Chapter 8 PROCEDURES FOLLOWING HAZARDOUS INCIDENTS

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LIST OF APPENDICES

General information

1. For the purpose of these instructions, a hazardous incident is one which would result in damage to an aircraft although the damage may not immediately be apparent. Great care is necessary when making an inspection after such an incident since undetected defects could have catastrophic results.

2. When an aircraft has been subjected to such conditions, to a degree which warrants the captain or pilot making a report on Form 700, it is essential that the checks detailed in the following appendices and any necessary repairs and/or adjustments are made before the aircraft is again certified as serviceable for flight. The checks are additional to any routine servicing which may be due, and it is recommended that before any inspection is begun, the pilot should be consulted regarding the nature and direction of the loads experienced in the aircraft, particularly if the incident involved is severe air turbulence or a heavy landing.

Definitions

3. The type of damage which may occur and which should be looked for when carrying out the operation "Examine for damage" is as follows:—

(1) Insecurity of attachments.

(2) Cracks in, or fracture of, structure and components.

(3) Corrosion or contamination.

(4) Structural distortion or skin wrinkling.

(5) Defective or missing rivets.

(6) Chafing, scoring and fraying.

(7) Broken locking devices.

Servicing notes

4. (1) The examination and checks called for in this servicing procedure are to be supervised by a senior N.C.O. assisted by personnel as required.

(2) All normal safety precautions applicable to this aircraft must be strictly observed and come under the direct supervision of the N.C.O. of the particular trade concerned.

(3) Unless otherwise stated, damage found during this servicing is to be categorized and repaired in accordance with Vol. 6. Damage different from, or in excess of that catered for in Vol. 6 should be reported in accordance with current authorized instructions.

(4) The Appendices cover possible damage resulting from any type of hazardous incident, and discretion (relative to the severity of the landing or abnormal flight, if any, found during the initial stages of the inspection) is to be used in regard to the extent to which the servicing is applied.

(5) It should be noted that the instructions contained in all parts of this chapter do not absolve personnel from the responsibility for acting upon circumstances indicating the need for further servicing.

Elongation of bolt holes and fits of bolts in main structure

5. The following can be taken as a general rule:—The maximum tolerances on FITTED bolts and FITTED bolt holes should not exceed 50 per cent above the standard Newall limits (A.P.1464B, Sect. 5, Chap. 5).

Note . . .

No tolerance due to wear or distortion is permissible on joint bolts for main airframe components, i.e., tail unit attachment joints, etc.

Appendix 1 HEAVY LANDING

In the event of an incident involving heavy impact or a forced overweight landing, the following servicing must be carried out in accordance with the sequence of inspection given:—

Item No.	Item	Operation
1	ALIGHTING GEAR	
	Shock absorber struts	(1) Examine port, starboard and nose shock absorber struts for damage, signs of bowing, and leakage at lower gland. Check for normal extension. **Note . . .** (*a*) *Serious leakage indicates gland failure and will entail fitting a serviced strut.* (b) *Should the ram of either a main or the nose oleo strut be bowed between* 0·010 *and* 0·10 *in., It may be straightened under a press, using semi-circular saddle blocks. After straightening, the ram must be subjected, to a crack detection test.*
	Undercarriages	(2) With the aircraft jacked and trestled, examine the undercarriages, by feel, for excessive fore-and-aft movement and end play.
	Wheels	(3) Remove all wheels, together with brake units of main wheels, for Bay Servicing. **Note . . .** (a) *Wheels can be checked for symmetry and twist by spinning wheel casting on a dummy axle* (b) *Damage to brake unit is to be suspected if unit is difficult to remove from wheel.*
	Electrical	(4) Examine microswitches and motor-driven actuators, along with their attachments, for damage.
2	NOSE UNDERCARRIAGE	
	Wheel attachments	(1) Examine wheel guards and attachments for damage. Examine wheel axles and brackets for distortion and cracks.
	Steering mechanism	(2) Examine steering mechanism, steering head and torsion links for distortion and damage. Examine steering jacks and hydraulic pipelines for damage and leakage.

Appendix 1—*continued.*

Item No.	Item	Operation
	Down-lock mechanism	(3) Examine down-lock mechanism for damage and wear at the locking plunger and down-lock housing recess.
	Doors	(4) Examine doors and door-operating rods for distortion and damage.
3	MAIN UNDERCARRIAGE	
	Brake pipelines	(1) Examine brake pipelines for fracture and damage.
	Wheel attachments	(2) Examine wheel axles, half-forks and telescopic torque tubes for distortion and cracks.
	Balance cylinder	(3) Examine diagonal balance cylinder and balance pipes, lower brace and lower side-stays to undercarriage, and their attachments for distortion and damage.
	Hinge tubes and down-lock mechanism	(4) Examine main and side stay tubes, upper side stays and down-lock mechanisn for distortion and damage.
	Doors	(5) Examine fixed door and outer door along with their attachments for distortion and damage.
4	FUSELAGE	
	Skin surface	(1) Examine skin surface for wrinkling, skin fractures or loose rivets, in areas near nose-wheel bay and where heavy components are internally mounted. **Note . . .** *Damage at the latter may indicate that the internal structure has been damaged by inertia loading; if damage is found, thoroughly examine all structural members from the area of distortion to the nose-wheel bay.*
	Nose-wheel bay	(2) Examine trunnion bearing brackets, trunnion bracing tubes and brackets, support beam and support structure, for cracks and possible shearing of attachment bolts and rivets. If any of these items are damaged, remove nose shock absorber strut and examine trunnion bearings. (3) Examine nose-wheel bay side member diaphragms for buckling of webs and check fittings for cracks. **Note . . .** *Cracked or flaking paint often indicates an area where strain, and possibly distortion, has taken place.*
	Pressure cabin	(4) Examine side member diaphragm attachments to pressure cabin rear bulkhead and bomb-bay frame for damage and possible shearing.

Item No.	Item	Operation
		(5) Examine cabin rear bulkhead skin for distortion, and rivets for signs of looseness or shearing.
		Note . . . *This is often indicated by crescent-shaped areas of unpainted metal beside the rivets, or by creases in the metal near the rivets.*
		(6) Examine windscreen and bomb-aimer's nacelle glazing for possible cracks, indicating distortion.
		(7) At upper servicing bay, examine the junction of cable to main fuselage, especially at the top surface, for distortion of attachment bolts.
		(8) Examine cabin flooring under radio crate for possible damage.
	Bomb bay	(9) At each side of the bay, examine the bomb-bay doors for correct fitment when closed.
5	MAIN PLANE	
	Main undercarriage bay	(1) Examine the pivot tube stabilizer, support stays and attachments for distortion and cracks.
		(2) Examine for distortion, the bolts securing the hinge tube spherical bearing housings to spanwise rib and to rear spar respectively. Examine the local structure and housing channels, where fitted.
		(3) Examine for damage, the spanwise undercarriage bay ribs, particularly the attachment cleats to ribs at Stn. 93 and 168.
		(4) Examine for damage the drag load diaphragms forward of spanwise ribs, including attachments to top and bottom surfaces.
	Inner plane	(5) Examine for cracks the web flanges of main spars at Stn. O and 93 (*Vol.* 6, *Part* 2, *Repair Leaflet* C.10) and front spar post at Stn. 93 (*Vol.* 6, *Part* 2, *Repair Leaflet* C.11).
	Wing surface	(6) Between Stn. 0 to 168, examine top skin surface for wrinkling and sheared or loose rivets.
		Note . . . *Between Stn.* 0 *to* 93, *skin damage may indicate that the inner plane internal structure has been damaged due to excessive loading set up by the weight of the engines. Consequently, if damage is found, all structural members from the area of distortion to the undercarriage must be examined.*
		(7) Examine for distortion and rivet shearing, the bottom skin surfaces from Stn. 0 to 168, including engine doors and drag angles at the root.

Item No.	Item	Operation
6	ENGINES	
	Engine mountings	(1) Visually examine for damage the front and rear engine mountings. If damage is evident, proceed with a thorough examination. This is a major operation and should not be undertaken unless the visual examination reveals damage. To effect the check, remove the engine and fire plating, and examine front and rear mountings carefully for distortion and damage. Examine the local structure, particularly in the vicinity of welds, for cracks and other damage. Refer to Vol. 6, Part 1, Chap. 6, Table 1, for damage limitations to mountings.
	Engine controls	(2) Check engine controls for full, free and correct movement.
7	ALIGHTING GEAR	
	Replacement	(1) On completion of other replacements, fit serviceable wheels. (Refer to Sect. 3, Chap. 5 for alighting gear component assembly and adjustments).
	Functional test	(2) Retract and lower each undercarriage and make checks (including nose-wheel steering checks) as detailed in Sect. 3, Chap. 5.
		(3) Lower the aircraft to the ground and remove jacking equipment from vicinity of aircraft.
8	FLYING CONTROLS	
	Flaps and support structure	(1) Examine the flap trailing edges for superficial damage which, if detected, necessitates inspection of the telescopic tie-rods and their attachments for possible damage.
	Control power units, flap and air brake gearbox	(2) Examine for damage the attachments of the aileron, elevator and rudde power units, tail plane incidence reduction gearbox, auto pilot and feel unit operating mechanism.
		(3) Examine for damage the attachments of the flap gearbox and the air brake gearbox.
	Controls	(4) Check all flying controls for full, free and correct movement.
		Note . . . *If any increase in friction or backlash is detected, the system should be checked from end to end to determine the cause.*
9	ELECTRICAL SYSTEM	
	Alighting gear	(1) See Item 1, operation (4).

Item No.	Item	Operation
	Fire extinguisher circuit	(2) See that the inertia switches are untripped and that the fire extinguisher bottles have not been discharged. Discharged bottles must be disconnected and the engine N.C.O. informed. **Note . . .** *Reconnect when serviced bottles have been fitted.*
	Batteries	(3) Examine batteries for security and evidence of damage and acid spillage. **Note . . .** *Particular attention should be given to the security of the battery tray at the bomb-bay forward end and any spillage in this area.*
	Lamps and systems	(4) Check filaments and other electrical equipment, including aircraft system components, for correct functioning.
10	FIRE PROTECTION SYSTEM	
	Fire extinguisher brackets	(1) Examine for damage.
	System	(2) Examine all fire extinguisher bottles for damage, leakage or discharge. Remove discharged bottles and fit serviced ones.
11	INSTRUMENT, WIRELESS AND RADAR INSTALLATIONS	
	General	(1) Examine instrument, wireless and radar components for damage and security of mounting attachments.
	Functional tests	(2) Check, as far as possible, instrument, wireless and radar equipment for correct functioning.
	GENERAL	
12	Fluid tanks	(1) Examine fluid tanks and pipelines for obvious leaks.
	Equipment	(2) Examine major items of equipment not previously inspected, particularly in the servicing bays, for any signs of failure or damage to their mountings and support structure.
13	AIRFRAME	
	Rigging checks	If inspections of items 1 to 12 reveal no damage the aircraft may be considered serviceable, but if there is any indication of a serious defect the aircraft must be checked for symmetry (*Sect.* 2, *Chap.* 4).

Appendix 2 FLIGHT THROUGH TURBULENT AIR

General

1. The inspection sequence overleaf should be followed, after the captain or pilot has reported that the aircraft has been subject to severe air turbulence. Such conditions include incidents when the aircraft is buffeted and the maximum speed exceeded, or when the aircraft is subjected either to violent vertical turns or abrupt changes in altitude. The defects which may result from such manoeuvres include structural distortion, usually indicated by skin wrinkles, and damage to or near main assembly points.

2. Where the aircraft is fitted with Mk. 1B or 2A fatigue meters which record the number of times threshold values have been exceeded, the inspection should be carried out in full when the maximum has been reached. If the maximum figure of 1·95 or 2·35 g respectively has not been reached, and an incident involving severe air turbulence has been reported, the aircraft may be accepted as satisfactory and no inspection is necessary other than a general external viewing of the skin surfaces for signs of wrinkling.

3. For aircraft not fitted with fatigue meters, the maximum acceleration experienced during a manoeuvre or when flying in turbulent conditions will be registered on the indicating accelerometer which will give visual indication of the acceleration forces imposed on the structure during flight. The decision as to the need for inspection must be determined, therefore, from the captain or pilot's assessment of the severity of the turbulence or the excessive g loading recorded prior to landing.

4. The following schedule is kept to a minimum, but includes all items where damage would be evident. If these areas show no signs of cracks or buckles, the aircraft may be considered serviceable. Any damage found in the specified areas, necessitates inspection which may include radiographic examination but this must be determined on evidence submitted through the normal channels.

Item No.	Item	Operation
1	FUSELAGE	
	Apertures	(1) Examine for signs of wrinkling the vicinities around windscreen, canopy, bomb-aimer's nacelle, crew entrance door, access door and bomb-bay doors. **Note . . .** *Twist in the fuselage may be indicated by wrinkles at about 45 deg. to the frames and is most probable in the vicinity of apertures.* (2) Check fit of entrance and access doors, together with their locks. Check, by operation, fit of bomb-bay door.
	Fuselage skin	(3) Examine remainder of fuselage skin for wrinkling, fractures and defective rivets, checking generally for hogging (underside wrinkles laterally across) and sagging (topside wrinkles laterally across), paying particular attention to the following break points:— (a) Nose fairing to pressure cabin. (b) Pressure cabin to centre fuselage. (c) Rear fuselage to centre fuselage. (d) Tail fuselage to rear fuselage. (e) Tail cone to tail fuselage. (f) Lower fin to rear fuselage. (g) Centre fuselage at wing roots
	Fuselage structure	(4) Examine for cracks, distortion and defective rivets, the frames, stringers and cleats in centre fuselage, particularly in the areas where component attachment structure is secured.
2	TAIL UNIT	
	Dorsal fairing, lower and upper fin, and fixed tail plane	(1) Examine skin surface for signs of wrinkling, skin fracture or defective rivets, particularly in the areas adjacent to the break joints. (2) Examine lower fin chordal members for signs of fracture, distortion or other damage.
	Variable-incidence tail plane Rudder	(3) Examine the following for distortion and damage:— (a) Elevator and fixed tail plane hinges (b) Mass balance weight attachments and structure adjacent to the spar boom and torque tube coupling; fin hinge attachments, and balance and trim tab hinges. (c) Structure at mass balance weight horn, and torque tube fitting at root end. Main hinge fittings, trim tab hinges (stbd.) and balance tab hinges (port).

Item No.	Item	Operation
3	MAIN PLANE	
	Inner planes	(1) Examine inner plane top and bottom skins for signs of wrinkling, skin fractures and defective rivets, paying particular attention to areas adjacent to:— (a) Wing root fillet. (b) Falsework above exhausts. (c) Intake fairings. (d) Butt straps at break joint, inner to outer plane. **Note . . .** *Excessive torsional loading in extreme cases may result in wrinkling at about* 45 *deg. to the wing chord.*
		(2) Examine for cracks the front spar posts at Stn. 93 (*Vol.* 6, *Part* 2, *Repair Leaflet* C.11) and main spar web flanges at Stn. 0 and 93 (*Vol.* 6, *Part* 2, *Repair Leaflet* C.10).
		(3) Examine for distortion and cracks the trailing structure of inner plane and ribs at Stn. 0, 45·28 and 93.
	Outer planes	(4) Examine outer plane top and bottom skin for signs of wrinkling, skin fracture or sheared rivets.
		(5) If distortion is indicated either by skin wrinkling or structural deformation during the preceding examination, and there is evidence of a serious defect, a thorough examination of the aircraft must be made including a symmetry check (*Sect.* 2, *Chap.* 4). If it is then suspected that the aircraft is bowed about its horizontal and vertical planes of symmetry or twisted throughout its length, further investigation including bow and twist checks must be made.

Appendix 3 EXCESSIVE USE OF BRAKES

The following servicing should be carried out on main undercarriages, in accordance with the degree of severity experienced, when excessive use of brakes has been reported:—

Preliminaries

1. Jack and trestle the aircraft (*Sect.* 2, *Chap.* 4).

Tyres

2. Examine tyres for damage, particularly "flat spots". Check extent of "creep" (*Sect.* 2, *Chap.* 4, *Key to fig.* 15). Remove wheel (*Sect.* 3, *Chap.* 5) and if tyre only is damaged it must be changed; if wheel or brake unit is also damaged, despatch wheel for Bay Servicing.

Note . . .

Old and new designs and worn tyres may be fitted together on the aircraft to combat "porpoising"; the leading tyres in any arrangement should be either of the latest design, or the least worn, as the case may be.

Main landing wheels

3. Examine wheels for signs of heating, damage, and cracks in the webs of the diaphragm spokes; check security of flange and wheel attachment bolts. If damage is found, remove wheel for Bay Servicing.

Maxaret anti-skid units

4. Inspect each Maxaret unit as follows:—

(1) Examine the Maxaret tyre for damage or wear, and check for correct engagement with landing wheel rim.

Note . . .

(i) *The wear limit is reached when the tyre is worn down to the wear-indicating rib. (Early types which are bonded to the steel shell periphery do not have a wear-indicating rib and such tyres are fully worn when the tyre diameter is less than* 3·625 *in.*

(ii) *At the point of contact with the driving track, there should be a flat tyre of* 0·75 *to* 1·0 *in. up to the limit permitted by the tyre wear check.*

(2) Examine the Maxaret unit and service pipes for external damage and signs of corrosion and cracks.

(3) Examine the Maxaret unit for security of mounting.

(4) Examine the pipe connections for security of attachment.

(5) Check that the indicator rod is approximately flush with the valve block face.

(6) Examine the shell for excessive clearance between its bearing mounting points.

(7) Clean the unit and ensure that the fly-wheel is free from any accumulations of oil which would impede rotation.

(8) Clean the track on which the unit is driven and ensure that the track is undamaged.

5. The Maxaret unit should permit maximum braking effort to be applied in any conditions without danger of locking the brakes. It should be noted, however, that excessive or short "run-on" characteristics can be developed in a unit which has defective or damaged internal parts. A suspect Maxaret unit should be removed and tested in accordance with A.P.1803S, Vol. 1, Book 2. When fitting a new or serviced unit, ensure that the correct unit is fitted to the appropriate wheel of the aircraft.

Note . . .

If the emergency (No. 2) *hydraulic Service was used during the incident the hydraulic supply, being connected directly to the jack cylinders, would by-pass the Maxaret units.*

Brake units

6. Inspect and service the brake units as follows:—

(1) Fit gauges and adapters at the test connections in the lines between the brake control valve and the brake units. With the change-over lever set to NORMAL, operate the brakes; the gauges should read:—No. 1 Service, $1500 \pm \frac{150}{0}$ lb/in², and No. 2 Service zero. With the lever set to STANDBY, both services should read $1500 \pm \frac{150}{0}$ lb/in² when the brakes are operated.

(2) Check for fluid leaks and examine the service pipes for security and for excessive scores, denting, distortion, chafing or fractures.

(3) Examine the brake unit for external damage and signs of distortion by burning. Check friction pad wear in accordance with instructions given in A.P.2337, Vol. 1, Book 2, Sect. 3, Chap. 2, App. 15. If necessary, remove the wheel and dismantle the brake for a detailed examination particularly of the friction pads and brake plates (A.P.2337, Vol. 1 reference as above). Renew worn or damaged parts, and assemble and test as detailed in A.P.2337.

(4) After fitting a newly serviced wheel (*Sect.* 3, *Chap.* 5) or accepting the existing wheel, brake unit and tyre as being in a fully-serviceable condition, adjust the brake clearance and complete the procedure as follows:—

(a) Using a suitable key or spanner, screw in the piston rods until they begin to resist further rotation, indicating that the clearance is taken up.

(b) Unscrew each piston rod six flats (one and a half turns), ensuring that the piston-rod locking collar springs freely into the square hole in the cover plate for every quarter turn of the piston rod, thus ensuring a positive lock.

(c) Ensure that the Maxaret tyre is in correct engagement with the landing wheel rim (*para.* 4 (1)), adjusting if necessary by fitting special shims under the mounting bracket. After bleeding the brakes in the normal manner, check the brake operation and hydraulic pressure (*para.* 6 (1)). Carry out a retraction test of the main undercarriage in accordance with Sect 3, Chap. 5.

(d) After ensuring that all necessary locking has been completed, lower the aircraft and remove the jacks and trestles.