

Section 51-10

Investigation

1. General

This Section tells you how to assess the class of the damage. It also tells you how to inspect glass fiber reinforced plastic (GFRP) and carbon fiber reinforced plastic (CFRP) composite structures. Damage assessment and repairs must be carried out by approved persons.

Refer to Section 51-00 for the types of structure used in the DA 40 and for repair limitations. Refer to Section 51-20 for general repair procedures.

2. Damage Classification

Damage is divided into the classes described below. In doubtful cases (i.e., if you are not sure about the classification of a damage), you must contact the airplane manufacturer.

A. Class 1

- Major structural damage that requires the partial replacing of a structural component, or
- Damage to a large area, or
- Damage to a highly stressed component or part.

This type of damage restricts or voids airworthiness.

B. Class 2

Holes and cracks passing through both skins of a sandwich construction component. The core damage must be able to be covered by a 75 mm (3 inches) diameter circle.

This type of damage restricts or voids airworthiness.

C. Class 3

Small holes or cracks in the outer skin where there is no internal damage to the component, the sandwich material, or the inner skin.

This type of damage restricts or voids airworthiness.

D. Class 4

Minor scratches, abrasions or similar damage which is not a crack or a puncture in the skin.

This type of damage may restrict airworthiness.

3. Types of Damage

There are two basic types of hidden failure in composite structures:

- Disbonding.
- Delamination.

Disbonding is the failure of a bond between two components. For example between the fuselage skin and a fuselage frame. Or between a composite component and a metal component. Or between a composite skin and a sandwich core material.

Delamination is the failure of the bond between layers of glass/carbon cloth in a component.

There are also two main types of cracks:

- Micro cracks which occur in the surface of the resin.
- Major cracks with broken fibers. Major cracks do not occur with normal flight loads or normal landing loads. You must repair major cracks.

4. Inspection Techniques

A. Examine Visually

Use this method to find all types of damage to composites. Use a bright light to examine visually the inside of a component. GFRP must be green or brown. If the GFRP has white areas, then it may be damaged. Look specially at areas where components bond to the GFRP.

CFRP must be black or black/brown. If the CFRP has white areas, then it may be damaged. Look specially at areas where components bond to the CFRP.

Look carefully at the outer surface of a component. If the paint has cracks or bubbles, then the composite may be damaged. Refer to Paragraph 5.

Also look for dents. Look specially in areas where stones can hit the airplane below the fuselage and the wings. Look specially in the areas of the walkways.

B. Light Test

Use the light test to find delamination. Use this test on components which do not have rigid foam inside.

CAUTION: DO NOT LET THE COMPOSITE GET HOT. HEAT CAN CAUSE DAMAGE TO THE COMPOSITE.

Point a very bright light at the surface and look at the other side of the surface. Damage shows as a dark area. You can point the light from the inside of a component or from the outside of a component.

Note: You can use the light test on thick GFRP but it is difficult to use on CFRP.

C. Coin Tap Test

Use the coin tap test to find delamination and disbonding. Tap a coin on the laminate surface in the area you will test. The sound of the coin tapping on the surface of the laminate will change as you move the coin over damaged laminate.

Look specially at the area around the damage for secondary damage, which can remain undetected.

5. Further Inspection

If you find paint damage when you examine a composite structure then do this further inspection.

Find a way to see the inside of a structure or a component. If necessary, remove panels (or other components), or you can use remote viewing equipment. For example, remove the wing tip assembly to see inside the wing. If you can see damage inside the component or structure you must do a repair.

Remove the paint coat in the area that you think is damaged. Remove the paint coat carefully, you must not damage the cloth under the paint coat.

Look carefully at the surface. If you find cracks in the composite you must repair the structure.

If you do not find cracks in the composite then do this test. Push the middle of the area to be tested with your thumb. If you can feel the skin hitting the core of a sandwich (or other layer/component), then the skin is disbonded and you must repair the structure.

In some cases you must cut inspection holes in the structure to do the test correctly. If you must cut inspection holes you must seek advice from Diamond Aircraft Industries.

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