



Australian Government
Civil Aviation Safety Authority

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Inspection of aircraft after abnormal flight loads, heavy landing or lightning strike

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This Civil Aviation Advisory Publication (CAAP) provides guidance, interpretation and explanation on complying with the Civil Aviation Regulations 1988 (CAR) or a Civil Aviation Order (CAO).

This CAAP provides advisory information to the aviation industry in support of a particular CAR or CAO. Ordinarily, the CAAP will provide additional 'how to' information not found in the source CAR, or elsewhere.

Civil Aviation Advisory Publications should always be read in conjunction with the relevant regulations/orders.

Purpose

This CAAP provides guidance material to any person developing a system of maintenance for an aircraft in accordance with regulation 42L.

For further information

For further information on this CAAP, contact CASA's Airworthiness and Engineering Branch (telephone 131 757).

Status

This version of the CAAP is approved by the Branch Manager, Airworthiness and Engineering.

Note: Changes made in the current version are not annotated. The document should be read in full.

Version	Date	Details
v1.1	October 2022	Administration review only.
(0)	May 2000	Initial CAAP.

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1 Reference material

1.1 References

Legislation

Legislation is available on the Federal Register of Legislation website <https://www.legislation.gov.au/>

Document	Title
Regulation 42L of CAR 1988	Systems of maintenance: matters to be included

2 Introduction

- 2.1.1 Aircraft are designed to withstand flight and landing loads within specified limits. If design limits are exceeded the structural integrity of the aircraft structure may be jeopardised and safety could be impaired. Any report or evidence on the aircraft which suggests that the design limits have been exceeded or equipment damaged should, therefore, be followed by a careful inspection appropriate to the nature of the occurrence and in accordance with the aircraft manufacturer's approved data.
- 2.1.2 The following advice is provided as guidance for special inspection requirements to certificate of registration holders, pilots and individuals involved in the maintenance of aircraft. It is not possible to provide precise details of inspections to be adopted after every type of incident due to the varying nature of the stress that may occur.
- 2.1.3 Where the aircraft manufacturer provides for special inspection requirements, those inspections must take priority over the guidance material in this article. Should the manufacturer's inspection requirements be found to be deficient the following samples are provided to supplement the manufacturer's recommendations.

3 Examination of aircraft

- 3.1.1 The inspection process must be to such a scope as to ensure that all defects, including sub-surface defects, are detected. By virtue of their design, aircraft differ in the manner in which an abnormal load may manifest itself. Wrinkling or distortion of fuselage or wing skins may well be an indication that structure deformation or failure has occurred and a full investigation should be carried out.
- 3.1.2 Should the inspection process reveal that the aircraft has suffered major damage, the Maintenance Release must be endorsed pursuant to regulation 50 of CAR 1988. If the damage is considered to be major damage and there is a likelihood the aircraft will be flown the Maintenance Release must be endorsed that the aircraft is unairworthy and the Maintenance Release ceases to be in force pursuant to regulation 47 of CAR 1988.

4 Heavy or overweight ground load and abnormal flight load inspection

- 4.1.1 If an aircraft has been flown through conditions of severe turbulence, or has been subjected to flight manoeuvres in excess of the manufacturer's recommended limits or has suffered a heavy or over weight landing, the aircraft must be assessed for damage.
- 4.1.2 The following inspections and actions are recommended prior to further flight.

4.2 Fuselage

- skins, bulkheads and fairings for distortion, cracks, wrinkles and loose or missing rivets or fasteners;
- composite fibre fairings for distortion, cracks, debonding and loose or missing rivets or fasteners;
- loose or missing access panels;
- landing gear support structure for distortion, cracks and loose or missing rivets or fasteners;
- emergency exit doors for ease of operation/removal;
- entry doors for correct fit, latching and operation; and
- evidence of hydraulic fluid or fuel leaks.

4.3 Fuselage interior

- loose or missing access panels;
- passenger and crew seats, seat belts and harness attach points for damage, distortion and security;
- cargo compartment tie-down fitting attach points for cracks and security;
- cargo tie-down nets and straps for obvious damage;
- instruments and instrument panels for damage and security;
- gyroscopic instruments for erection time, precession and unusual noises;
- support structure for heavy components such as galley modules, batteries, water tanks, fire extinguishers and auxiliary power units for distortion, cracks and loose or missing rivets or fasteners;
- evidence of hydraulic fluid or fuel leaks; and
- evidence of battery fluid leakage.

4.4 Wings

- upper and lower wing skins and fillet fairings for distortion, cracks, wrinkling and loose or missing rivets or fasteners;
- composite fibre fairings for distortion, cracks, debonding and loose or missing rivets or fasteners;
- loose or missing access panels;

- landing gear support structure, including uplock mechanism support (for abnormal flight load inspection) for distortion, cracks and loose or missing rivets or fasteners;
- engine mount support structure for distortion, cracks and loose or missing rivets or fasteners;
- wing/fuselage attachment support structure for distortion, cracks and loose or missing rivets or fasteners;
- internal wing structure, with access panels removed, for distortion, cracks and loose or missing rivets or fasteners;
- wing flight control, lift augmentation and spoiling device attachment support structure for distortion, cracks and loose or missing rivets or fasteners;
- lift support struts for distortion, cracks and bowing;
- lift support strut attachment support structure for distortion, cracks and loose or missing rivets or fasteners;
- float attachment support structure for distortion, cracks and loose or missing rivets or fasteners
- interplane bracing wires for correct tension, lugs for cracks and elongated holes;
- interplane bracing wire attachment support structure for distortion, cracks and loose or missing rivets or fasteners;
- wing centre section structure for distortion, cracks and loose or missing rivets or fasteners; and
- evidence of hydraulic fluid and fuel leaks.

4.5 Vertical stabiliser

- vertical stabiliser left and right skins and fairings for distortion, cracks wrinkling and loose or missing rivets or fasteners;
- composite fibre fairings for distortion, cracks debonding and loose or missing rivets or fasteners;
- vertical stabiliser attach fittings for distortion, cracks and loose or missing rivets or fasteners;
- loose or missing access panels;
- rudder hinge support structure for distortion, cracks and loose or missing rivets or fasteners;
- stabiliser internal structure, with access panels removed, for distortion, cracks and loose or missing rivets or fasteners; and
- evidence of hydraulic fluid leaks.

4.6 Horizontal stabiliser

- horizontal stabiliser upper and lower skins and fairings for distortion, wrinkling, cracks and loose or missing rivets or fasteners;
- composite fibre fairings for distortion, cracks, debonding and loose or missing rivets or fasteners;
- horizontal stabiliser attach fittings for distortion, cracks and loose or missing rivets or fasteners;

- loose or missing access panels;
- elevator hinge support structure for distortion, cracks and loose or missing rivets or fasteners;
- stabiliser internal structure, with access panels removed, for distortion, cracks, loose or missing rivets or fasteners; and
- evidence of hydraulic fluid leaks.

4.7 Landing gears (heavy or overweight ground load inspection only)

- landing gear and landing gear attach fittings for distortion, cracks or movement;
- retract struts, brace struts, torque links and all other undercarriage components for distortion, cracks, loose or missing fasteners and hinge pins;
- axles and axle attach fittings for distortion or cracks;
- landing gear up lock and down lock mechanism for distortion or cracks;
- landing gear doors, door latch and actuating mechanism for distortion, cracks and loose or missing rivets or fasteners;
- check oleos for abnormal extension, scoring and leakage;
- cracked wheel hubs, loose or missing bolts;
- tyres for distortion, bulging, flat spots, creeping, cuts and loss of pressure and wheel hub balance weights;
- evidence of hydraulic fluid leaks from actuators; and
- a retraction check.

4.8 Control systems

- control surface skins, closure ribs and spars for distortion, cracks, debonding and loose or missing rivets;
- control surface hinges for distortion or cracks;
- trim tab/s for distorted skins, closure ribs or spars, cracks, debonding and loose or missing rivets;
- lift augmentation and spoiling devices for distorted skins, closure ribs or spars, cracks, debonding and loose or missing rivets;
- mass balance weights and surface horns for security and attachment;
- operation of control surfaces for full and free movement; and
- operation of engine controls for full and free movement.

4.9 Engine, engine mounts, mount frames and nacelles

- engine mounts and frames for distortion, cracks, loose or missing rivets or bolts and broken welds;
- tubular engine mounts and frames should be checked for distortion, cracks or bowing;

- turbine engines check for freedom of rotating assemblies and on piston engines for freedom of rotation with spark plugs removed;
- engine compartment firewall for distortion, cracks and loose or missing rivets or fasteners;
- engine shock mount assemblies for damage;
- engine nacelle for signs of chafing, distortion, cracks and loose or missing rivets or fasteners;
- engine nacelle latches for correct and positive latching;
- evidence of hydraulic fluid, fuel or engine oil leaks;
- propeller shaft shock-loading in accordance with the manufacturer's approved data;
- propeller attachments and counterweights; and
- engine oil system chip detectors.

4.10 Floats (heavy or overweight ground load inspection only)

- Bilges for evidence of leakage particularly in the vicinity of plating joints, keel strip and chine angles;
- Float structure for damage, distortion, cracks, skin wrinkles and sheared or loose or missing rivets or fasteners; and
- struts for bowing and general damage and bracing cables for correct tension.

5 Inspections as a result of lightning

- 5.1.1 Lightning is a discharge of electricity between highly charged cloud formations, or between charged cloud and the ground. The discharge may strike an aircraft and result in very high voltages and currents passing through the structure.
- 5.1.2 Lightning strikes may have a number of effects on an aircraft: and examples are as follows:
- strike damage where the discharge enters the aircraft; and
 - static discharge damage subsequent to the strike; and
 - skin damage where the lightning bounces across the skin surface.
- 5.1.3 Strike damage is generally confined to wing tips, leading edges of wings and stabilisers and the nose of the aircraft. Damage is usually in the form of small circular burn marks or holes spread over a wide area, blisters on radomes and cracks in fibre glass.
- 5.1.4 The following actions are recommended prior to further flight:
- an extensive inspection of the aircraft skin for evidence of lightning strike. Bonding strips and discharge wicks should be checked in areas where there is evidence of a lightning strike;
 - a check of flight control and lift augmentation and spoiler devices for proper bonding. Inspect bearings for roughness and resistance to movement;
 - an inspection of engine nacelles for evidence of pitting or burning. If the damage is consistent with a lightning strike, the discharge may have tracked through the engine bearings. In this case, some manufacturers recommend oil filters and chip detectors be examined for contamination, with repeated checks at specified intervals;
 - if the landing gear was extended when the lightning strike occurred, an inspection of the gear for static discharge. Check for residual magnetism and demagnetise where necessary;
 - functional checks of radio, radar equipment, instruments, compasses, electrical circuits and flying controls in accordance with the manufacturer's approved data; and
 - a bonding resistance check on radome.