# HGFA WEIGHTSHIFT MICROLIGHT

# INSPECTION GUIDELINES

The following guidelines are provided as an aid to the Inspection Report.

These guidelines should be used as an accompaniment to (NOT a replacement of) the Aircraft Manufacturer's Inspection requirements

These guidelines are designed to assist Inspectors to carry out two yearly Independent Inspections of HGFA Weightshift Microlight aircraft in accordance with Section 9.7.7.1 of the HGFA Operations Manual.

This document is to be used in conjunction with the HGFA Weightshift Microlight Inspection Report. Each entry found on the HGFA Weightshift Microlight Inspection Report is herein listed under the same headings, together with guidelines on what to look for during the inspection.

These guidelines are also a useful guide for owners as to how to conduct periodic inspections in conjunction with the regular maintenance requirements specified by the Aircraft Manufacturer. Periodic inspections must not be confused with pre-flight inspections which are vital checks and general condition inspections. Correct and diligent inspections will not only reveal defects, but will reveal wear, that if left unchecked will become costly to repair.

Where inspection reveals wear or deterioration that may not yet warrant part replacement, the owner must note the condition of the specific component and ensure that regular future inspections are carried out to monitor any further deterioration. The HGFA advises members to ensure that their inspections are both regular and thorough.

## ACCEPTABLE LEVELS OF WEAR AND DETERIORATION

The level of acceptable wear and deterioration in any component is dependent on the specific component's purpose. Any component that is either under continuous in-flight load, or that is critical to ensure flight safety is deemed to be an "essential component". The level of wear, degradation or deterioration that is acceptable in essential components is minimal. Any essential component must be replaced where the level of wear or deterioration of the component in any way reduces the strength of the airframe; or where the degradation causes any change to the configuration of the airframe. Following are some general guidelines to acceptable wear and deterioration.

An essential wing spar should be replaced where: it shows signs of corrosion, with pitting through 10% or more of the tube wall; or it has been damaged and a dent is visible in the spar; or it has been bent and straightened and either a kink or visible crazing remains; or where any crushing of the tube wall has occurred.

**Note:** "pitting" is the result of corrosion identified by small crater-like cavities; "crazing" is the visible discolouration or change in the sheen of the aluminium; with fine cracks or grain-like marks appearing in the tube. Pitting or crazing indicates a weakened area of the tube.

As a guide, an essential component should be replaced where elongation of any bolt hole exceeds 10% of the original diameter of the hole.

Any essential wire or cable component should be replaced where any individual strand of the cable is fractured. Note that wires should be closely examined in the area immediately adjacent to any swages or thimbles.

Where the term “excessive wear” of metal components is used in these guidelines, this means wear that has caused more than just the removal of the metal’s protective coating. That is, wear that results in the physical reduction of the diameter of a bolt or the reduction of the thickness of any metal fitting.

Where any cracks or excessive corrosion are detected in a bolt or metal fitting, the component should be replaced. Minor corrosion of a bolt or metal component should be removed and steps should be taken to prevent corrosion recurring.

**Note:** Where an inspector or owner is uncertain as to the need to replace any component, it is recommended to err on the side of caution, and have the component replaced.

## SECTION 1: AIRCRAFT AND OWNER DETAILS

Complete all aircraft and owner details on the Report form, including the registration number. Refer to serial numbers stamped on the engine, base and wing and enter these numbers on the Report form.

Note that the propeller information is only required where the propeller is non-standard.

If an additional wing is used with the trike base, attach a separate Report form for each additional wing.

**Note**: Check compliance: i.e. Wing/Base combination iaw Airborne SB-018

**LSA aircraft** - Check compliance with Aircraft Certification document i.e. Modifications

## SECTION 2: GENERAL

### 2.1 Log book entries checked

Inspect the aircraft log book for details of maintenance, repairs, modifications and accidents. Ensure all maintenance has been carried out in accordance with Section 9.7.7 of the HGFA Operations Manual

### 2.2 Placards checked

Ensure that all required placards as required by the Aircraft Flight Manual are fitted and legible.

### 2.3 Modification compliance (LSA)

The Aircraft must comply with the Certification document. **Any** deviation from this would be deemed as a Modification.

**Any** modification must have written approval from the Aircraft Manufacturer which must be kept with the Aircraft Logbook.

## SECTION 3: TRIKE BASE STRUCTURE

### 3.1 Base tube/s

Check that the base tube is true and that there are no signs of stressing - usually indicated by whitening or crazing of the anodising. Drilled holes should not show evidence of excessive elongation. Look for cracks emanating from drilled holes and the seat-frame lower attachments. Examine the deflexor-wire, if fitted, for correct tension and that the turn buckle is in safety and locked.

### 3.2 Mast tube/s

Check that the mast tube/s are true and that there are no signs of stressing - usually indicated by whitening or crazing of the anodising - particularly about the seat frame abutment and the engine mountings. Drilled holes should not show evidence of excessive elongation or play between the mast or hang point re-enforcement. Examine mast backup cable especially around lower attachment.

### 3.3 Front strut

Check that the front strut (front mast brace) is true, and that there are no signs of stressing usually indicated by whitening or crazing of the anodising. Drilled holes should not show evidence of excessive elongation and there should be no play between components in a multi-tube front strut. Excessive scoring between the front strut and the control frame can occur. Ensure that the owner is aware of the need to fit a sacrificial material to the strut to prevent light scoring from accelerating. Carefully examine the front-strut attachment lugs for signs of cracking and wear.

### 3.4 Undercarriage

Examine the undercarriage for excessive play and wear. Check that all undercarriage tubes are true and that there are no signs of stressing - usually indicated by whitening or crazing of the anodising. Drilled holes should not show evidence of excessive elongation or wear. Pay particular attention to the attachment areas and the axle connections.

### 3.5 Seat frame

Examine the seat frame for excessive inward bowing and compression of the bend radii – an indication of an accident or heavy landing. Examine the seat frame for cracks especially around the bend radii and the seat frame attachments. Inspect the seat attachments for distortion and correct assembly.

### 3.6 Seat harnesses, buckles, and seat fabric

Examine the seat harnesses and seat fabric, ensure that all attachments are serviceable and that the seat harness can be released under load. Seat harnesses must not be "roped up" but should lay flat across the occupants' lap. Examine the stitching and look for signs of fraying or abrasion. Ensure that the seat harnesses are not contaminated with oil or fuel and that they are correctly routed. Examine the seat rear pockets for holes or defective zips.

### 3.7 Steering head and front forks

Examine the steering head/s to ensure that they operate smoothly, in the correct sense and that excessive play is not apparent. Ensure that the front forks are straight and that the axle holes are not excessively worn. Suspension springs, if fitted, must not be worn or elongated.

### 3.8 Hang point attachments

Examine the hang point attachments for signs of stressing - usually indicated by whitening or crazing of the anodising; and that drilled holes do not show evidence of excessive elongation. Check that there is no play between the hang bolt bush and the mast attachment. Look for cracks and signs of damage, especially on abutment faces. (Hang bolts should be replaced in accordance with the Aircraft Manufacturer's requirements)

### 3.9 Engine mounts, including wires

Examine the engine mounting for cracks and distortion. Ensure that there is no excessive play between the mounting and the airframe structure and that all cable supports are serviceable and free from wear.

### 3.10 Drag links and bracing tubes

Examine the drag links for signs of stressing - usually indicated by whitening or crazing of the anodising - and that drilled holes do not show evidence of excessive elongation and that the undercarriage is firmly supported and not free to move. Look for cracks around drilled holes and attachment lugs. Ensure that the tubes are not bent or badly abraded around the attachment lugs. Examine the attachment lugs for splaying out.

### 3.11 Undercarriage wires

Examine the undercarriage wires for signs of elongation and fraying, particularly at the thimble ends. Mast to undercarriage support wires should be tight with the trike unit fully rigged - retention wires if needed. Examine any light weight tensioners for wear and cracking.

### 3.12 Wheels, tyres and brakes

Examine wheel assemblies for cracks and the axles for end-float. Check tyre pressures, creep marks and tyre tread. Examine the tyres for cuts, splits, bulges and signs of perishing. Ensure that brakes are correctly adjusted and operating correctly - ensure front wheel brake skids, if fitted, are not damaged or are not likely to cause damage to the contact area on the tyre.

### 3.13 Brackets, plates and joint assemblies

Examine all brackets, plates and joint assemblies for correct assembly, cracks, distortion, hole elongation, security and locking.

### 3.14 Bolts, nuts, washers, pip pins, pop rivets

Ensure all bolts are serviceable and free from corrosion. Bolts must not be taking the load across the threads. Examine nuts for security and locking. Bolts that are subject to rotation must be positively locked. Examine all rivets for looseness and signs of dissimilar metal corrosion around their heads. All nuts should have washers and pip pins should be a flush fit. Bolt threads must protrude at least 1½ threads through the nut. Look for signs of overtightening, usually seen by crushing of tube walls. Check that nuts are not thread bound (over tightening nuts to the end of the thread can cause bolt failure).

### 3.15 Pod, spats, fairings and fabric skirts

Examine the pods, spats and fairings for crack, delamination, damage and security - if fitted. Examine fabric skirts for wear and security, security cords must not have excessive amounts of spur end - this could be ingested into the fan. Pay particular attention to drilled holes in fibreglass, as these readily crack.

### 3.16 Instruments and electric

Check that all mandatory instruments are fitted and are working. Electrical cables must be secure and fuses must be fitted to all independent circuits. Examine cable terminations for signs of over/under-crimping, or signs of overheating. Cables should be secured with ties, cleats or fairleads; not insulation tape! Any circuit breakers should be functionally checked.

## SECTION 4: POWER UNITS / PROPELLER

### 4.1 Engine and attachments

Ensure that the engine is securely mounted and that the mounting bolts are not excessively corroded. Check engine for damage and leaks as well as vibration chaffing.

### 4.2 Flexible mountings

Ensure that all flexible mountings are serviceable and not perished. Examine for distortion and permanent set. Pay particular attention to the mounting safety washers, contact between the washers and the mountings attachment bolts are a positive indication of heavy landings.

### 4.3 Exhaust system, silencer and supports

Examine the exhaust for cracks, loose baffles, leaks and general security. Check that securing springs are not worn or stretched. Ensure that exhaust spring safety wires are loose and do not restrict the spring operations. Check that ball joints are free to move and are lubricated with anti-seize grease.

**4.4 Cooling system (including radiator mounting, radiator core, cap and hoses)**

Examine radiator mounting for security; examine radiator core for any signs of excessive corrosion; check that the radiator cap is sealing; and inspect hoses for degradation or perishing. Ensure that the hoses are free of kinks that may impede coolant flow. Check fan and fan belt (where fitted) for adjustment and condition.

**4.5 Gearbox / reduction drive**

Examine the gearbox/reduction drive for security. Belt reduction drives should be checked for wear on the gears and belt as well as for belt tension. Examine the reduction gear – if fitted - mounting bolts for security and locking. Look for cracks and signs of mechanical contact between surfaces.

**4.6 Rotary valve lubrication reservoir**

Check rotary valve oil for contamination and replace if necessary. Milkiness in the oil indicates seal problems.

**4.7 Prop-shaft, flanges, bearings, gears and bolts**

Examine the propeller shaft, flanges, bearings and a gear for wear, damage, corrosion and cracks. Ensure that all bolts are correctly secured and free from corrosion.

**4.8 Propeller**

Examine the propeller for cracks, chips and loose or cracked tape. Cracked tape should be replaced. Check propellers for delamination and that the propeller is the correct type, diameter and pitch. Ensure that all bolts are correctly secured and that the propeller bosses are not over-tightened. Check propeller tracking (propeller run-out should not exceed 3mm).

**4.9 Fuel tank, cap and vent**

Examine the fuel tank/s for leaks and security. Check that the vent is functioning and that drip tray drains, fitted on tanks mounted above the engine are clear.

**4.10 Fuel lines, filter, fuel cock, and pump**

Ensure that all fuel lines and pulse lines (fuel line vacuum hoses) are serviceable, the fuel filter/s are clean, and that the pump vent is clear. Ensure that the fuel tap can be operated and that the placards are fitted. Fuel lines showing signs of cracking or hardening should be replaced. Check that the fuel pump has been overhauled or replaced as recommended.

**4.11 Carburettor, air induction filter, security**

Check the carburettor/s for wear and damage especially around the flexible mountings. Examine the needle/s for signs of wear. Ensure air-filter/s are secure, clean and undamaged.

**4.12 Engine controls (power, choke, mixture)**

Ensure that all controls work in the correct sense and that controls do not lock when operated together. Examine all control runs for wear, kinks and signs of corrosion. Ensure that all controls that are friction set are not prone to slippage. Examine the splitter box – if fitted - is secured.

**4.13 Engine Ground Run**

Ground run the aircraft to ensure that there are no unusual sounds or vibrations and that the engine appears to be operating smoothly up to 3/4 power. Check that dual ignition systems are operational.

**4.14 Starting system**

Ensure that the starter system is operating smoothly and that the cord is routed correctly and undamaged. For electric starting systems refer to the Owner's Manual.

**4.15 Electrical system, charging/low-tension, lights and fuses**

Examine as far as possible all electrical cables, lights and fuses.

**4.16 Ignition, switches, contact breakers, plugs, leads**

Check that the ignition switches are serviced as desired and that they operate correctly. Remove and examine the spark plugs for correct grade, gap and condition. Examine high tension leads for wear and caps for security.

Ensure that inverted engines have suppressor cap safety ties to prevent the suppressor caps unseating from the spark plugs.

**4.17 Compression test**

2-stroke engines: Conduct a compression test iaw Manufacturer's requirements.
- ensuring the ignition is off! Record the results on the Report form.

4-stroke engines: Conduct a differential pressure test iaw Manufacturer's requirements and record the results on the Report form.

**4.18 Cyclone Bearing Test**

Using a cyclone bearing tester, test wear by rotating piston to T.D.C. and measure end play. Bearings should be replaced when play reaches recommended service limit (eg. Rotax 582 = .083 mm maximum play).

## SECTION 5: WING STRUCTURE

### 5.1 Leading edges. (including sleeves)

Examine the leading edges for signs of stressing - usually indicated by whitening or crazing of the anodising - and that drilled holes do not show evidence of excessive elongation and that they are straight without dents of any sort. Check that there is no play between the leading edges and sleeves.

### 5.2 Cross-tubes. (including abutment)

Examine the cross-tubes for signs of stressing - usually indicated by whitening or crazing of the anodising - and that drilled holes do not show evidence of excessive elongation and that they are straight and that there are no dents of any sort. Examine the attachments for cracks and correct assembly. Examine the cross tube plates for distortion and that the tension cable and back-up cables are serviceable.

### 5.3 Keel (and bowsprit)

Examine the keel and bowsprit for signs of stressing - usually indicated by whitening or crazing of the anodising - and that drilled holes do not show evidence of excessive elongation and that they are straight and that there are no dents of any sort. Check that there is no play between the keel and other airframe members. Examine the attachments for cracks and correct assembly. Pay particular attention to the hang point, nose, and king post attachments.

### 5.4 Control Frame

Examine the control frame for signs of stress especially around the attachment holes. Examine the control frame for bowing, and for wear or elongation of the drilled holes. Ensure that attachment bolts are not worn or corroded. Examine attachment brackets for cracks or damage.

### 5.5 King-post

Examine the king post for compression damage or bending. Examine the drilled holes for elongation or signs of stress.

### 5.6 Special airframe members

Examine any special airframe member, i.e. tip sticks, washout rods, etc. for damage, cracks or signs of stress.

### 5.7 Wing battens

Examine the wing battens for damage and kinks, check battens against the batten profile – do not adjust to standard trim if battens are inside the manufactures' limits! If the amount of camber in one or two tip batons varies from one wing to the other, it is possible that this may have been intentionally done to correct a slight turn in the wing. This should be noted on the baton profile for further reference.

### 5.8 Nose plates

Examine the nose plate assembly for cracks and distortion. Examine drilled holes for elongation and signs of stress.

### 5.9 Hang point

Examine hang point attachments for distortion, cracks or elongation around holes. Look for signs of stressing and note the hang point position. Pay particular attention to all bolts and examine the thrust washers - if fitted - for wear. Ensure that all pip pins safety rings are tie wrapped.

## SECTION 6: RIGGING

### 6.1 Cables, thimbles and swages

Examine cables for looseness, wear, and stretching of the thimbles. Look for broken strands and signs of corrosion - usually seen as bulges in the cables or outer covering. Ensure that swages appear correctly formed and that the cables are not damaged where it enters the swage. Ensure that the cables have not been restricted in their movement by over-tightening of the cable attachment bolts. Ensure that any corrosion is within the Manufacturer's limits.

### 6.2 Nuts, bolts and washers

All bolts on the wing must be aircraft quality. Ensure that bolts are not waisted, corroded or installed so that the threads take the load. All bolts that are subject to rotation must be positively locked. Bolt threads must protrude at least 1½ threads through the nut. Ensure all bolts are secure and that washers are fitted under each nut.

### 6.3 Swan Catch

Examine the swan catch for wear on the tang, and signs of stressing or elongation. Ensure that the drilled holes are not elongated and that the buckles are securely locked.

### 6.4 Tangs, turnbuckles, toggles and clamps

Examine tangs, toggles and clamps for excessive wear and ensure that turnbuckles are in safety and locked.

## SECTION 7: SAIL

### 7.1 Stitching

Examine the stitching for signs of ageing or degradation. Ensure that the stitching can withstand a moderate amount of abrasion without failure. Pay particular attention to the keel pocket, leading edge attachments and areas of re-enforcement. Any broken or loose stitching must be repaired.

### 7.2 Damage

Look for signs of damage and inadequate repairs to the sail cloth. Homemade repairs to the trailing edge are unacceptable.

### 7.3 Degradation (Bettsometer)

Test the sail cloth with a Bettsometer, iaw Aircraft Manufacturer's instructions (normally 1360 grams but **always refer to the Aircraft Manual**)

Remember that it is a test and once the desired figure is reached do not continue to exert further pressure. Sails should be tested with the sail tension applied. A Bettsometer may be borrowed from the HGFA Office. A sail that fails the Bettsometer test must be replaced.

### 7.4 Discolouration

Look for discolouration. Test such areas with the Bettsometer to ascertain its strength.

### 7.5 Batten pockets

Examine batten pocket stitching. Look for holes in the pocket that would allow the batten to rotate or be incorrectly fitted. Ensure that all bungie cords are correctly tensioned and terminate in a reef knot.

### 7.6 Keel Pocket

Examine the keel pocket for damage, discolouration, or frayed stitching.

### 7.7 Sail attachments

Examine all sail attachments for wear, ageing, corrosion and distortion. Examine any "D" rings for corrosion, distortion or wear.

## SECTION 8: SYMMETRY AND RIGGING

### 8.1 General rigging

Examine the rigging of the aircraft, any difficulty in rigging must be investigated to ascertain whether or not the aircraft is incorrectly assembled or adjusted.

### 8.2 Symmetry when rigged

Check that the symmetry of the aircraft appears normal, and that the aircraft has no noticeable leans or differing washout.

### 8.3 Security of fasteners

Ensure that all the fasteners are fitted and in good condition.

### 8.4 Level of corrosion

Record the overall level of corrosion on the Report form.

## SECTION 9: AIRCRAFT INFORMATION

### 9.1 Accidents logged

Check that any accidents and any heavy landing checks have been recorded in the Aircraft Logbook

### 9.2 Repairs logged

Ensure that any repairs evident have been recorded in the relevant logbook.

### 9.3 Scheduled Servicing logged

Each scheduled servicing for trike base, engine and wing must be recorded in the relevant logbook. For Rotax engines, the servicing schedule should be printed and signed for each maintenance event and kept with the Engine Logbook.

### 9.3 Modifications logged

Ensure that all modifications are recorded in the relevant logbook. Additionally, ensure that the logbook contains any written approvals for major modifications

### 9.6 Mandatory Service Bulletins logged

Ensure that any Mandatory Service Bulletins have been recorded in the relevant logbook.

**9.4 Engine hours and condition of Engine**

Record the total Engine hours and circle what you judge to be the overall condition of the engine: Fair, Good or Excellent.

**9.5 Airframe hours and condition of Airframe**

Record the total Airframe hours and circle the overall condition of the Airframe.

**9.5 Wing hours and condition of Wing**

Record the total Airframe hours and circle the overall condition of the Wing.

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***Note:*** *Although these guidelines may appear to list all the necessary information needed to carry out a two-yearly aircraft inspection, it must be remembered that this schedule is generic and can only be used as a guide. Each type-approved aircraft has an Aircraft Manual which should be used when carrying out aircraft inspections. This booklet is written to complement the HGFA Weightshift Microlight Inspection Report, and to expand upon the headings listed on that form.*

*If any HGFA member wishes to make suggestions for improvement to these guidelines, please contact the HGFA Operations Manager. Any input or suggestions will be gratefully appreciated.*

**The development of these guidelines and the HGFA Weightshift Microlight Inspection Report have been made possible with the generous assistance of the British Microlight Aircraft Association.**