approximately 1 minute for the aircraft pressure to stabilize, then close the pressure shut-off valve and shut off the air compressor.

Step 7. Using a timer, stopwatch or other suitable device, observe and record the decay time (in seconds) for the pressure to fall from 0.9 psig to 0.7 psig.

If the decay time is less than 40 seconds or if the leaks are audible or concentrated in one area, repeat preliminary leak testing according to section 5.3, repair of leaks according to section 5.4 and acceptance pressure testing according to section 5.5. Continue to repeat preliminary leak testing, repair of leaks and acceptance pressure testing until the decay time is 40 seconds or greater and leaks are not audible or concentrated in one area.

Consider the aircraft satisfactory for air leakage rate only if the decay time is 40 seconds or greater and any leaks are not audible or concentrated in one area.

5.6 Post Test Procedure

5.6.1 On completion of successful acceptance pressure testing:

- remove all blanking plates, caps or plugs fitted to facilitate pressure testing.
- remove the slave bilge drain valves from the lower fuselage and store in the box provided on the test rig.
- remove the dummy access panel from the right hand side of the fuselage.
- remove the duct plugs from the rear pressure bulkhead.

6 Requirements

6.1 Ensure all observed leaks have been recorded and repaired or reported to Liaison Engineering as specified herein.

7 Safety Precautions

7.1 Observe general shop safety precautions when performing the procedure specified herein.

7.2 Secure and lock all windows, doors and hatches on the aircraft before pressurizing.

7.3 Ensure that pressure inlet and return lines run free and clear without kinks or other obstructions.

7.4 Ensure that only personnel directly involved in the pressure testing are allowed near the aircraft during such testing.

7.5 The air compressor test cart and manometer must be carefully monitored by a designated operator at all times during pressure testing.

7.6 The pressure test cart is fitted with a pressure gauge and pressure relief valve on the manifold. Ensure that the manifold pressure relief valve is set and locked to blow-off at 5 ± 1 psig.

7.7 An aircraft under pressure test must be fully de-pressurized by venting the pressure line to atmosphere before attempting to open any windows, doors or hatches.

8 Personnel Requirements

8.1 Personnel must have a good working knowledge of the applicable procedure and requirements as specified herein and must have exhibited their competency to their supervisor.

9 Maintenance of Equipment

9.1 Check the pressure test rig every 4 months for accuracy of the pressure gauge and the setting of the manifold pressure relief valve as specified in paragraph 7.6.

Flow Chart 1 - AIr Leak Testing