BGA AIRWORTHINESS AND MAINTENANCE PROCEDURES

PART 4, LEAFLET 4-3

SPECIAL PROCEDURES FOLLOWING HAZARDOUS INCIDENTS

INTRODUCTION

There are a variety of hazardous incidents likely to be experienced by aircraft following which it becomes necessary to perform a number of additional checks and inspections to establish the aircraft's integrity. The aim of this leaflet is to provide guidance to BGA inspectors on a range of such situations and the additional checks and inspections to be carried out

SPECIAL NOTES

At all times during the conduct of the checks and inspections detailed below, Health and Safety (H & S) and Control of Substances Hazardous to Health (COSHH) regulations must be observed and those regulations override any instructions detailed below. The COSHH regulations require product data sheets to be available and a file should be kept of data sheets for all products used; Data sheets are available from the product supplier or manufacturer.

1. Lightening Strike inspections
2. Heavy landing inspections
3. Rough field Landing inspections
4. Extreme turbulence inspections
5. Overweight flight inspection
6. Lost tool or equipment inspection
7. Ground loop inspections
8. Chemical spills in aircraft
9. After fire inspections
10. Engine over speed
11. Propeller ground strike
12. Oxygen leaks
13. Handling Asbestos
14. Handling Depleted Uranium

1 LIGHTNING STRIKE INSPECTION.

The greatest danger is from undetectable damage caused by overheating or tracking of the electrical current.

a) Inspect the entire aircraft and establish the entry and exit points of the lightning strike.
b) Inspect current paths, including control rods, cables, cranks, bearings and fittings for any signs of overheating, arcing, distortion, roughness of operation and general unserviceability. Check electrical wiring. If any doubt exists remove the component for closer examination or carry out non-destructive testing.
c) Inspect honeycomb structures for signs of distortion, delamination or discoloured finish.
d) Check the condition of lightening strike bonding and any static discharges.
e) If the aircraft is equipped with an engine; check for signs of unserviceability, inspect the contents of oil filters and magnetic plugs if fitted.

f) Check for correct and smooth operation of the variable pitch propeller.
g) Check all instrument systems for correct operation.
h) Check compass correction. If errors exist check steel tubes or components for residual magnetism prior to making corrections.
i) If in doubt about any inspection investigate further.
j) Make a log book or worksheet entry detailing the inspections.

2 HEAVY LANDING INSPECTION

The checks in this section are also applicable to a Hard Landing. The level and extent of the inspections required will depend on the severity of the landing, pilot's report and damage, if any, found. The majority of the loads experienced during a heavy or hard landing will be in the form of positive "G" due to rapid deceleration. Other forces must not be discounted such as rapid forward deceleration, side loads or negative "G" during any bounce. The extent of work to be carried out is known as Level 1 for initial inspections and Level 2 for a more in depth inspection

Level 1 Inspection The extent of inspection required for Level 1 is as follows:

a) Inspect the exterior of the aircraft for obvious signs of damage – wrinkling or looseness in fabric covering, distortion of skins, cracks in the gel coat, pulled rivets of fasteners, alignment of wings and tail surfaces.
b) Debrief the pilot if possible to determine the force of the suspected heavy landing. Interrogate the "G" meter if installed. If a high "G" was experienced or suspected proceed to level 2 after completing level 1.
c) Determine if any water or solid ballast was being carried as this could have a bearing on the level of inspections required.
d) Inspect the landing gear for obvious signs of damage or distortion with weight off the wheel or skid. Ensure that the wheel rotates smoothly and is not distorted.
e) Inspect the wing attachments and surrounding structure.
f) Check the wing structure by carrying out a wing frequency check – with the glider on its wheel(s) gently oscillate one wing tip up and down. The opposite wing should react with the same or very similar oscillations.
g) De rig the glider – note any abnormalities during de-rigging such as tight pins or spigots.
h) Inspect wing pins, spigots and attachment devices.
i) Inspect Fuselage for signs of damage, bending or misalignment.
j) Inspect landing gear and structure for signs of bottoming, damage or distortion.
k) Inspect Tail plane and Empennage for signs of damage, bending or misalignment.
l) Inspect the seat structure by removing the seat pan if appropriate.
m) Inspect the security of any ballast or equipment installed.
n) Rig the glider – note any abnormalities.
o) Check instruments for correct operation.
p) Inspect the battery for cracks or leaks.

Motor gliders
q) Check engine bearer frames and attachments
r) If no obvious damage – carry out propeller flange run out check especially if a heavy variable pitch propeller is fitted.
s) Check engine oil filters and magnetic plugs.
t) Check engine crankcase for cracks (oil leaks) especially at mounting points.

u) Make a log book or worksheet entry detailing the inspections.

If any damage is observed or suspected during level 1, proceed to level 2.

Level 2 Inspection The depth of inspection required for level 2 is as follows:

Note: resultant damage of wooden and composite structures can be very difficult to locate. It may be necessary to carry out invasive inspections to determine serviceability and employ the use of specialist inspection equipment

a) A thorough inspection of wing structure using equipment to inspect the spars and ancillary structure.
b) Carry out NDT of wing and tail attachment fittings and pins.
c) Inspect the fuselage structure by removal of fabric or skin as required to gain access.
d) Inspect composite structures looking for signs of de lamination, white stress lines, dust or cracks.
e) Inspect the engine mounting structure including mounts, frames, cowlings etc. if necessary remove engine to facilitate the inspection
f) Inspect the fuel tank and mountings especially if a quantity of fuel was being carried.
g) Inspect the landing gear after removal of the wheel(s), inspect the mountings and structure, check axles for correct alignment, and check retraction and extension systems.
h) Inspect tail surfaces and mounting structure.
i) Check internal structure of canopies, instrument panels and ancillary equipment.
j) Remove engine for mounting frame and attachment point inspection
k) Consider engine shock load inspection.
l) Make a log book or worksheet entry detailing the inspections.

3 ROUGH FIELD LANDING INSPECTIONS

Depending on the severity of the rough field consideration should be given to including part or all of the Heavy Landing Inspection:

a) Debrief the pilot to establish the speed and direction of the landing in relation to the ground conditions.
b) With the weight off the landing gear inspect the wheel(s) for damage and the landing gear for excessive play or signs of over stressing. Be aware of side load damage.
c) Inspect the underside of the fuselage for damage.
d) Inspect the tow hooks; carry out a normal and back release test.
e) Check pitot heads and probes especially if fitted in the nose of the glider. Check for blockages.
f) Inspect the outboard wing leading edges and underside for damage.
g) If low tail aircraft, inspect the underside of the elevators and stabiliser.
h) Inspect the tailskid and base of the rudder.
i) Inspect canopy and release mechanism for actual or partial actuation
j) Make a log book or worksheet entry detailing the inspections.

4 EXTREME TURBULENCE INSPECTIONS

The forces experienced during turbulence may be in any direction – Acceleration or Deceleration, Positive “G” or Negative “G”. This must be taken into account when performing the appropriate inspection.

a) Inspect the exterior of the aircraft for obvious signs of damage – wrinkling or looseness in fabric covering, distortion of skins, pulled rivets of fasteners, alignment of wings and tail surfaces.
b) Debrief the pilot if possible to determine the force of the turbulence
c) Interrogate the "G" meter if installed.
d) Determine if any water or solid ballast was being carried.
e) Inspect the wing attachments and surrounding structure.
f) Inspect the tail surfaces for signs of damage.
g) Inspect the fuselage paying special attention to the tail boom particularly on "T" tail aircraft.
h) Inspect the seat structure and harness attachments by removing the seat pan if appropriate.
i) Inspect the security of any ballast or equipment installed.
j) Make a log book or worksheet entry detailing the inspections.

If any damage is found or suspected reference should be made to the manufacturer or use appropriate sections of Level 2 of heavy landing inspections.

5 OVERWEIGHT FLIGHT

If the aircraft has been flown at or above 120% of the max all up weight or the structural limitations have been exceeded advice should be sought from the airframe manufactures. In the absence of a source of this information the following may be used;

1 Carry out the Extreme Turbulence Inspection 4-3-4.
2 Carry out NDT inspection of wing and tailplane pins and fittings.
3 Make a log book or worksheet entry detailing the inspections.

6 LOST TOOL OR EQUIPMENT INSPECTION.

Any tool, parts or equipment lost inside an aircraft is especially dangerous, and more so in the case of gliders that frequently carry out aerobatic manoeuvres with reduced or negative "G". These foreign objects can become loose and could jam the controls or distract the pilot and cause an accident. It is imperative that any lost article is found and accounted for. Unfortunately lost hardware tends to blend in to the surrounds and sometimes is particularly difficult to see.

a) Without disturbing any interior cushions, seats, fixtures and fittings try to trace the path of the object.
b) Use good lighting and inspection equipment to aid the search for the lost item.
c) Remove internal equipment to aid search.
d) In a quiet environment, tap the underside of the area and listen for bouncing foreign items.
e) In a clean area place a dustsheet on the floor. With the aircraft de-rigged rotate the fuselage or flying surface as appropriate to allow the item to fall out. Gently tap to dislodge.
f) Continue to search until the missing article is found. Take into account that it may have travelled some distance.
g) It is recommended that workshops and tools be kept in a tidy condition to avoid searching for missing items that are subsequently found on the floor or bench.

7 GROUND LOOP INSPECTION.

A ground loop may be a fairly gentle affair or may be the result of a cartwheel in extreme circumstances. The inspections should take this into account when determining the depth of investigation.

a) Carry out Heavy Landing Inspection 4-3-2 as appropriate.
b) Inspect wing roots and fuselage for possible compression damage at leading and trailing edges.
c) Inspect wing tips for ground contact damage.
d) Inspect tail boom for signs of distortion, over stressing or other damage.
e) Inspect canopy and release mechanism for actual or partial actuation.
f) Make a log book or worksheet entry detailing the inspections.

8 CHEMICAL SPILL IN AIRCRAFT

The first action is to determine the substance of the chemical spill and establish if any hazard to health is posed.
Follow the relevant COSHH information, and wear the necessary personal protective equipment (PPE).
Read any warnings on the container and take note of hazards.
Follow environmental regulations for the safe disposal of spills and cleaning materials.

The most likely chemicals to be spilt in BGA aircraft are:

I. Battery Acid – Sulphuric acid
II. Fuel – Gasoline
III. Cleaning fluid – Solvents
IV. Cleaning fluid – Detergent
V. Brake fluid – Mineral oil
VI. Brake fluid – Automotive
VII. Mercury

I **Battery Acid Spillage** Spillage of battery acid is to be treated as follows:

Warning

Battery acid contains Sulphuric Acid that is very corrosive and extremely harmful. PPE is essential. Generally Gel batteries are used in gliders. These will give protection to spillage in the event of an accident; a cracked battery may ooze acid and become a hazard.

a) Mop up any surplus spill with disposable cloths.
b) Flush the affected area with water, be aware of run off water and make suitable arrangements for its disposal.
c) Prepare a neutralising solution of Bicarbonate of Soda or Washing Soda in warm water and apply to the affected area.
d) After a few minutes flush the area again.
e) Repeat until satisfied that all the acid is neutralised and washed away.
f) Check the area with litmus paper to check for acid.
g) Inspect the affected area for damaged paint or areas where the spill may have penetrated and investigate.
h) Raise a carried forward defect to flush and recheck the area in 1 or 2 weeks.
i) Re apply protective coatings if second check is clear.
j) Make a log book or worksheet entry detailing the inspections.

II **Fuel Spillage** Instances of fuel spillage are to be treated as follows:

Caution

Petroleum sprit in Avgas or Mogas form is extremely inflammable and fire precautions should be exercised. Wear PPE, as petroleum sprit should be kept off the skin. Do not siphon by mouth.

a) Identify cause of spill or leak and rectify or drain.
b) Provide adequate ventilation.
c) Mop up spill with disposable cloths.
d) Allow area to dry in safe conditions

e) Some fuels and 2-stroke mixture will leave unwanted deposits these should be removed with suitable solvents.
f) Fuel will wash lubricating oil from bearings, re-lubricate if necessary.
g) Re apply protective coatings as necessary.
h) Make a log book or worksheet entry detailing the inspections

III Spillage of Cleaning Fluids – Solvents

Spillages of solvent cleaning fluids are to be treated in the same way a Spillage of fuel.

IV Spillage of Cleaning Fluids – Detergents

Normally cleaning detergents are not harmful to aircraft or personnel but some commercial strength detergents can be irritant or harmful to the skin or eyes. Wear PPE and take the following action:

a) Thoroughly wash the affected area with clean water and dry.
b) Re lubricate and re apply protective coatings if applicable.

V Spillage of Brake Fluid – Mineral Oil

Mineral based brake or hydraulic fluid (Aeroshell fluid 4 or DTD 585) is not in its self particularly hazardous unless ingested but may leave a slippery residue also the residue may attract dirt and dust. Take the following action:

a) Identify cause of spill or leak and rectify or drain.
b) Mop up spill with disposable cloths.
c) Remove residue with solvent and allow to dry.

VI Spillage of Brake Fluid – Automotive

Caution

Automotive type brake fluid (Dot 3 or 4) is irritant and hazardous in contact with the skin and poisonous if ingested and should be avoided. It is also detrimental to paint finishes.

a) Identify cause of spill or leak and rectify or drain.
b) Mop up spill with disposable cloths.
c) Remove residue with brake fluid solvent, isopropyl alcohol or methylated sprit and allow to dry. Do not use petroleum based solvents.

VII **Spillage of Mercury**

Warning

When elemental mercury leaks on to a metallic structure, severe structural degradation occurs. The rate of the diffusion of the mercury into a metal is related to the type of metal touched. The diffusion is also related to the type of finish protection applied. But when the diffusion has started it cannot be stopped. Structural degradation is not always visually apparent until a load is applied to the structure. The removal of spillage and rectification of mercury damage is required before flight.

a) Remove all mercury with cardboard or paper troughs. You can also use "eye droppers" or powerful vacuum cleaners.
b) Remove any access panels or equipment to gain access to possible run areas.
c) Use a 10X magnifying glass to examine structure visually. Look for bare metal, scratches or gaps that would allow the mercury to enter.
d) If you think mercury has penetrated the structure inspect with X-ray. Droplets of mercury will show up as white spots on the film.
e) If any contamination is found or suspected the metallic components must be replaced before flight.
f) Clean hands and all tools and equipment with soap and hot water.

9 **AFTER FIRE INSPECTION**

Caution

The extinguishing agent used to control a fire can be very toxic and the residue, especially if dry powder or foam is used can be very corrosive. It is imperative that PPE is worn and deposits are removed as quickly as possible. General advice is given, always refer to the manufacturers if possible and consult with the insurers.

a) Remove extinguishing agent deposits using clean water.
b) Inspect the aircraft for fire damage in consultation with the insurance representative if appropriate.
c) All components damaged by fire must be replaced and the removed items identified as fire damaged. These items are usually scrap and must be made not available for reuse.
d) Consequential damage caused by smoke, extinguishing agent etc must be inspected for serviceability and items removed for overhaul if necessary.
e) Composite materials are very susceptible to heat damage and if subjected to extremes of heat they must be thoroughly tested prior to re introduction to flying service. This may involve removing a sample for destructive testing to confirm that reserve strength is not degraded.
f) Wooden structures will normally show signs of heat damage by blistering of protective varnish or charring. Adhesives used in wooden construction will also be affected by heat damage.
g) Metal structures are less susceptible to heat damage but in extremes of heat, near to the actual fire, may become distorted or softened. Carry out NDT to determine the hardness is within specified limits. Replace any structure that is heat damaged.
h) Make a log book or worksheet entry detailing the inspections.

10 **ENGINE OVER SPEED INSPECTION**

The engine and propeller manufacturers maintenance manual should be consulted to establish the maximum limits allowed during over speed situations and the necessary course of action. In the absence of any information the following may be used:

Caution

Observe magneto and propeller safety precautions.

a) Establish the cause of the over speed and rectify if appropriate.
b) Inspect engine for any signs of damage, freedom of rotation obvious compressions.
c) Inspect propeller for damage. Check for cracks on the forward face of the blades. Check the track.
d) Carry out a compression test.
e) Inspect the valve operating mechanism for distortion or broken springs (N/A 2 stroke)
f) Inspect oil filters and screens for debris.
g) If any damage is found or the over speed was over 120% of rated speed, the engine should be removed for overhaul or inspection.
h) Make a log book or worksheet entry detailing the inspections.

11 PROPELLER GROUND STRIKE INSPECTION

Sudden stoppage is a very rapid deceleration of the engine when a propeller strikes the ground. Normally the engine will require a shock load inspection as damage to the internal components can be expected. Damage to gear teeth, reciprocating parts, shafts and mountings can be caused by the inertia of driven components. In addition the forward speed of the aircraft should be considered as this can subject the crankshaft or gearbox to a bending stress and the engine mounting structure to abnormal loads. If there is some doubt if a shock load inspection is required carry out the following.

a) Inspect the propeller. If only very minor tip damage has occurred in soft ground continue with inspection. If the propeller is badly damaged or metal propeller bent a shock load inspection should be carried out.
b) Inspect the crankshaft with a DTI to check for run out or excessive end float.
c) Inspect cowlings for miss alignment or damage.
d) Inspect engine mountings and frame for distortion, cracks or signs of overloading.
e) Examine oil filters and screens for debris.
f) Carry out an extended ground engine run and monitor all parameters.
g) Examine oil filters and screens for debris on completion of ground run.
h) Only return to service if all the above are satisfactory if defects are found remove engine for shock load inspection.
i) Raise carried forward to inspect the oil filters and screens in 5 hours of engine operation.
j) Make a log book or worksheet entry detailing the inspections.

12 INVESTIGATION OF OXYGEN LEAKS

Warning

Oxygen is very hazardous in contact with any grease, oil, flammable solvents, dust, lint, metal filings or other combustible materials. Ensure that the area, all tools, clothes, hands and equipment or consumables are clean before starting work on an oxygen system. Contact with any of the above may cause spontaneous combustion or explosion.

Danger Warning

Grease or Oil will cause an explosion on contact with oxygen.
Do not smoke
Do not use any lubricants

a) Shut off oxygen at source. Close bottle valves.
b) Move aircraft to a well ventilated area.
c) Trace leaks using approved oxygen leak detector only. Use an oxygen sniffer if available.
d) Tighten fittings to specified torque only or replace faulty components
e) If the leak is from a fitting or joint do not over tighten. Disassemble joint, clean and reassemble. If the leak persists replace the pipe or component.
f) Do not repair by welding or soldering as this is a specialist job and the correct process has to be followed.
g) Replenish the oxygen system using only aviator's oxygen. This contains lower moisture content than general medical oxygen that should not be used, as it is more susceptible to freezing at high altitude.
h) Make a log book or worksheet entry detailing the inspections

AMP Leaflet 4-11 provided additional guidance on maintenance of Glider Oxygen Systems

13 PRECAUTIONS IN THE HANDLING OF ASBESTOS

Warning

Friction materials such as brake linings do not normally contain asbestos these days but some older aircraft or old stock brake linings may contain asbestos. Asbestos can also be found in some gaskets or in heat insulation material.

If asbestos is suspected observe the following:

a) Wear a protective dust mask.
b) Do not breathe in dust.
c) Do not use compressed air to clean out dust.
d) Asbestos should be disposed of as special waste at an approved facility. (contact your local council or specialist waste contractor)
e) Replace with asbestos free parts if possible.

14 PRECAUTIONS WHEN HANDLING DEPLETED URANIUM

Warning

Depleted Uranium has been used for aircraft mass balance weights. It is believed that its use has been restricted to transport aircraft and not used on gliders. However in the unlikely event of some being used and requiring maintenance the following must be observed.
Depleted uranium emits Alpha radiation and in good condition the surface finish will contain it. Additionally the skin forms an effective barrier against this radiation. The danger arises when the particles enter the body through breathing dust or by cutting.

Wear full PPE (Gloves, mask, overalls, eye protection and cover exposed skin)

a) Do not work, sand, file, drill depleted uranium
b) If any corrosion is found it must be encapsulated by applying sealant. Do not attempt to remove corrosion.
c) Remove the component
d) Store in a wooden box and mark **"RADIOACTIVE HAZARD"**
e) Contact your local HSE for advice on how to dispose of the article. (advice could be sought from Airline Health and Safety officers)

f) Replace with item manufactured from a safe material.