22. Preparing for Flight

Rig the aeroplane ready to fly.

22.1 Airframe

22.1.1 Dihedral and washout

The following specifications are intended as a rough indication of the correctness of the alignment of the wings. Unless there is a noticeable deviation from these, such as the presence of anhedral or wash-in, any concerns will be addressed at the test flying stage where the use of different-length lift-strut end-fittings can be used to adjust the wing alignment.

a) The dihedral should be around 1.2° per wing: a straight line between centre of the leading edge tubes at the wing tips should be around 10cm above the same position at the centre of the cabin.

b) The washout should be around 1° at the wing tips compared to the wing roots: this corresponds to a twist upwards of around 2cm of the height of the trailing edge over the chord of the wing, from root to tip.

If this is grossly wrong it is likely that the internal bracing cables are not taught. If either cable is loose the turnbuckle should be tightened. If one of the cables remains slack whilst the other is tight it may be that the covering is not properly seated on the leading edge, requiring removal of the wing covering and refitting as per the instructions.

22.1.2 Jury struts

Figure 346; jury struts.

a) With the wing properly mounted and aligned, the jury struts can be made to fit.

Do not fit the jury struts before the aircraft is completed, as this will change the required lengths significantly and cause the lift struts to be pulled out of alignment.

b) Check that the upper mounting brackets are long side downwards, Fig 324.

c) The jury strut components are of differing lengths. Determine the correct tubes for each position.

d) The horizontal bracing strut should be cut to length, drilled and fitted to the lift struts, Figure.

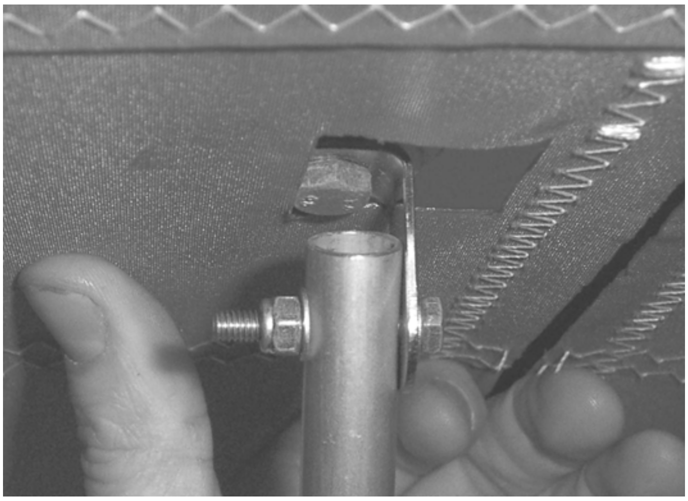

Figure 347; jury strut upper bracket, fuselage to left of picture.

e) Ensure that the horizontal brace is not being bent into a curve by misalignment of the lift struts.

If necessary the stainless-steel lift strut end fittings may be tweaked slightly.

f) Then cut, drill and fit the front and rear jury struts.

Ensure that they fit properly, without pushing or pulling the lift struts out of line. The ends of the tubes will need to be filed to clear their mounting bolts as required.

The tubes should be on the inboard side of the brackets.

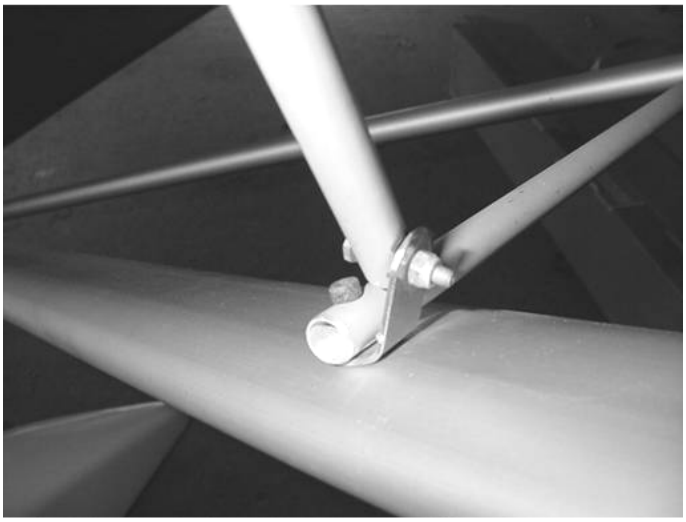

Figure 348; jury strut to lift strut attachment, fuselage to left of picture.

22.1.3 Aerofoil Jury struts

Aerofoil Jury struts are available as an option and are the required fit for the Skyranger Swift approved build standard.

a) Check that the eyebolt attachment in the wings are aligned fore and aft. Rotate if necessary

b) Loosely fit the lower U brackets to the wing lift struts. The horizontal bracing strut should be cut to length, drilled and fitted to the lift struts, with its ends flush with the ends of the brackets.

   The front bracket is the one that leans forwards. The rear bracket is more upright. The rear bracket is not symmetrical however and has the edge most upright to the front.

c) Fit the horizontal brace and U brackets as shown, with a thin plastic washer between the U bracket and the lift strut.

d) Fit the Jury struts and bolt them into position. The lower fitting uses a 4mm bolt. The upper fitting has a rubber grommet fitted to the eyebolt to prevent lateral movement, and the Jury strut fits over this. It is then fixed with a 4mm bolt and aluminium spacer over the bolt. Washers should be used both under the head of the bolt and under the nut.

Fig 349; Aerofoil jury strut overview

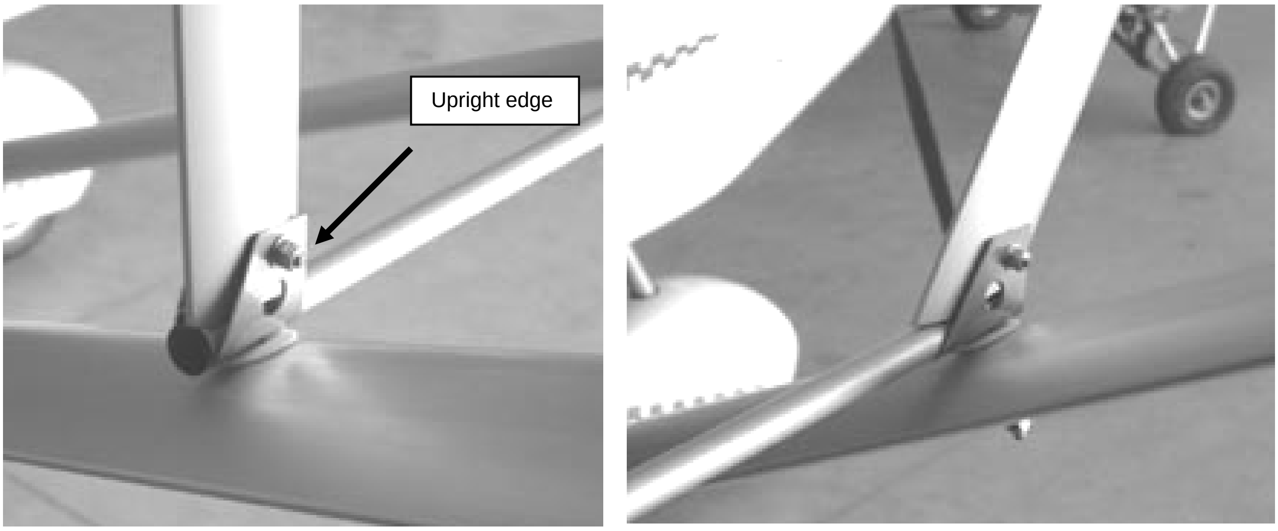

Fig 350; Rear and front lower fittings. Note orientation (looking from rear)

Fig 351; Rear and front upper fittings.

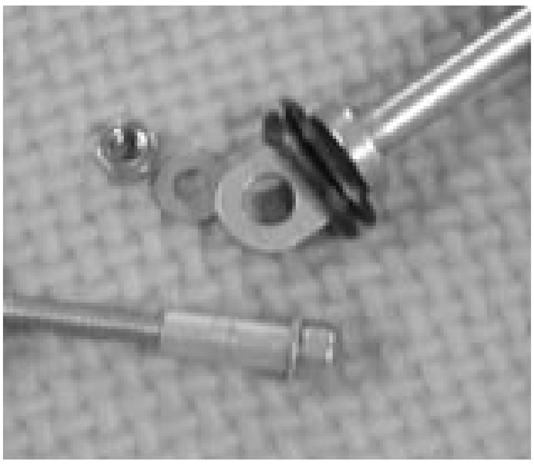

Fig 352; Upper fixing hardware. Note position of rubber grommet

22.1.4 General checks

a) Check that all nuts and bolts are properly tightened and threadlocked.

b) Check that all bolts subject to rotation in use are correctly split-pinned.

c) Check that all electrical connections are properly made, with no risk of short-circuiting.

d) Check that all fuel, oil, and water pipe clips and other connections are properly tightened and sealed.

22.2 Baggage Bag

a) Loop the rear securing straps around the base of the rear fuselage bracing frame at its lower corners, with the buckle towards the fuel tanks.

The strap should loop around the back of all the tubes.

Figure 353; rear securing strap.

b) Pass the upper securing straps around the upper rear fuselage tubes above, but not around, the turnbuckles.

The straps will have to be slid back down the tubes for them to reach.

c) Burn a hole through each strap where the Velcro is, and secure with small pan-head bolts, with the pan-head towards the tube.

Figure 354; upper securing strap with Velcro and bolt.

d) Burn holes in the lower Velcro straps and secure with small pan-head bolts.

e) Connect the lower straps to the rear securing straps using the click-in buckle.

Note that the lower fixing do not go around the rear cabin uprights TU6. The baggage bag should be free to move upwards and backwards or access to the fuel tank fillers will be restricted.

22.3 Controls

a) Mount all the control surfaces and secure with split pins, unless further transportation is to occur.

b) Check the full and free movement, in the correct sense, of all combinations of the controls.

c) Check the neutral positions of the flaps and their operation.

The flaps should be set with the centre of their trailing edges 5cm below the level of the rear fuselage covering.

Put some prop tape around the flap pushrods where they rub against the fuselage covering surrounding their exit holes.

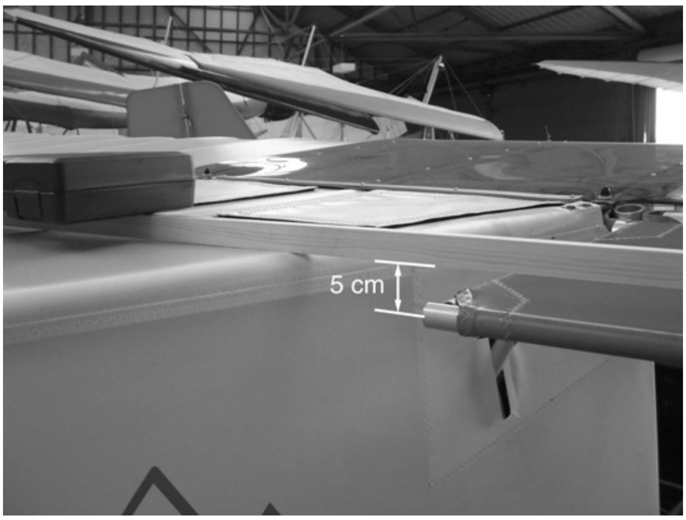

Figure 355; flap neutral setting.

d) Check the neutral positions and operation of the ailerons.

Ensure that the stick is kept central whilst adjusting the ailerons.

The ailerons should be set with their trailing edges level with those of the flaps.

Check that the aileron upward movements are around 25° using a protractor. The downwards movement is less, due to the differential built into the system.

If necessary, restrict the movement by increasing the diameter of the stops at the torque-tube horn, using tape around the tube to pad-out the stops.

e) Check the tension in the aileron cables.

Pulling the overhead cable rearwards to contact the wing covering tensioner tubes should require a pull of 3kg, plus or minus about 0.3kg. This will result in the overhead cable resting on the tubes in the wing roots, but being clear of the tubes at the jury strut attachment locations. Tension will be felt as the cable is pulled rearwards to around the location of the colour change on the wing upper-surface.

f) If there is any remaining friction in the aileron control circuit, the fit of the aileron hinges must be checked.

The ailerons should drop freely under their own weight with the cables detached. If any friction is felt then remove the aileron eyebolt hinges and file the holes in the aileron leading edges until the ailerons move freely. This will greatly improve the feel of the aileron controls.

A very small touch of oil on the hinges works wonders, but not too much otherwise it will stain the coverings where it blows off.

g) Ensure that the tubes which the aileron cables touch are protected by oversized pieces of prop tape or similar.

h) Check the neutral position and operation of the elevator.

The elevator should be horizontal with the stick at 90° to the central cabin tubes, not vertical.

Elevator movement should be 25° each way. If necessary file the stop positions on the stick pivot piece to increase movement.

i) Ensure the rudder-stop cables have been properly crimped and fitted.

j) Check the neutral position and operation of the rudder and nose-wheel.

With the rudder straight, the nose-wheel should be straight. Rudder movement should be 25° each way. Nose-wheel movement should be symmetrical each way.

k) Wire-lock all turnbuckles.

l) Check the correct operation of the brakes.

22.4 Powerplant

22.4.1 Fuel tank calibration

a) Put a small quantity of fuel into the tanks.

b) Drain the fuel through the fuel pickup connection.

Any remaining fuel is roughly the unusable fuel, although it will be affected slightly by the flying attitude.

c) Add measured quantities of fuel into the tanks, marking the side of the tanks at 5 litre intervals, starting from zero at the unusable fuel level.

Allow time for the tank levels to balance before marking each level. This can take a few minutes.

22.4.2 Propeller pitch

Assemble and fit the propeller following the instructions supplied with the propeller.

Set the propeller pitch to that specified in the HADS for your propeller.

Note that some installations are defined on a max static RPM (5000RPM for 912 and 912S installations using the Kiev prop 273 and 283 respectively). This means that once the engine has had its initial run up the propeller pitch may have to be finely adjusted to accurately achieve this. If the RPM is a long way out when the prop is set on its recommended starting pitch, then the RPM guage may not be indicating accurately and may need calibrating with an optical tachometer (your inspector or local engine service facility should have one).

22.4.3 Engine run-up

Read the engine manual for procedures relating to the first operation of the engine, and subsequent running-in. Follow all requirements for engine and gearbox oil, coolant mix etc. .

It may be advisable to tie the aircraft to a solid structure before any engine power tests, rather than relying on the brakes, particularly on wet grass.

Carburettor balancing on the Rotax engines may be set approximately by comparing the movements of the throttle levers on the carburettors, however for best results the balance should be set by a Rotax engineer familiar with vacuum-gauge balancing.

The Engine Installation Checklist will have to be completed with the assistance of your Inspector.

22.4.4.Throttle Friction

This is adjusted using the two nuts at the port end of the throttle lever torque tube. Set enough friction by tightening the inboard nut to prevent the throttles from vibrating open or closed, then lock this setting with the second nut. Do not set any friction at all on the starboard end of the torque tube.

22.4.5 912 Idle Adjustment

The throttles on the 912 engines are sprung to the open position and rely on the cables being pulled taught to achieve the idle setting.

To get a reliable idle setting first loosen the idle adjustment screw(s) on the carburettor(s). Set the idle with the throttle levers against the stops in the cabin, by adjustment of the cables at the carburettor. When this is complete, screw the idle adjusters on the carburettor(s) until they nearly, or only just, touch the throttles.

If your engine idles with the lever held rearwards, but the RPM springs up significantly when it is released, then the setup is not correct. The most likely causes are:

1. Carburettor levers touching the stops on carbs before the throttle lever touches its stop.
2. Insufficient throttle lever friction.
3. Too much throttle lever friction (causes a ‘stepped’ opening and closing)
4. Firewall flexing where cables outers attach. *In this case either reposition the cable guides closer to the edge where it meets the cowling, or make up a bracing strut to stiffen it (this can come forwards at an angle and attach to the cabin upright tube)*

22.4 6 Fuel flow measurement

This should be performed with the help of your inspector who should have suitable equipment or access to such. Connect a T-piece into the fuel line near the carburettor(s). Connect this to a fuel pressure gauge and a fuel tap, using a length of pipe long enough to reach back into the cockpit.

The fuel flow rate may then be measured: run the engine at full power (aircraft will need stoutly securing for this – and mind the propwash doesn't do any damage to aircraft or objects behind!) with the end of the fuel pipe pointed into a measuring jug in the cockpit, open the tap until the fuel pressure drops to no less than the minimum specified in the engine instructions; measure the time required to bleed off 1 litre of fuel into the measuring jug. Note 1 bar = 100kPa = 15psi roughly.

The excess fuel flow rate is calculated by dividing 3600 seconds by the number of seconds taken for 1 litre. This is required to be greater than 25% of the full power fuel consumption, typically 20-30 litres per hour depending on engine type. Therefore an excess fuel flow rate around 5 litres per hour or greater is required. Much greater flow rates than this minimum are normally found.

An alternative method is to arrange a separate fuel tank to supply the engine by gravity feed, whilst measuring the amount of fuel the pump supplies into a measuring jug beneath the aircraft (use an extension tube on the fuel line, don't try to hit the bucket from the engine!). This then gives the entire fuel flow rate, which must be greater than 125% of the full power fuel flow rate.

22.5 Weight and Balance

A weight and balance spreadsheet is included on the CD to assist you.

The aircraft will have to be weighed with the assistance of your Inspector, using the information given in the HADS. Note that the weighing attitude is critical on a tall aircraft like the Skyranger, and that bathroom scales are notoriously inaccurate. Typical weights are around 255kg for a four-stroke example with typical level of equipement, give-or-take 5kg or so.

Due to the seat weight limits and fuel capacity being greater than the minimums required, plus the option of the baggage bag, the weight and balance spreadsheet is likely to show CG limits being exceeded at loads considerably above the 450kg MTOW. To resolve this the BMAA technical office has suggested that the max seat loads entered on the spreadsheet are reduced from their 120kg per seat value until the CG is within limits. This does not affect the actual max seat load, but note that the 450kg MTOW must be complied with to automatically guarantee that the CG remains within limits.

22.6 Placards

A number of items require placards as listed in the HADS. A generic placard sheet is supplied including a cable-crossing placard. Apply this to the front vertical tube in sight of the pilots, to show the required crossing of the aileron cables. Do not omit this placard, miss-rigged controls are a common but avoidable problem on any aircraft, and have potentially fatal consequences.

For any other placards, a PC can be used to create and print them out onto paper. Then cover them in an oversize piece of Fablon or similar to hold them in place, this is simple and works well. Alternatively printable adhesive film is available from some computer and office suppliers.

A number of the placards require information gathered during test flying, and so must await its completion.

22.7 Test Flying

22.7.1 Paperwork

a) See the section on the BMAA homebuilt system at the beginning of this manual.

b) Register the aircraft with the CAA and fit registration letters.

c) In case of queries with these BMAA administered procedures, ask your inspector and/or the BMAA.

d) Read the Pilot’s notes.

e) Ensure that all paperwork is complete. In particular the AW029 needs to be signed by the BMAA Chief Technical Officer and then finally by your inspector. Check that the airfield you intend to fly from has been approved on the form, and that you and the test pilot at least are named on the form

22.7.2 Flight Test Day

With all the paperwork completed the day of the test flight will come!

Test flying any newly constructed aeroplane is a serious business, and should be accomplished with the likelihood of possible emergencies as the major consideration. For this reason the airfield used for test flying should be of generous proportions.

As a guide the field should have a useable runway length of at least 400M without obstructions like wires or buildings on approach or climb-out within another 200M. Surrounding terrain should be such that options exist for all stages of initial climb to altitude to land successfully in the event of an emergency.

It may be tempting to ask the test pilot to fly the aeroplane from the small strip where it has been constructed, and will be based, which may not be ideal for test flying. Please do not put them in the awkward position of having to refuse. The inconvenience of moving the aeroplane to a suitable test flying location is far less than the inconvenience of a rebuild!

A windsock and fire extinguisher on site are essential items. A device for measuring windspeed is desirable.

Some of the test flying will be involved with sorting out a few final adjustments, so make sure you take to the field the following items:

The +5mm lift strut end (the extra one lying at the bottom of your pile of leftover parts!).

Lockwire, lockwire pliers and side-cutter pliers.

General tools (Screwdrivers, spanners etc.)

Propeller pitch setting tool

Fuel, in cans to allow choice of fuel load to vary CG position

Some spare hardware – split pins, nyloc nuts etc.

All 450kg of associated paperwork!

Refer back to section 1.2 for more information on the paperwork and test flying procedure.

And finally, don't forget your camera to record the moment!

Happy Flying!

23 Additional Information

23.1 Example BMAA Homebuilt Registration Form

BMAA - DETAILS OF HOMEBUILT AIRCRAFT PROJECT

BMAA / HB /

Homebuilt number will be allocated by the BMAA, and will become the aircraft serial number.

Introduction

This form is designed to declare the details of a homebuilt aircraft project to the BMAA.It does not take the place of any other reports that may be requested by the BMAA Chief Technical Officer but is essential to clearly shown what the planned project is and the source of main parts to be used. Where information is not available or irrelevant leave blank - the BMAA will correspond with you if this data is essential. BMAA will not accept registration of a project until it has been proven a viable microlight aeroplane, if in doubt, check!

1. Description

(a) Type:	(b) Registration:	(c) Plans or kit No:
SKYRANGER (UK)	G-SKYR	UK/400

If any configuration changes are planned which are not on a currently approved aircraft, please detail this on a separate sheet. There is no extra charge for changes to configuration but please inform the BMAA at the outset wherever possible.

2. Intended Power plant

(a) Engine type / model: ROTAX 912 UL		Upright ☐ Inverted ☐ Horizontal ☑ Radial ☐ Other ☐ (specify):	
(b) No. Cylinders: 4	(c) 2 stroke / 4 stroke: FOUR STROKE	(d) Capacity / hp 1211.2 CM³ / 81 HP	
(e) Exhaust: ROTAX	(f) Intake system: STANDARD / AIR FILTERS	(g) Gearing System and ratio: INTEGRAL GEARBOX 2.27:1	
(h) Propeller Type: KIEV 263/1700	(i) No. blades: 3	(j) Diameter: 180 CM	(k) Pitch: (if known) 24° @ 35cm
(l) Source and any history of engine: NEW			

If an unorthodox engine (e.g. jet, rotary or diesel) is to be used, please describe on a separate sheet(s). BMAA may request detailed further information for any engine or propeller type not previously cleared.

2. Fuel System

(a) Fuel Tank(s) Source / location / type(s):	(b) Fuel Pumping method(s)
STANDARD SKYRANGER KIT	ENGINE DRIVEN PUMP - STANDARD 912

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4. Wings

(a) Covering material:	(b) Supplier:	(c) Fabric colour(s)
STANDARD SKYRANGER KIT, DACRON		RED / WHITE

5. Wheels

Mainwheel type:	Size:	Supplier:
STANDARD SKYRANGER KIT		
Nose / tailwheel / skid type:	Size:	Supplier:
Brakes type, source and description:		

6. Owner / Builder's Details

Name: JOE BLOGGS	BMAA No: 0001	Home tel: 02222 33333 Work tel:
Correspondence address: SKYRANGER HOUSE, WINGTIP CLOSE, FLOORVILLE,		
Build location: HOME / GARAGE		

☑ **I would like to receive a form BMAA/AW/036 Hardback Aircraft and Engine Logbook (£14)**

7. Nominated Senior of Homebuilt Inspector's Details

Inspector must sign below to confirm that they are prepared to inspect this project and have inspected and consider satisfactory the build location / workshop facilities. This must be an inspector approved by the BMAA Chief Inspector, who expects to be able to take-on supervision the entire project.

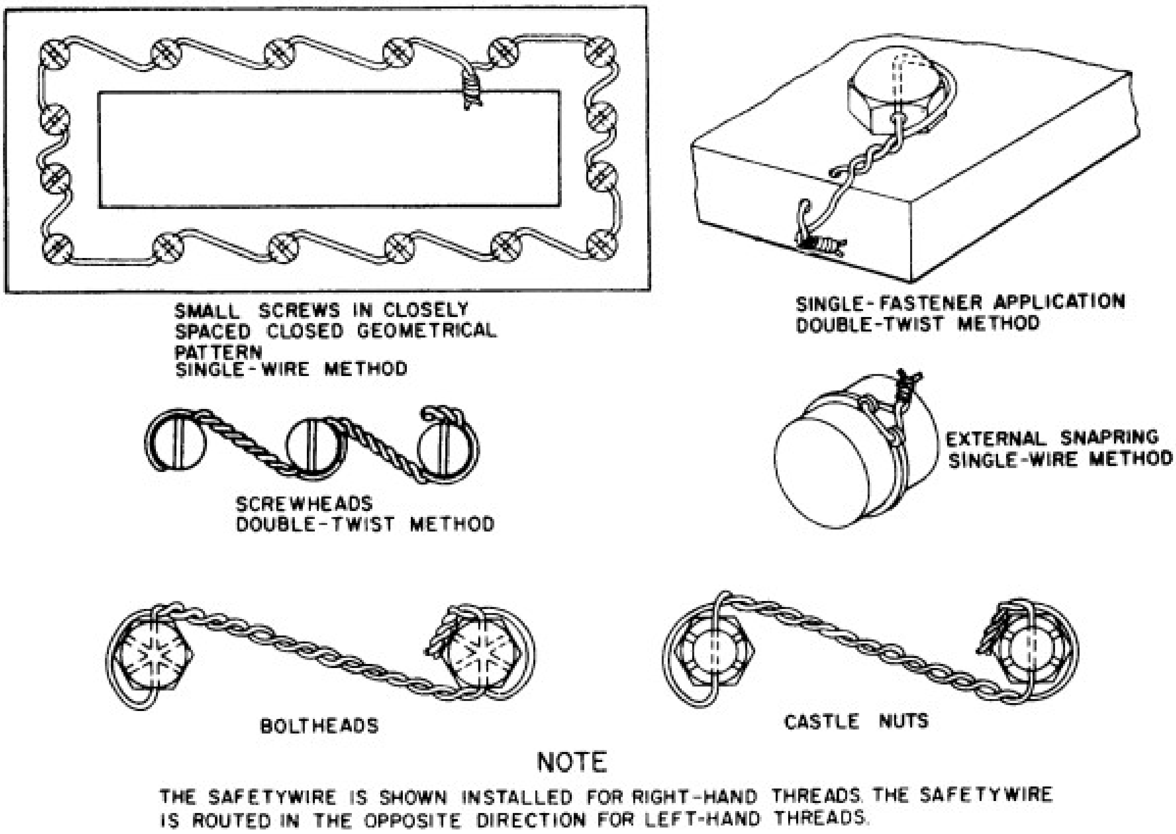
Name: GREASY JOE	BMAA No: 0002 Insp No: 0001	Home tel: 0101 2222 Work tel:
Correspondence Address THE CARAVAN, BACK OF HANGER, WINDY MEADOWS AIRFIELD, NORTHANTS		

8. Checklist

(a)	Form fully completed and signed	✓
(b)	Certificate of conformity (required for registration of series kits)	✓
(c)	Copy of engine certificate of conformity (can be supplied later)	✓
(d)	Copy of propeller certificate of conformity (can be supplied later)	✓
(e)	Cheque for £30 (or £44 if you require an aircraft logbook) payable to BMAA	✓

Inspector's signature:	Date: 22/2/03	Owner's signature:	Date: 22/2/03

23.2 Wire-locking



Section 2. SAFETY METHODS FOR TURNBUCKLES

212. GENERAL. Safety all turnbuckles with safety wire using either the double or single wrap method, or with any appropriately approved special safetying device complying with the requirements of FAA Technical Standard Order TSO–C21. The swaged and unswaged turnbuckle assemblies are covered by AN Standard Drawings. For safety wire sizes and materials, refer to figure 4.22. Do not reuse safety wire. Adjust the turnbuckle to the correct cable tension so that no more than three threads are exposed on either side of the turnbuckle barrel. Do not lubricate turnbuckles.

213. DOUBLE WRAP METHOD. Of the methods using safety wire for safetying turnbuckles, the method described here is preferred, although either of the other methods described is satisfactory. The method of double wrap safetying is shown in figure 4.23(A). Use two separate lengths of the proper wire (see figure 4.22). Run one end of the wire through the hole in the barrel of the turnbuckle and bend the end of the wire towards opposite ends of the turnbuckle. Then pass the second length of the wire into the hole in the barrel and bend the ends along the barrel on the side opposite the first. Spiral the two wires in opposite directions around the barrel to cross each other twice between the center hole and the ends. Then pass the wires at the end of the turnbuckle in opposite directions through the holes in the turnbuckle eyes or between the jaws of the turnbuckle fork, as applicable, laying one wire along the barrel and wrapping the other at least four times around the shank of the turnbuckle and binding the laid wires in place before cutting the wrapped wire off. Wrap the remaining length of safety wire at least four turns around the shank and cut it off. Repeat the procedure at the opposite end of the turnbuckle.

Cable size	Type of wrap	Diameter of safety wire	Material (annealed condition)
1/16	Single	0.040	Copper, brass.[1]
3/32	Single	0.040	Copper, brass.[1]
1/8	Single	0.040	Stainless steel, Monel and "K" Monel.
1/8	Double	0.040	Copper, brass.[1]
1/8	Single	0.057 min.	Copper, brass.[1]
5/32 and greater.	Double	0.040	Stainless steel, Monel and "K" Monel.[1]
5/32 and greater.	Single	0.057 min.	Stainless steel, Monel or "K" Monel.[1]
5/32 and greater.	Double	0.051 [2]	Copper, brass.

[1] Galvanized or tinned steel, or soft iron wires are also acceptable.

[2] The safety wire holes in 5/32-inch diameter and larger turnbuckle terminals for swaging may be drilled sufficiently to accommodate the double 0.051-inch diameter copper or brass wires when used.

FIGURE 4.22—Turnbuckle safetying guide.

When a swaged terminal is being safetied, pass the ends of both wires, if possible, through the hole provided in the terminal for this purpose and wrap both ends around the shank as described above. When the hole in the terminal is not large enough to accommodate the ends of both wires, the hole may be enlarged in accordance with note 2 of figure 4.22 and the safetying completed as described above. If the hole is not large enough to allow passage of both wires, pass the wire through the hole and loop it over the free end of the other wire, and then wrap both ends around the shank as described.

a. Another satisfactory double wrap method is similar to the above, except that the spiraling of the wires is omitted as shown in figure 4.23(B).

b. The wrapping procedures described and shown on MS 33591 may be used in lieu of the safetying method shown herein.

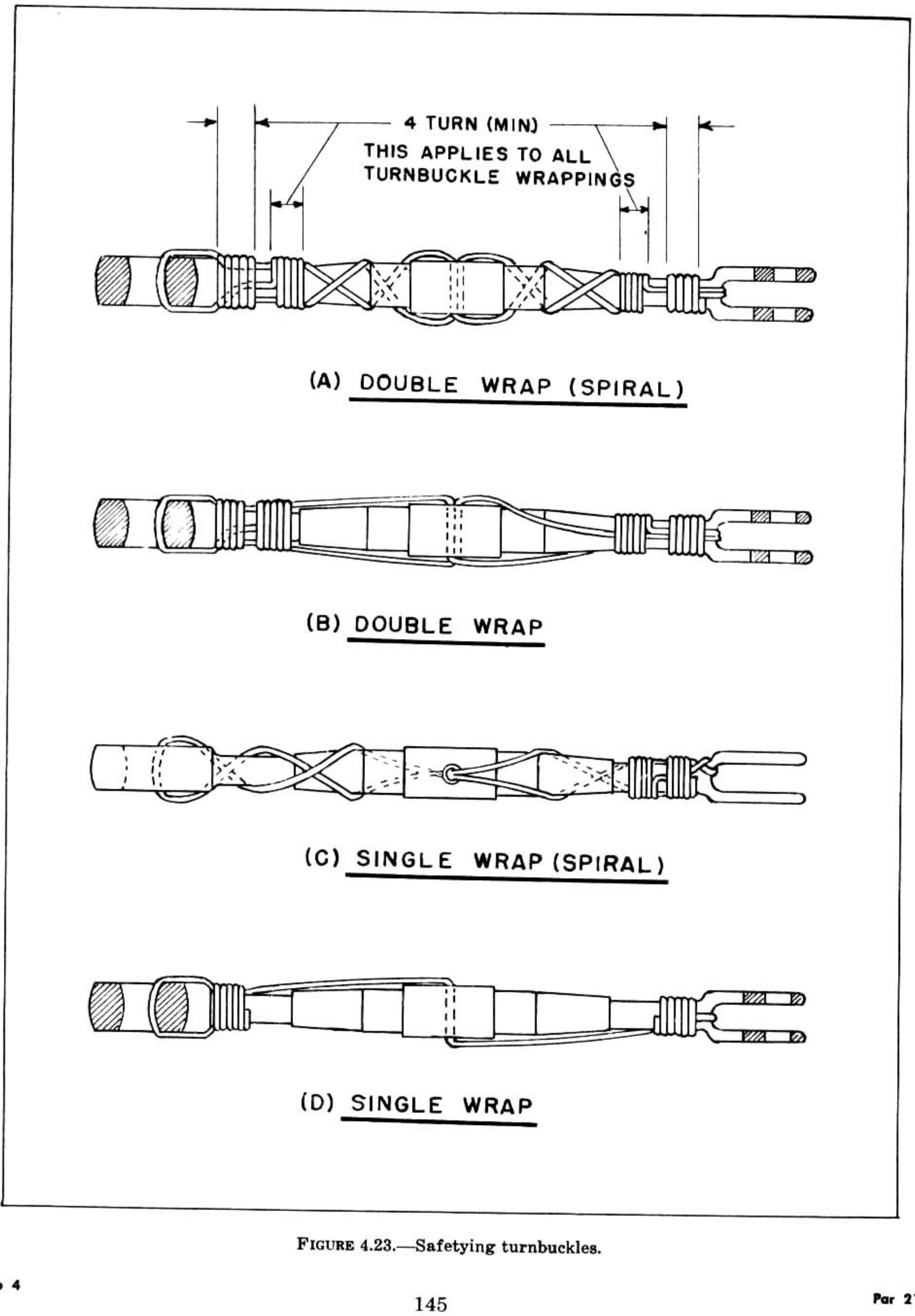


FIGURE 4.23.—Safetying turnbuckles.

214. SINGLE WRAP METHOD. The single wrap methods described in the following paragraphs and as illustrated in figures 4.23 (C) and (D) are acceptable but are not the equal of the double wrap methods.

a. Pass a single length of wire through the cable eye or fork, or through the hole in the swaged terminal at either end of the turnbuckle assembly. Spiral each of the wire ends in opposite directions around the first half of the turnbuckle barrel so as to cross each other twice. Thread both wire ends through the hole in the middle of the barrel so that the third crossing of the wire ends is in the hole. Again, spiral the two wire ends in opposite directions around the remaining half of the turnbuckle, crossing them twice. Then, pass one wire end through the cable eye or fork or through the hole in the swaged terminals, in the manner described above, wrap both wire ends around the shank for at least four turns each, cutting off excess wire. This method is shown in figure 4.23(C).

b. Pass one length of wire through the center hole of the turnbuckle and bend the wire ends toward opposite ends of the turnbuckle. Then pass each wire end through the cable eye or fork, or through the hole in the swaged terminal and wrap each wire end around the shank for at least four turns, cutting off excess wire. This method is shown in figure 4.23(D). After safetying, no more than three threads of the turnbuckle threaded terminal should be exposed.

215. SPECIAL LOCKING DEVICES. Several turnbuckle locking devices are available for securing turnbuckle barrels. Persons intending to use a special device must assure the turnbuckle assembly has been designed to accommodate such device. A typical unit is shown in figure 4.24. When special locking devices are not readily available, the use of safety wire is acceptable.

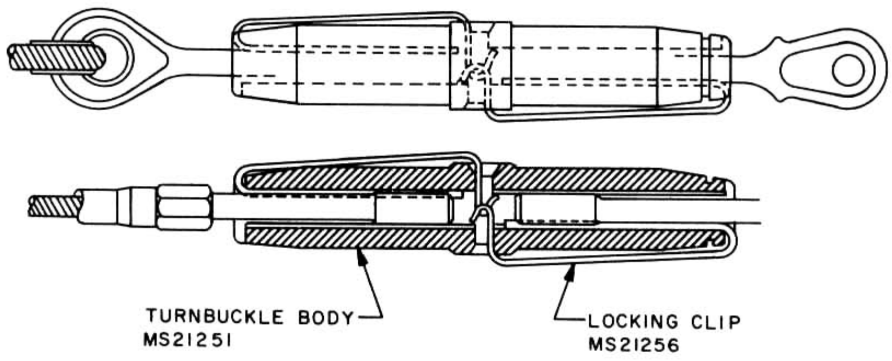


FIGURE 4.24.—Clip type locking device.

216.–226. RESERVED.

23.3 Kit Boxes and Wing Fold Dimensions

	CONTENTS	LENGTH	WIDTH	HEIGHT	WEIGHT
BOX 1	TUBING	4300mm	330mm	330mm	100 kg
BOX 2	SEATS	1380mm	330mm	330mm	30 kg
BOX 3	SAILS	2400mm	770mm	230mm	45 kg
BOX 4	ENGINE	880mm	690mm	490mm	85 kg
BOX 5	COWLS	770mm	600mm	900mm	14 kg
BOX 6	WHEELS	420mm	420mm	420mm	15 kg
BOX 7	LEXAN	1300mm	300mm	300mm	11 kg
BOX 8	SPATS	740mm	570mm	440mm	8 kg
BOX 9	UK MODS	280mm	280mm	280mm	8 kg
BOX 10	FLOOR	1100mm	1100mm	4mm	1 kg

Measurements and weights may vary, overall total weight should remain constant.

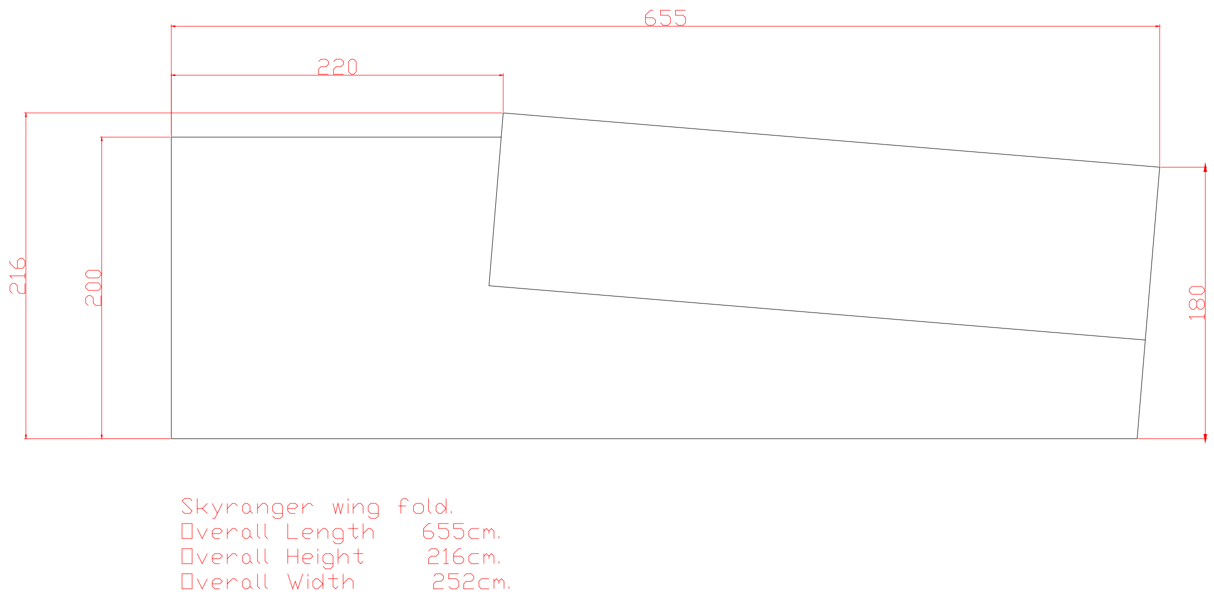


Figure 327; approximate size of aircraft with wings folded.

24 Index

19 Amendments

Date	Page No.	Change / Addition
17/08/2004	All	Issue 3.0 based on issue 2.2 incorporating numerous hints and tips.
3/11/2004	214-225	Quality of wiring diagrams improved for colour laser printing.
20/12/2006	All	Issue 4.0 based on issue 3.0, but incorporating additional drawings, CKT exhaust fitting, Drainable sump verification procedure, Screen centre batten option, Fuselage cross batten option, Revised door latches option, Skyranger Swift variant information, including Aerofoil jury struts. Additional hints and tips.