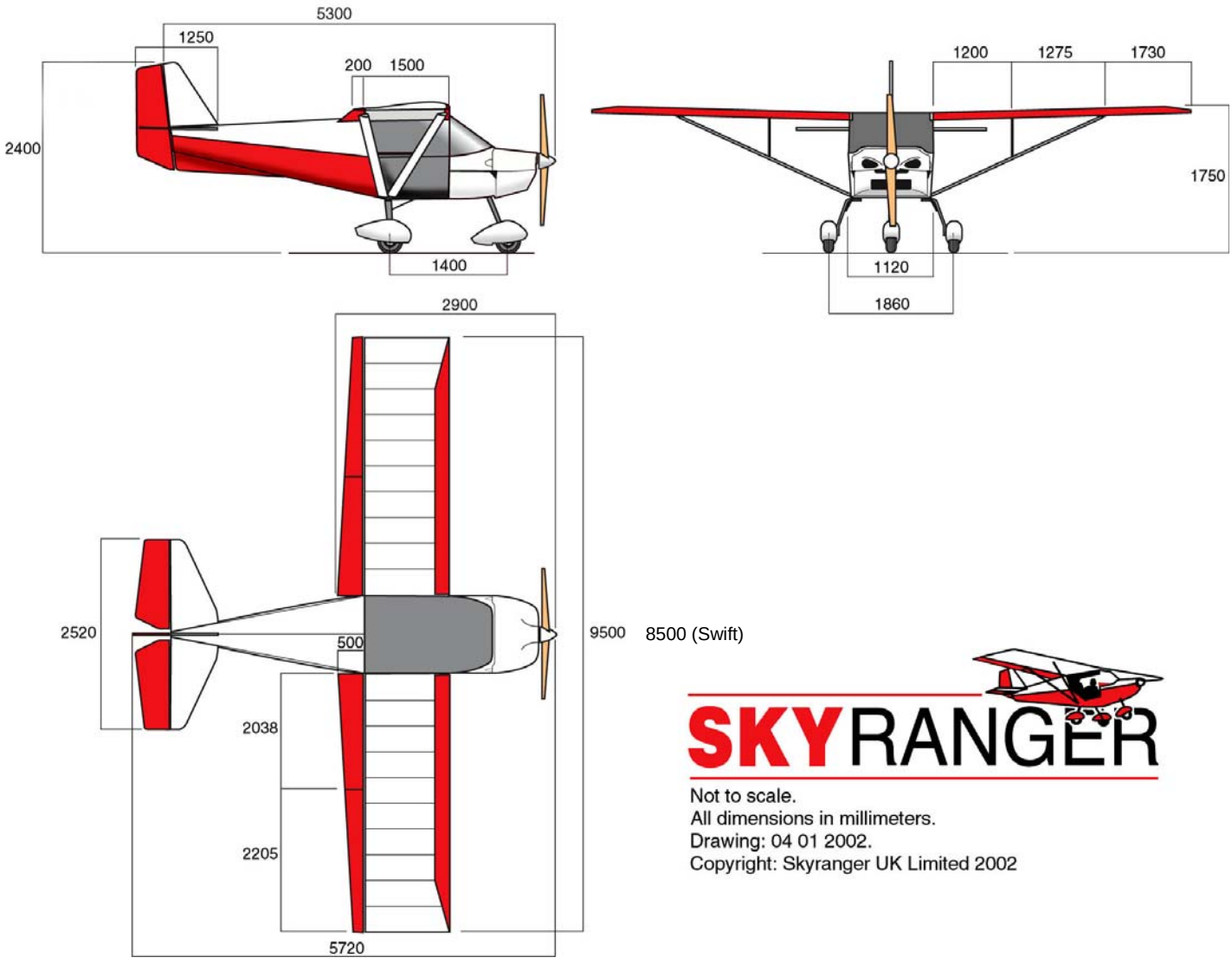
Skyranger UK Build Manual

Issue 4.0



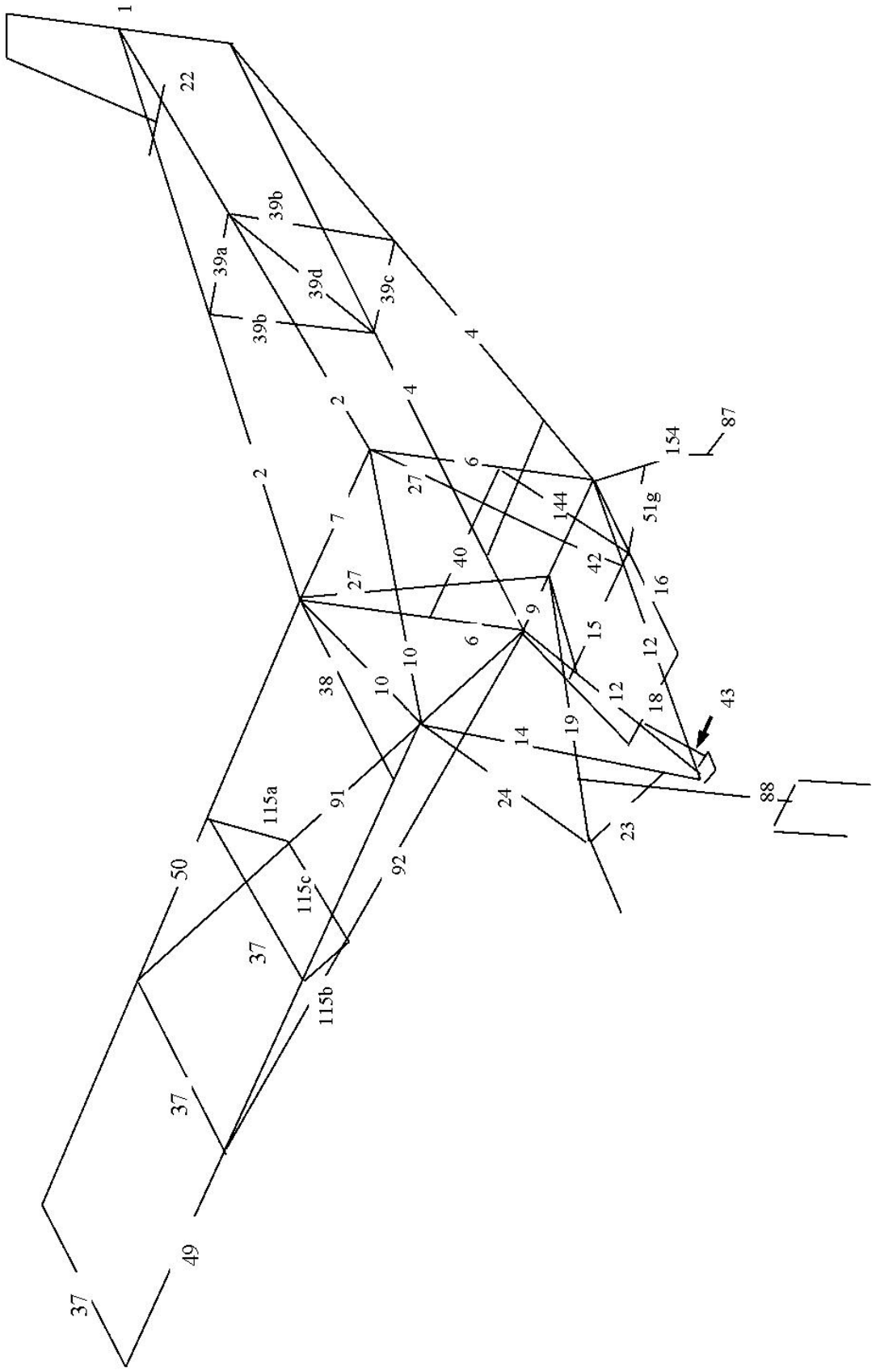


Figure 1; tube numbering scheme.

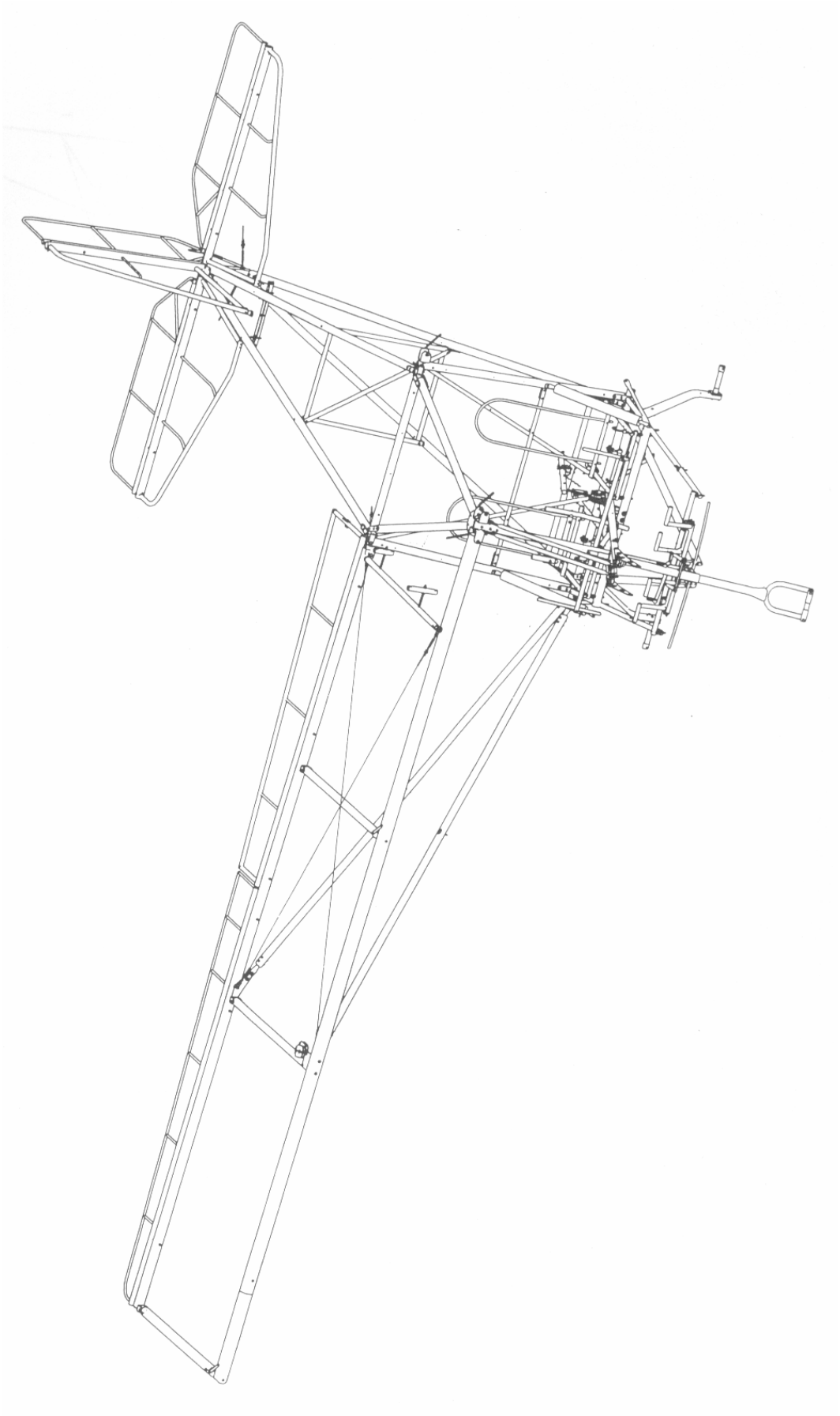


Figure 2; Skyranger frame.

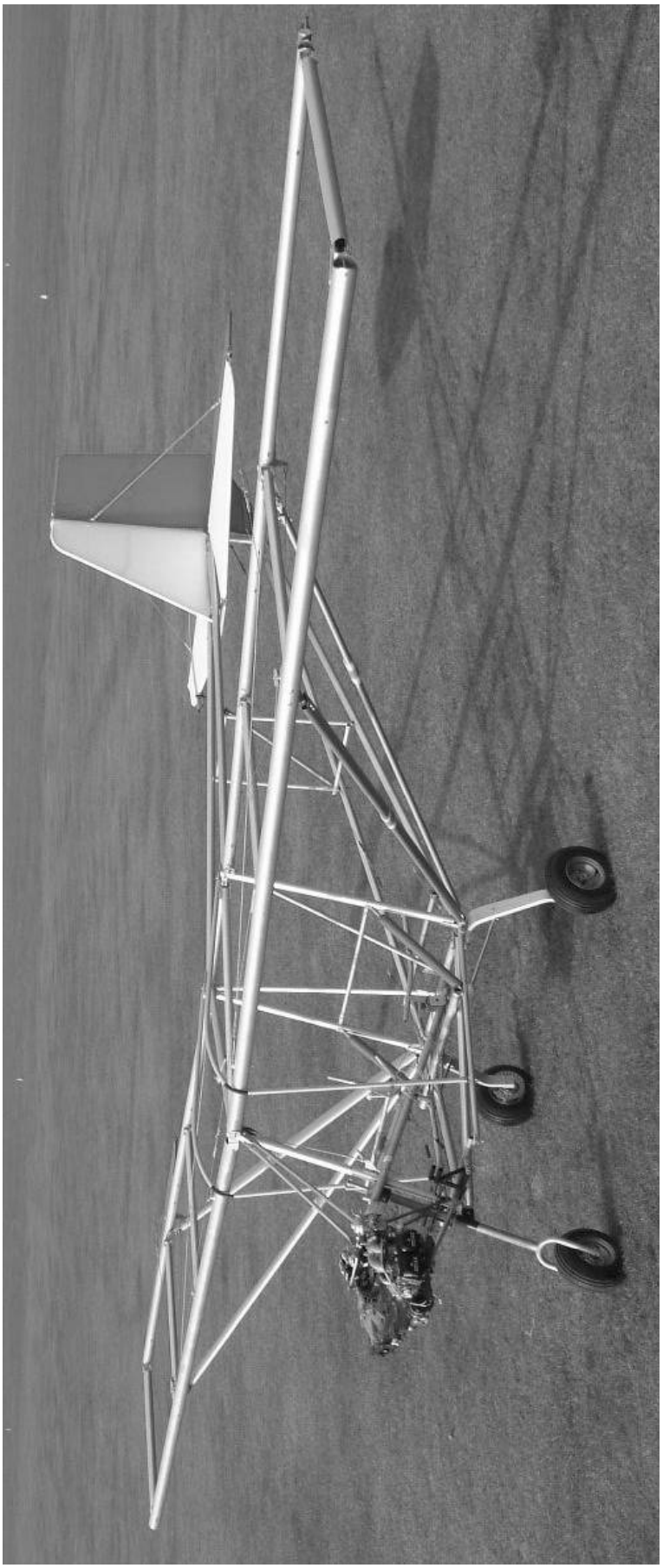


Figure 3; uncovered frame.

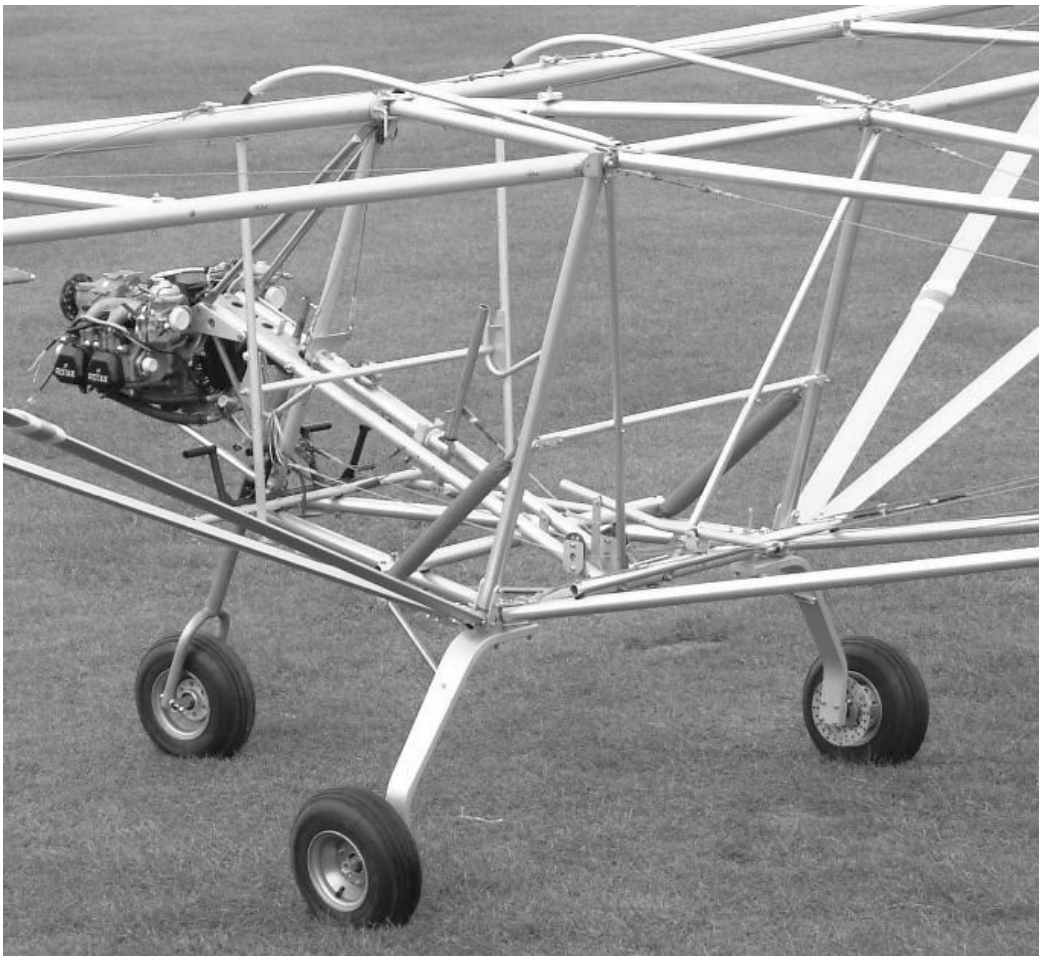


Figure 4; uncovered forward fuselage.

Figure 5; simply assemble thus...

Contents

Introduction

1.1 How to Build Your Aircraft

Building the Skyranger is a fairly straightforward process, but it can be made much more difficult than necessary if one basic rule is not followed:

READ THE INSTRUCTIONS!

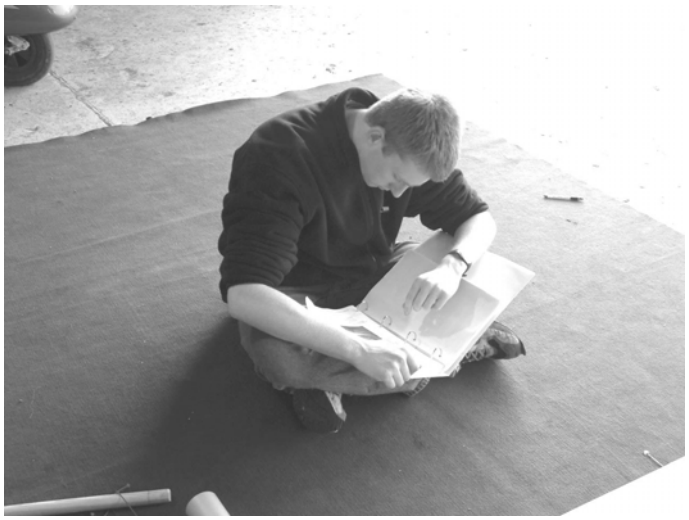


Figure 6; a rare sight, but essential for successful building (the manual that is, not Rob)!

1.1.1 The Build Manual

Reading the whole manual before starting is suggested. Reading ahead by at least the section being worked upon, as each section is reached, is recommended. Reading the instructions for the components under your spanners is essential! It is remarkable how often the instructions are over-looked or misread, remembering that you are going to fly in your finished aircraft!

Instructions, however, are never as good as they could be, and so corrections and suggestions for improving the instructions are welcome, preferably in writing by email. These can then be included in future updates of the manuals.

If you have errata or receive updates to the manual, mark these immediately in your copy of the manual so that you do not forget them when you reach that stage.

An electronic copy of the build manual is included on the CD in Adobe PDF format, along with the reader software needed. This can be used to print off replacement pages, to zoom in on photographs, and to print colour versions of the wiring diagrams. Updates to the manual will be made available either on CD or via the Skyranger website (www.skyranger.co.uk).

Don’t rush things, work carefully, and don’t forget to enjoy building your aeroplane!

1.1.2 In case of difficulty

If you cannot find a part, ensure that you have determined what it looks like, and that it is not already attached to a sub-assembly in the area you are working on. Often parts are hidden by the packaging, or lurking in the bottom of a box of bits in the corner of the garage, rather than being missing from the kit.

If you have a problem that you cannot resolve by a careful read of the instructions with the appropriate parts in front of you please have a look in the Skyranger internet discussion group, send an email, or if all else fails ring:

Skyranger Hotline 01604 644222

Note that most enquiries can be answered by a careful read of the manual, so do give it some thought before calling.

That way you'll get through when you really are stuck!

This number should be used rather than Flylight's lesson booking line. Email is preferred and more convenient than the telephone, as it makes it simple to communicate answers to other builders and allows time for a better reply to your questions.

Figure 7; We await your call on the Skyranger Hotline!

1.1.3 Photographs

The manual has lots of drawings and photographs to help you build your aeroplane. The photographs are chosen to illustrate each point, but often include other areas of the aeroplane in the background. However, due to the number of modifications made during the UK certification phase you should be cautious about assuming that background items are shown as they should be on UK specification aircraft.

1.2 The BMAA Homebuilt Aircraft System

Before starting the build of your Skyranger you must register the project with the BMAA. The required forms are downloadable from the BMAA website at **www.bmaa.org**, go to the Technical Information section, click on Forms, and download form BMAA/AW/022.

An example form for a Skyranger fitted with a Rotax 912UL and standard Kiev prop is shown in Section 0 at the end of this manual.

You will have to find a BMAA Inspector to oversee the project. A list of Inspectors is available from the BMAA if required. Fill in the form with information about your aircraft and Inspector.

Send this form, along with the certificate of conformance for the aircraft, engine and propeller, with the current fee to the BMAA.

The BMAA will then register the project and issue you with a project number. They will send you a pack of paperwork with information about building a BMAA homebuilt, and a stage inspection form to be completed during the build by yourself and your Inspector.

Please read all the paperwork that the BMAA send you when you receive it – this may prevent stress later!

You can also register the aircraft with the CAA and order registration letters (available from Pegasus-Mainair 01706 655134), to save time later.

Your Inspector is required to visit prior to commencing any real building to inspect your workshop and the kit. This forms the first stage inspection.

Your Inspector has to sign off several key stages of the build. Get his signature on the form at the time, just in case! He can be a very useful source of knowledge and advice, and should be your ‘mentor’ during the build. Also, a second pair of eyes and an experienced mind can often solve problems for you in an instant.

Inspectors will vary somewhat in their likes and dislikes, and so requirements may vary from what you may consider to be sensible. It is best to listen to your inspector’s views, but in case of specific queries either you or your inspector may contact Skyranger UK or the BMAA directly to discuss matters.

Please respect the stage inspections and do not present him with a fully built aircraft for the first visit! It is not his fault if you have to undo a lot of building to make right something that should have been checked in a stage inspection before continuing further. If there is a delay in having an inspection it is better to get on with building bits and pieces like wheels and wing frames than to continue adding to the main assemblies.

When your aircraft is complete and to your Inspector’s satisfaction, the completed stage inspection form is sent to the BMAA. Also required to be sent at the same time is the Engine Installation Check Sheet (either the Rotax version or the generic BMAA version for non-Rotax engines). This details tests required to ensure correct installation and set up of the engine, such as the fuel-flow test described in Section 0. Again your inspector has to witness the tests and sign the form.

The BMAA will then process the paperwork and raise a BMAA AW029 giving permission to test fly, along with a draft MAAN (Microlight Aircraft Approval Note) for

specific clearance and flight testing of your aircraft. This will require checking and returning to the BMAA for an authorisation signature to make it valid.

Initially your aircraft must be flown by a BMAA Test Pilot, or a specially authorised check pilot. He/She will fly the aircraft to the flight test schedule to ensure that your aircraft is set up and flying as it should. You can accompany them for the flight tests as observer / secretary. When the aircraft is flying satisfactorily (some trimming / adjustments may be required), then if you have suitable experience you may fly the aircraft. 5 hours of flying are required to prove reliability and debug the aircraft, before an application can be made for a full permit to fly. Whilst waiting for this to arrive you are normally permitted to fly the aircraft, continuing to obey the restrictions of the test flying clearance contained in the AW029.

If you are the first with a new engine or propeller type, or have made any major modifications to your aircraft, then 25 hours of reliability testing are usually required. If you plan any modifications then it is essential that the BMAA is informed at the beginning of the project, so that a technical investigation can be made and approval for you to go ahead can be given.

It is likely that you are keen to begin construction, and are waiting impatiently for the paperwork and your inspector to allow you to do so. However, this short delay can be used very productively to familiarise yourself with the instructions and the components, and prepare them for use.

1.2.1 UK modifications

UK modifications from the original Skyranger build standard are identified in the text by “UKMOD”. The modified parts are included as standard in your kit, and form part of the UK Skyranger build standard, and therefore do not require any additional modification paperwork or signing-off.

1.2.2 Other modifications

You may desire to install equipment such as a radio, strobes etc.. These will constitute modifications to the standard aircraft and therefore must be done in accordance with BMAA procedures. Details of the most common modifications are included in the TIL’s, and Standard Minor Mods (SMM) available on the BMAA website (www.bmaa.org) . If these are done at the time of construction it will save time and money later.

For modifications not covered by the TIL’s, or SMM’s, it is probably better to complete the standard aircraft and commence flying before proceeding with the modification. This is because non-standard modifications will introduce complexity and delays into getting you aircraft flying, and so these are best done at leisure when you already have your aircraft in the air.

Note that the Skyranger succeeds in providing a capable aeroplane at an excellent price by following the principle of simplicity. Some areas may look basic at first glance, but meet the stringent requirements of BCAR Section S without adding cost and weight. Any modifications you make must also meet Section S, but it is up to you how much cost you are willing to bear and where you spend your weight. However, increased cost and less fuel carrying capacity are difficult to avoid.

Do not begin any modifications without first speaking to your inspector, the BMAA, or Flylight Airsports.

1.3 General Assembly Notes

Before starting to assemble anything, read the whole of this manual to get an overall impression of the order and methods of assembly. The sequence of construction is the one used to build the importer's aircraft, and should be adhered to. If you wish to change the sequence, you may find difficulty in fitting other parts later, so read ahead carefully to determine the effects of your changes. Flylight Airsports cannot advise on, nor be responsible for, the consequences of not following the instructions, as if we have not tried something we cannot comment upon it with any experience.

1.3.1 Unpacking

To familiarise yourself with the kit components it is useful to unpack the kit and sort it into groups for each assembly stage, such as wing parts, fuselage parts, undercarriage etc.. Do this in conjunction with the packing list and the instruction manual to determine that you have all the required parts.

If you cannot find a part, check under the packaging on related assemblies, and make sure you know what it is that you are looking for, as parts may be rolled up or transported inside other parts.

Don't forget to check all the boxes, in case you've put a box aside somewhere.

1.3.2 Initial assembly with plain or wing nuts

During initial assembly it may be helpful to use wing nuts or normal nuts rather than Nyloc nuts for test fitting pieces, or on pieces which need to be removed later to fit the coverings or other parts. Alternatively, only tighten the Nyloc nuts up to the Nyloc section until ready to apply threadlock and tighten properly.

1.3.3 Assembly

If in doubt about a part, or an assembly, read ahead and pay particular attention to drawings and photographs. Note that the direction of bolts (up/down, pointing forwards/backwards) may differ between drawings and photographs. Normally, the bolts will be inserted from the top or the front, unless other considerations apply, such as coverings or access.

Remember to replace any plain nuts with Nyloc nuts before final assembly, and also:

REMEMBER TO USE LOCTITE 243 ON ALL NUTS.

This is usually available from your local fastenings company, look them up in the Yellow Pages under "Fixings and Fasteners", and you will never be stuck for nuts and bolts again!

Loctite should be used very sparingly. A common mistake is to overuse it. Loctite smeared over the outside of fasteners acts as a corrosive agent. Any surplus should be immediately removed with a soft cloth.

A good tip is to paint a red stripe across the nut and bolt end after final tightening. This way it will be easy to inspect and spot any nuts not finally tightened.

1.3.4 Main tools needed for assembly

Spanners: 6, 8, 10, 12, 13, 14, 17mm
Allen keys: 4, 6, 8mm
Metal saw
Drill and bits for metal
Rivet pliers
Cutting pliers
General pliers
Screwdrivers, flat and cross-head
Hammers, metal and rubber/plastic
Mouse tail file with diameter less than 6mm
Flat file
Engineers Rule
Tape measure
6mm reamer (desirable)
Wire-locking pliers (desirable)

1.3.5 Products needed for assembly

Loctite 243, to be used on all bolts
Silicon grease
Oil for general use
Oil for engine and gearbox, see engine documents
Epoxy adhesive (Araldite or similar)
Lock-wire

1.3.6 Holes

All the holes have been drilled to a high accuracy, however it may sometimes be necessary to use a round file or reamer to ease the insertion of some bolts. Be careful not to make a hole too large however, sometimes all that is required is to loosen other bolts nearby, or to apply pressure to some other part. Generally bolts should not be tightened up until all the parts in a particular sub-assembly are assembled, to avoid the common problem of the final bolt not fitting!

1.3.7 Washers

Metal washers should be used to prevent scratching of the surface as a nut is tightened.

Nylon washers, or similar plastic washers, should be used to:

a) fill spaces between parts, such as between tubes and U-brackets
b) avoid friction between two moving metal parts, such as the stick and its supporting bracket
c) avoid contact between parts of different materials, especially stainless-steel and aluminium

The final point above is primarily to prevent the hard steel wearing through the soft aluminium due to vibration, rather than for electrolytic reasons, as the bolt passing through both materials will still complete the electrical connection.

1.3.8 Saddle washers

Normally they are shown on the drawings and photos.

Generally they are used between two crossed tubes or between a tube and a flat bracket.

Take care not to overtighten bolts which pass through plastic saddle washers as you may cause them to split.

1.3.9 Bolts

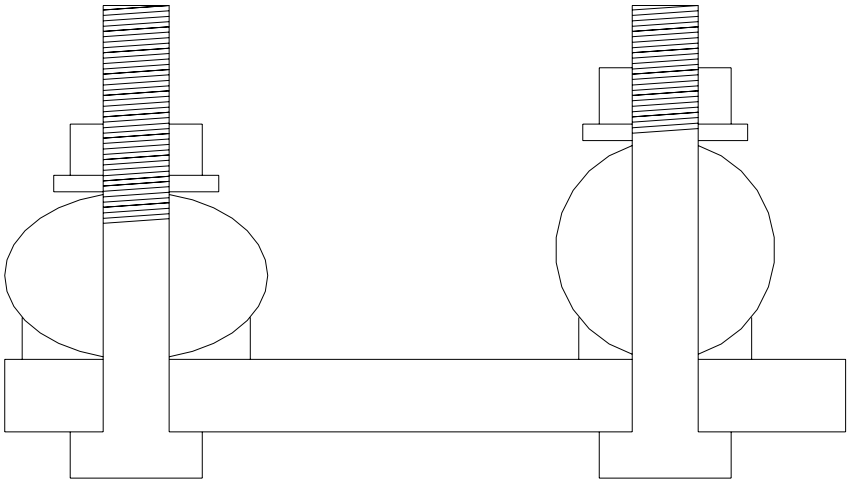
Important: all bolts should bear on their unthreaded lengths, not on the threaded portions.

It is also important that nuts are not screwed on so far as to become ‘threadbound’ by reaching the limit of the threaded portion. You can use an extra washer or two to adjust the effective length and prevent this where required.

Turn nuts, not bolts, when tightening, as this may damage the plating and encourage corrosion. Washers are only needed under nuts to allow them to be turned, whereas bolt heads should not be turned.

Do not over-tighten bolts, avoid deformation of tubes or brackets.

IMPORTANT: tubes must not be visibly deformed.



Left - WRONG – squashed tube, thread in tube. Right – RIGHT – tube still round, thread stops in washer(s).

Figure 8; bolt tightening.

Every wing nut has to be fastened by a security ring.

Nyloc nuts should be used only once.

When cutting bolts short, a minimum of two threads should protrude from the nut.

Paint the cut end to prevent rusting.

Bolts subject to rotation should be drilled and locked with a split pin. Examples include stick pivot bolt, torque-tube pivot bolt, rudder link bolts.

1.3.10 Wire-locking

Certain parts require securing with lock-wire, such as engine bolts and turnbuckles. If you have not done this before, discuss how to do it with your inspector. A basic guide to wire-locking bolts and turnbuckles is included at the end of this manual.

1.3.11 Stainless-steel parts

A number of tubes have flattened steel end-fittings which may require slight “tweaks” to align them as required. This should be done carefully in a vice, with wooden jaw pieces to protect the surfaces.

Avoid bending the parts back and forth repeatedly, and avoid bending them at the hole position.

The finish on the stainless-steel parts is quite varied. If desired these parts can be polished to a shiny finish, although those positioned in the pilot’s line of sight may be covered in anti-reflection black coatings or plastic sleeving if desired. Scotchbrite pads can be used to provide a pleasing, even, cosmetic finish.

1.3.12 Coverings

Handle the coverings with care, pay attention to the risk of bolt heads, corners and reinforcements/stiffeners damaging the covering as it is put on.

Dacron coverings need care to avoid getting dirty and becoming stained. Keep your hands and tools clean and oil-free when working with or near these coverings.

You can remove most dirty marks on dacron with a sponge soaked with tepid water and a mild detergent, followed by rinsing using only tepid water.

1.3.13 Part numbering

Numbers in bold italics refer to a part number, either as shown on the relevant drawing or a universal part number with a prefix. Prefixes refer to the following:

tu	tube
tual	aluminium tube
tuac	steel (acier in French) tube
u	U-bracket
ual	aluminium U-bracket
me	metal plate piece
meal	aluminium metal plate piece
meac	steel (acier) metal plate piece
ca	cable, wire rope

The material-type part of the number is not always used.

During assembly follow the drawings and photographs corresponding to the text.

1.3.14 Drilling and cutting

When drilling holes or cutting parts be very careful to measure and mark the correct positions. Check these a second time before proceeding to cut or drill.

The old adage of measure twice, cut once still applies!

Otherwise, you won't be the first to ring up to order a new bit, having chopped something too short!

If you find a part which you think is wrong, in terms of size etc., be very sure that this is so before cutting or drilling etc. to correct the problem. For instance, over-long bolts may have extra parts to be fitted later. Leave irreversible actions until the end of the build!

When drilling holes in metal, use a centre punch to prevent the drill wandering, and start with a small pilot drill working up to the required hole size.

It can be useful to use masking tape on fibreglass gel surfaces to help prevent cracking, and to reduce the risk of marking the surface if the drill should slip.

1.4 Finish

All Aluminium parts are supplied anodised. Do not be alarmed if some marks are present in the finish of the tubular parts, this is a result of the suspension method at the anodising plant. You may also notice areas on tubing that may appear to have fine sanding marks. This is done prior to the anodising process to polish out any small scratches. It is also not unusual to find small areas of silver paint applied at the final stage over any small remaining marks prior to leaving the factory. Some light scuff marks may be present as a result of storage and transit. This is normal. Deep scratches or dents are not acceptable – ask you inspector for advice, and refer the problem to the importer.

Aluminium plate parts may be painted to improve their cosmetic appearance if desired. Use a Scotchbrite pad or lightly sand with fine wet and dry before using a suitable aluminium primer and top coat. Ensure that all painting operations result in a thin covering that will not hide defects from inspection.

Steel components are all supplied plated and / or powder coated, for corrosion resistance. Again they may be painted for extra protection or cosmetic reasons if desired.

Further protection from corrosion can be beneficial for longevity, and to resist the ravages of operation near the sea or storage in damp hangars. Aluminium and steel parts can be treated with corrosion protection products such as the excellent ACF50. This should be squirted in all tube ends and around fittings and applied to the outside with a soft cloth. An initial thorough application before covering is recommended (Xlam or Dacron if not intended to laquer), followed by periodic repeat application.

'Wax oil' or similar propriety products may also be used inside tubes and around fittings.

Cowlings and spats are supplied in white gel-coat finish. These may be painted any colour using standard automotive processes. Take care to thoroughly degrease to remove mould releasing agents before commencing this process. Although the cowlings and spats are intended to be painted to match the aircraft colour scheme, typically some light sanding with 1200 grit wet and dry and polishing with T-Cut or

equivalent will result in an acceptable unpainted finish which is not unattractive with most colour schemes.

Dacron coverings may be lacquered with a special process using Automotive Polyester or Acrylic Lacquer mixed with a flex agent. Refer to the importer for more information. Advantages are stronger colours and a sealed shiny finish which allows oil etc to be wiped off without leaving marks. Disadvantages include extra weight and the loss of the ability for the coverings to be re-used in the event of removal for damage repair.

1.5 Weight

The UK prototype Skyranger in standard long wing specification with Dacron coverings, Rotax 912 and standard dash and instrument fit has been found to have an empty weight of approximately 252kg. The Swift airframe is approximately 3 Kg lighter. Options such as Xlam coverings, wheel spats, spinner, carpet, baggage hammock etc will have a weight penalty. Painting metal parts, cowlings and applying lacquer to the coverings will have a weight penalty. Additional avionics or strobes are also surprisingly heavy.

It may be necessary to make choices in these options to ensure that the weight remains inside the maximum permitted Zero Fuel weight (ZFW) for the aircraft. The ZFW will vary according to the fuel burn of the chosen engine option. Refer to the Homebuilt Aircraft Data Sheet (HADS) or the BMAA for further information on the rules regarding weight for this class of aircraft.

Weight is surprisingly cumulative and dividends will be gained by ‘thinking light’ during every stage of the build. The benefits of an aircraft kept well under the maximum permitted weight will be better performance and payload capacity.

Below is an approximate guide to the weight of specific options:

Xlam coverings	+1.5Kg
Wheel spat kit	+ 4.0Kg
Wingtip fairings	+ 1.5Kg
Baggage hammock	+ 1.5Kg
Carb heat (912 engines)	+0.7Kg
Heater option	+2.5Kg
2 piece doors	+0.5Kg
Spinner	+0.5Kg
Type 2 (curved top) instrument panel and dash	+0.5Kg
Centre console kit	+ 1.5Kg
Quick adjust seat kit (per seat)	+0.5Kg

2 Forward Fuselage

Note: During assembly of the fuselage, hand tighten the bolts only as far as the Nyloc section. After the fuselage is complete and you are sure it is correct, you can go back and tighten all of the nuts.

If you wish plain nuts, or even better wing nuts, can be used in the initial construction, to be replaced with Nylocs when the time comes to tighten the nuts up. However, note that it is often beneficial to have the nuts loose anyway, to ease any alignment difficulties.

2.1 Tube Numbering

Refer to these drawings for tube numbers throughout the forward fuselage assembly sequence.

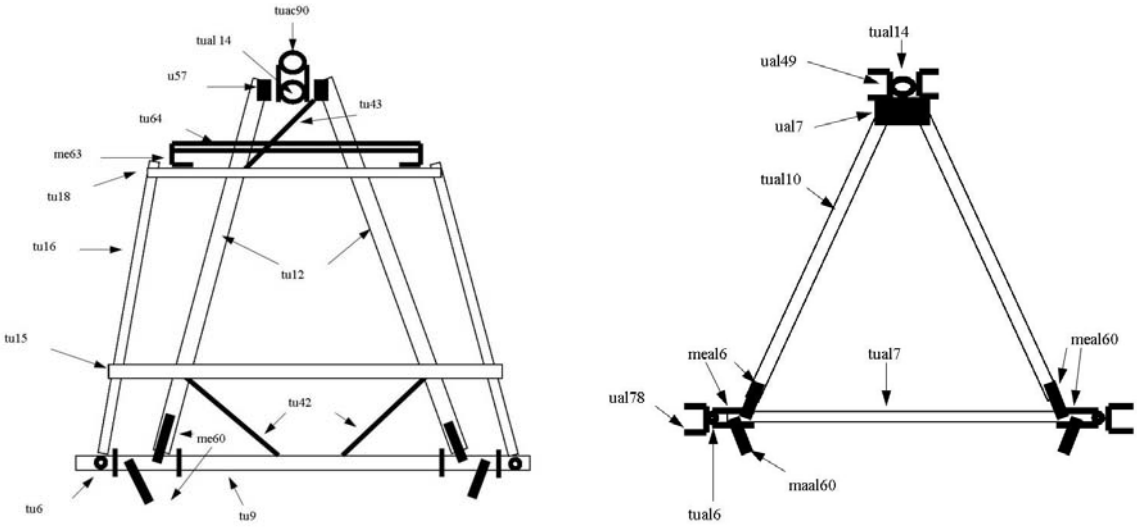


Figure 9; cabin lower and upper triangle tube numbering.

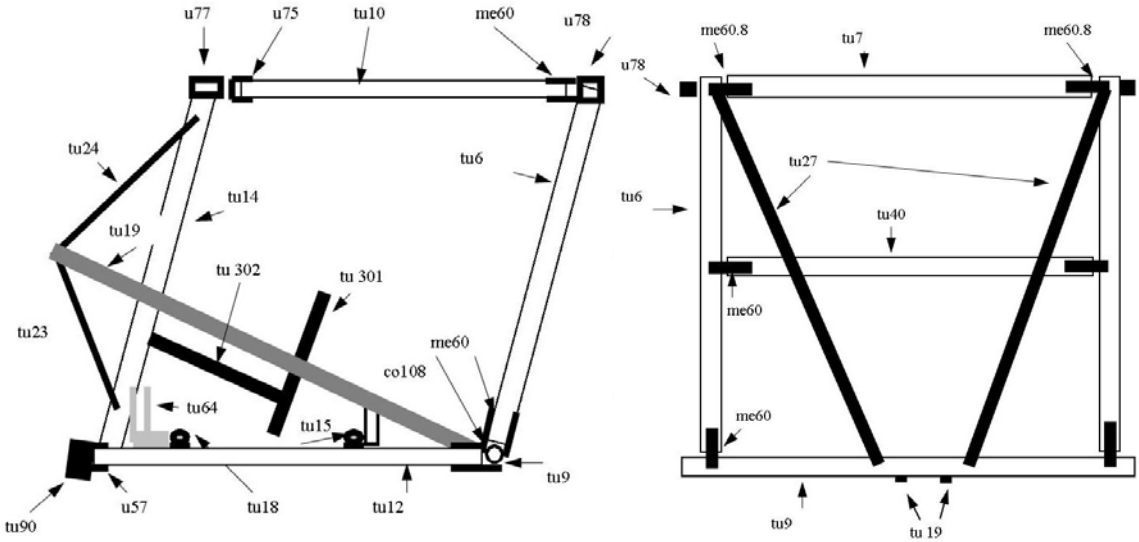


Figure 10; cabin viewed from port side, and rear cabin frame viewed from rear.

Figure 11; forward fuselage from front quarter.

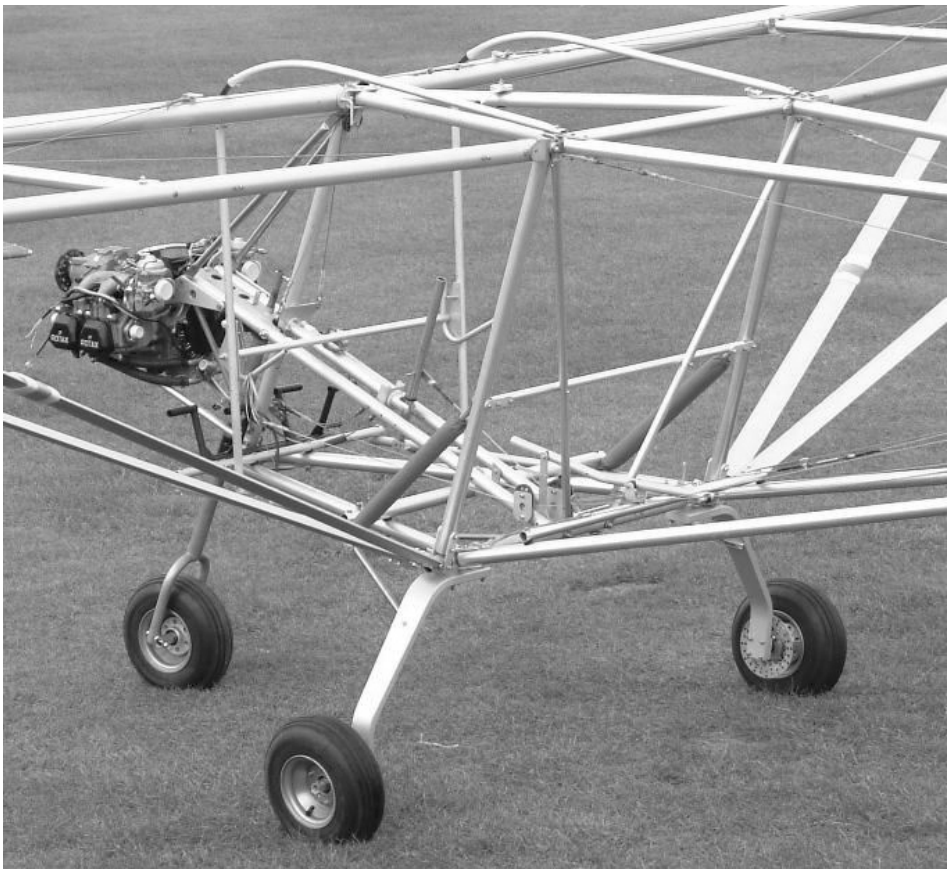


Figure 12; forward fuselage from rear quarter.

2.2 Lower Cabin Triangle

2.2.1 Orienting the main undercarriage cross-beam *tu9.*

Refer to Figure 13. The main undercarriage cross-beam ***tu9*** is made of steel, and is fitted with a steel inner sleeve (UKMOD).

a) Flip the beam over until satisfied that the holes are in the correct positions.

*The holes in the steel main undercarriage cross-beam **tu9** are drilled at an angle through the beam so that the tail section of the fuselage, which attaches to the third set of holes in from the ends, tilts upwards from the beam whilst the lift-strut attachment bolts, nearest the ends, remain horizontal.*

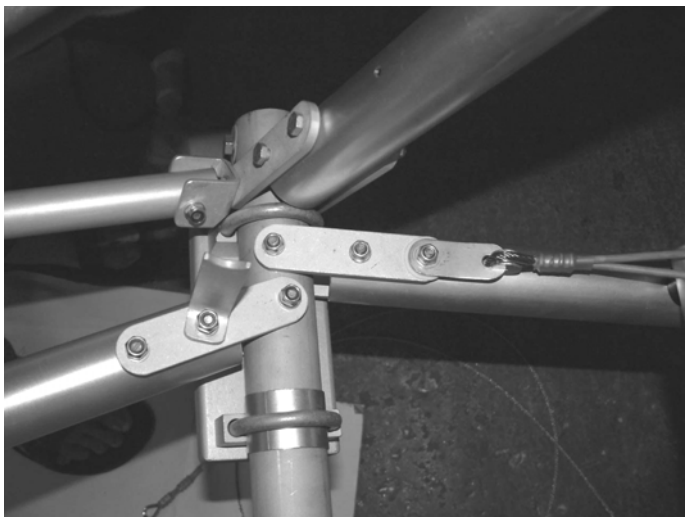


Figure 13; starboard end of tu9, looking from above, front of aircraft to left.

2.2.2 Fitting the sides of the lower cabin triangle to the main undercarriage cross-beam.

Refer to Figure 13, Figure 14 and Figure 15.

a) Assemble the aluminium linking plates ***9*** onto the pair of lower cabin triangle tubes ***tu12***, including the seat support brackets.

The linking plates are drilled with three 6mm holes, not at equal intervals. The centre hole is offset away from the single mounting hole. Remember the anti-crush spacers on the bolts (inside the tubes).

The middle bolts have the seat support bracket, an L-shaped piece, on their upper ends, with the upstanding part of the bracket in front of the bolt as per Figure 15 rather than Figure 13. A piece of fuel tube may be slit to fit over the support, and secured with silicone sealant, to make a better rest for the seat base later.

The bolts should pass from bottom to top (contrary to the drawing, but as per the photographs), to clear the undercarriage legs later.

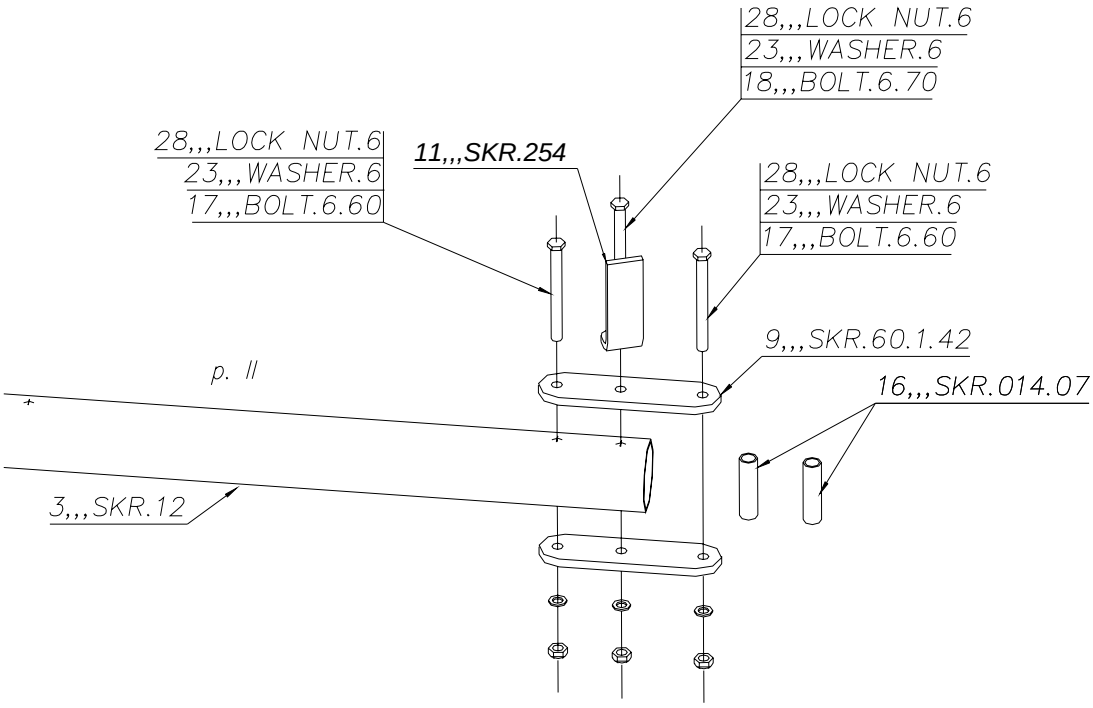


Figure 14; lower cabin triangle, rear of tube tu12.

b) Assemble the pair of lower cabin triangle tubes ***tu12*** to the main undercarriage cross-beam ***tu9*** using the fourth set of holes inwards from the ends of ***tu9.***

*The front ends of the lower cabin triangle tubes **tu12** should have the cut-outs on the inside, visible in Figure 16.*

Bolt spacers are not needed in the steel undercarriage tube.

The bolts should pass upwards, to clear the undercarriage legs later.

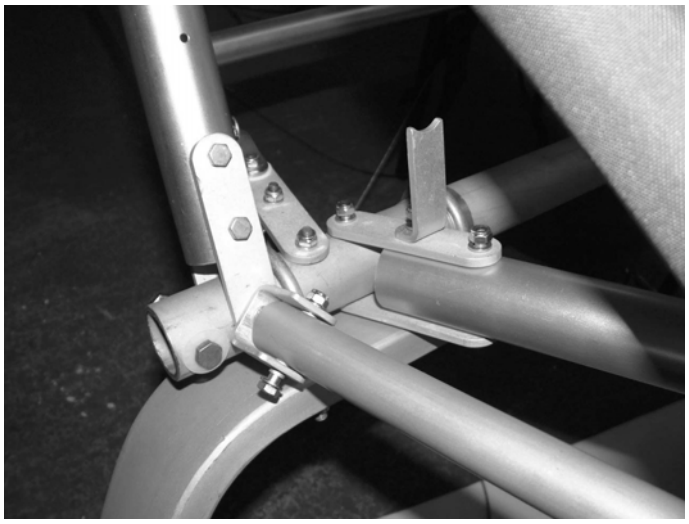


Figure 15; starboard end of tu9, looking from front.

2.2.3 Fitting the front vertical to the lower cabin triangle.

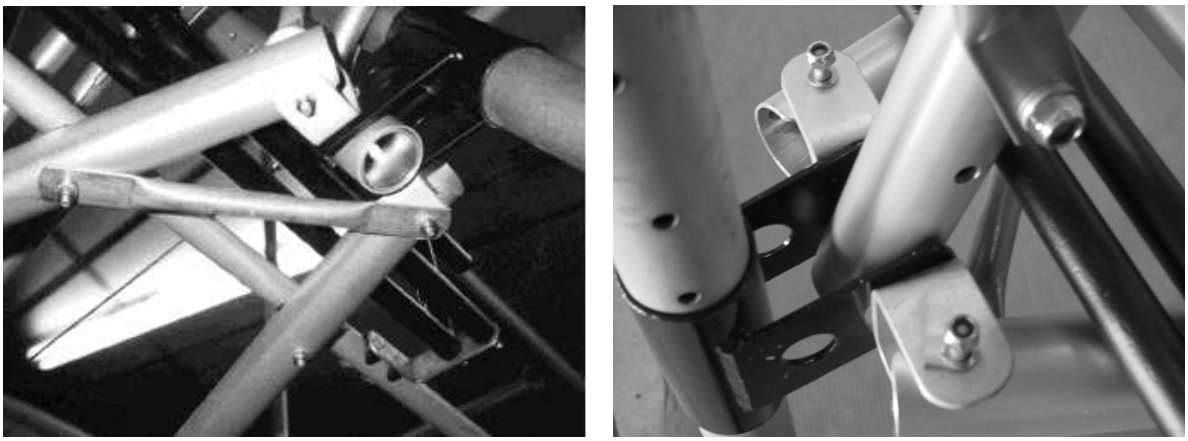


Figure 16; forward end of the lower cabin triangle viewed from below and above. Note non-UKMOD nose leg lower guide.

a) Fix the lower guide ***7*** for the nose-leg to the lower part of the front vertical ***tu14***, between the two U-brackets ***5***.

Note these U-brackets are slightly different from those used elsewhere in the kit, with the holes on the side parts further from the end (16mm from the end to the hole centre).

*The front vertical **tu14** has a row of three 6mm holes at its upper end (amongst others), and a row of three 8mm holes at the lower end.*

*UKMOD: a spacer tube is used on the U-bracket and nose leg guide securing bolt as it passes through the front vertical **tu14**.*

*UKMOD: The guide **7** has additional webs welded onto it top and bottom, Figure 17.*

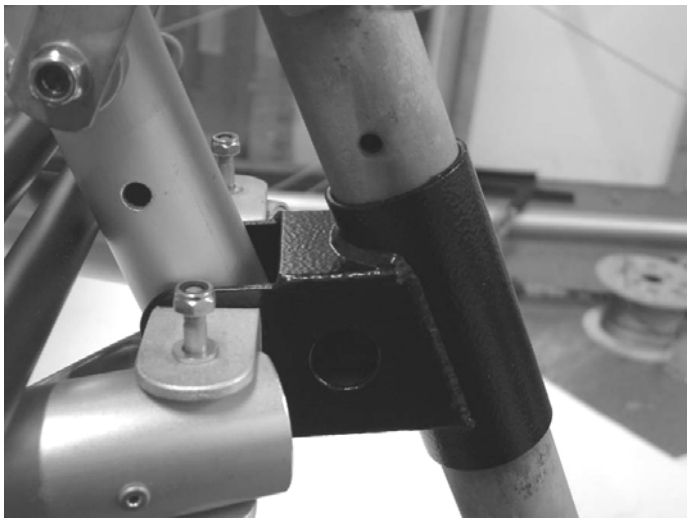


Figure 17; UKMOD nose leg lower guide.

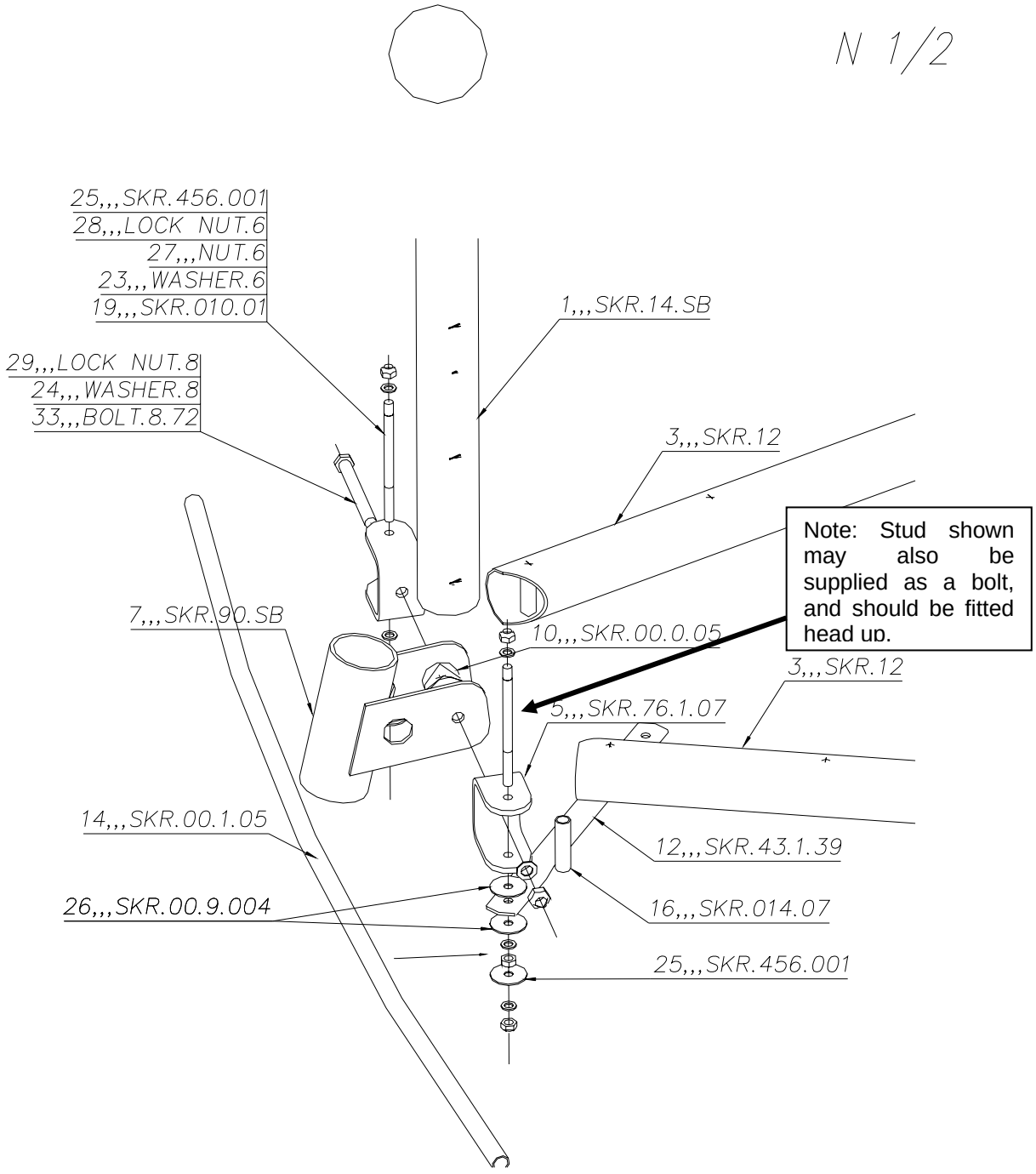


Figure 18; forward end of lower cabin triangle.

b) With the nose-leg lower guide ***7*** parallel to the front vertical ***tu14***, if the top or bottom webs on the guide ***7*** touch the front vertical tube ***tu14*** in this position they should be filed back to allow around 2mm of clearance to allow for flexing.

c) Apply threadlock to the bolt securing guide ***7*** to the front vertical ***tu14*** and tighten firmly, but take care not to distort or crush the tube.

This should be done at this stage as the bolt holding this bracket is not easily accessible later.

Whilst the spacer should prevent crushing of the tube, it is better not to rely on it. It is permissible for the spacer to remain slightly loose, as under load it will still prevent excessive deformation of the tube.

Do not distort the tube.

d) Mount the U-brackets ***5*** to the lower cabin triangle tubes ***tu12***

Note the use of a sleeve in the tubes.

The studs should be long end downwards to mount the bottom of the firewall and the front of the fuselage covering later.

Support the upper end of tu14 with one of the wooden seat bases while fitting it to the U-brackets.

e) Mount the steel diagonal-brace ***tu43*** to the bottom of the stud through the port tube. Use thin plastic washers ***26*** and steel washers ***25***.

The other end of the brace will be attached to the rudder pedal mounts later. The brace may be supplied attached to the mounts, have a look under the packaging.

Thin plastic washers may be used to take up any slack between the tubes and U-brackets.

Ignore the small tube shown in the drawing as 14,,,SKR.00.1.05, as this is part of the covering to be fitted later.

2.3 Upper Cabin Triangle

2.3.1 Fitting the sides of the upper cabin triangle to the upper rear cabin cross-piece.

Refer to Figure 19 and Figure 20.

a) Fix the aluminium linking-plates ***2*** on the upper rear cabin cross-piece tube ***tu7***, which links the trailing-edges of the wing.

These linking plates are drilled at one end with an 8mm hole and at the other with two 6mm holes.

The row of small holes where the rear fuselage covering will be secured should point forwards, whilst the bolts point rearwards.

The bolts will be tilted down and backwards compared to the vertical bolt holes for the cabin upper triangle and tail cone tubes, as the rear cabin frame is raked backwards.

Figure 19; starboard end of the upper rear cabin cross-piece, looking from above and behind. Note the bolt holding the trailing edge bracket should be reversed, with the nut on the outside.

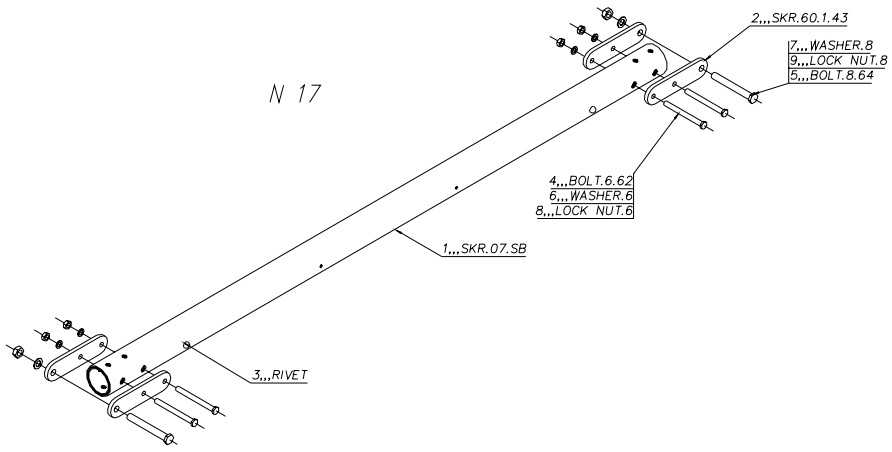


Figure 20; upper rear cabin cross-piece.

Refer to Figure 19 and Figure 21.

b) Assemble the upper cabin triangle tubes ***tu10*** with aluminium linking-plates to the upper rear cabin cross-piece ***tu7***.

*The drawing shows the lower cabin triangle tubes **tu12**, however the fittings are the same on the upper cabin triangle tubes **tu10**. Note that the tubes themselves are not the same.*

*The cut-outs at the front of the upper cabin triangle tubes **tu10** should face outwards.*

c) Fit the trimmer cable outer termination bracket to the fore-most of the bolts holding the rear of the starboard side **tu10**, shown in Figure 90.

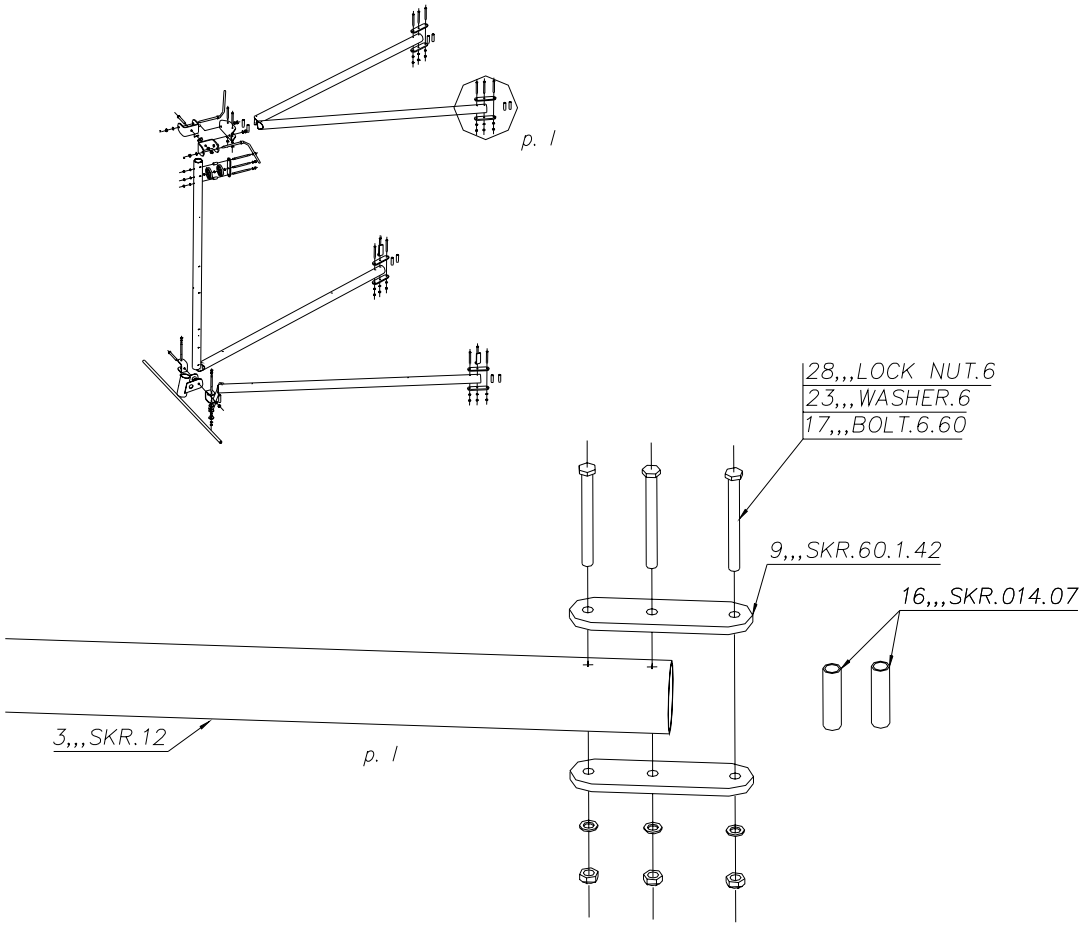


Figure 21; rear of upper cabin triangle tube tu10.

2.3.2 Assembling the top of the front vertical tube.

Refer to Figure 23 and Figure 24.

a) Fix the U-bracket ***4*** and the pair of U-brackets ***6*** for the leading-edges on the front vertical tube ***tu14***.

The two U-brackets for the leading-edges should be parallel.

The bolts must point rearwards as per the drawing and photos, in order to clear parts of the wing fold kit if one is to be fitted.

UKMOD: an anti-crush spacer tube should be fitted to the bolt holding the leading edge attachment U-brackets as it passes through the front vertical ***tu14****.*

b) Mount the aileron cable pulleys.

Replace the uppermost bolt with a 75mm long plain pin from the aileron connection kit, discarding the spacer, Figure 22. This allows the use of handed connections as per Service Bulletin SKR-SB-002.

If the pin is tight, run a 6mm drill or reamer through the holes to ease the fit. Secure the pin with a nappy pin or split ring in front of the upright tube. Removal of this pin allows the aileron cables to be removed from the pulleys when de-rigging, as otherwise the modified aileron cable ends cannot pass around these pulleys.

Figure 22; replacement pin above pulleys.

c) Temporarily assemble the two upper cabin triangle tubes ***tu10***, linking them to the double U-bracket ***4***.

Don't worry about the spacers etc. at this stage, as the tubes will not be lying flat making this difficult. Once the rear ends of the upper cabin triangle tubes are connected the front ends can be fitted properly one by one, at a later stage.

Figure 23; forward end of upper cabin triangle.

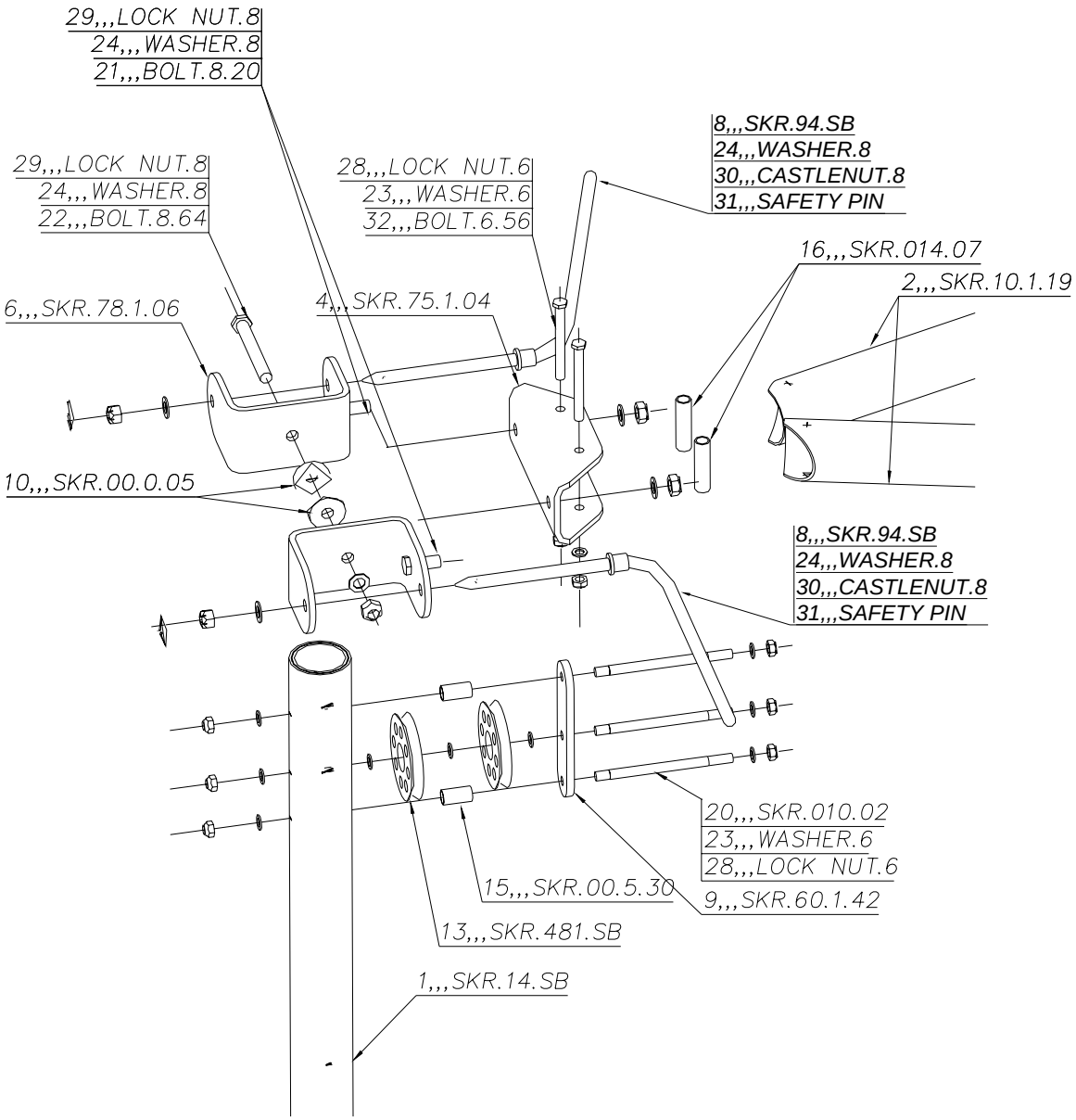


Figure 24; forward end of upper cabin triangle.

2.4 Rear Cabin Frame

2.4.1 Preparing the rear cabin uprights.

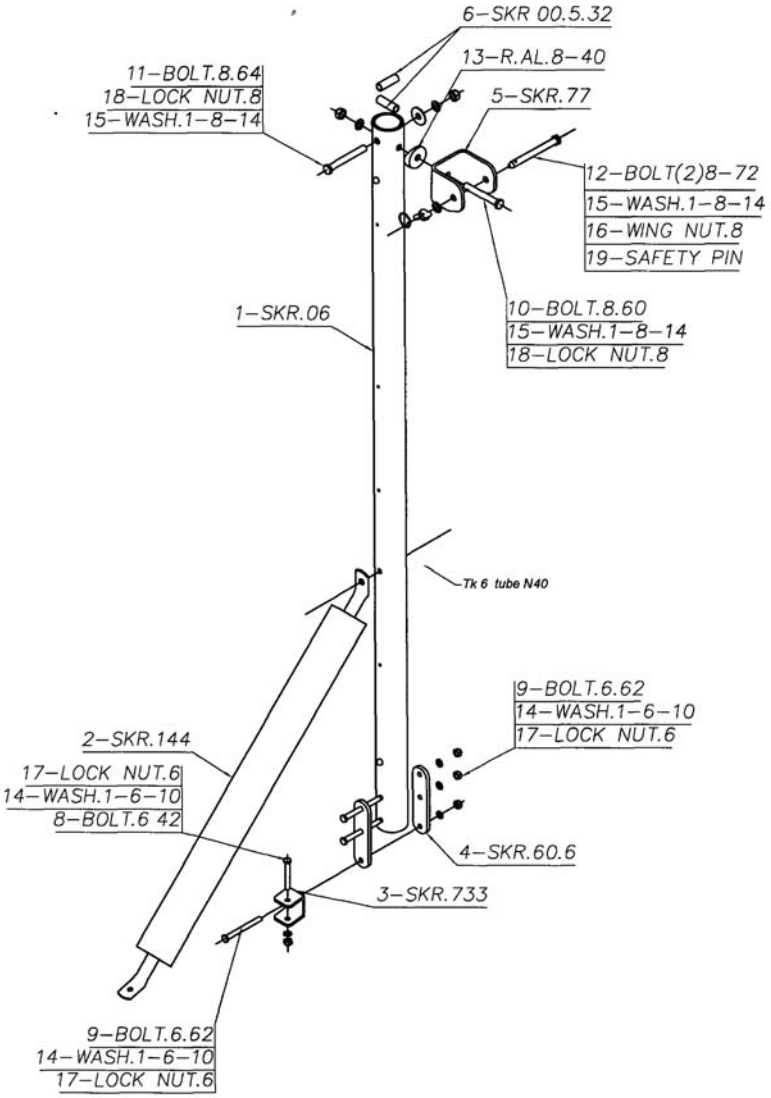


Figure 25; rear cabin uprights.

a) Fix the steel U-brackets for the trailing-edges with the taper downwards, using an aluminium saddle washer under each, against the rear cabin uprights ***tu6.***

*The rear cabin uprights **tu6** have inner sleeves at their upper end, and are not handed.*

*The small holes should be on the front side on the rear cabin uprights **tu6** to secure the covering later.*

*Position the nuts on the outside, against the U-bracket, rather than the inside as shown, with two threads protruding from the nuts. This prevents the nuts fouling the upper rear cabin cross-piece **tu7**.*

A spacer should be used on the bolt inside the tube.

b) Locate the rear cabin frame diagonals ***tu27*** temporarily and check the clearance from the saddle washers, see Section 2.4.3.(d) Rear cabin frame bracing.

Depending on the size of the saddle washers fitted between the Steel U brackets and the TU6 uprights, it may be necessary to file the edges of the saddle washers to clear the upper ends of the rear cabin frame diagonals **tu27***.*

c) Apply threadlock and tighten the bolts holding the trailing edge U-brackets, as they are not easily accessible later, but not so tight as to prevent rotation of the fittings by firm hand pressure.

Do not distort the tube.

2.4.2 Fitting the rear cabin uprights.

Refer to Figure 13, Figure 15, and figure 25.

a) Assemble the rear cabin uprights ***tu6*** to the main undercarriage cross-beam ***tu9***, using the second set of holes from the end.

Remember the bolt spacers on the two bolts at the bottom of ***tu6****.*

UKMOD: the small steel pieces ***14*** *on figure 25 are replaced by canted aluminium U-brackets, and the bolts securing them are longer than the others. Do not tighten these bolts yet, as the brackets will require filing to clear other parts when the undercarriage is fitted.*

These U-brackets are shown for identification in Figure 26. Filing to clear the undercarriage is carried out in the section on fitting the undercarriage.

Note that the brackets are handed, with the mounting hole offset in order to minimise the amount of filing which will be required later.

The bolts should all point rearwards through the main undercarriage cross-beam ***tu6****.*

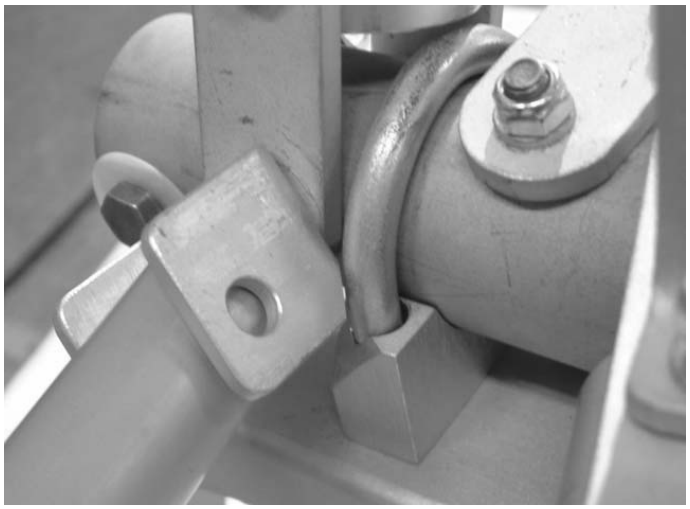


Figure 26; side member attachment bracket and undercarriage leg outer clamp, starboard side.

Refer to Figure 19.

b) Lift the upper triangle into position on the rear cabin uprights ***tu6*** and temporarily secure with an 8mm diameter bolt.

Do not worry about the spacers etc, as it is tricky to support the frame and include all the spacers without dropping them down the tubes!

c) Secure the bolts through the rear cabin uprights ***tu6*** and the upper cabin triangle tubes ***tu10*** including the proper spacers etc..

This is easier now the upper cabin triangle is in place, although it is still worth leaving all the accessible bolts loose until more of the fuselage is assembled.

Don't forget the bolts at the front of ***tu10****.*

The 8mm bolts securing the rear cabin uprights ***tu6*** *are fitted with spacers and the nut must not be done up yet as there are more pieces to fit to it.*

2.4.3 Rear cabin frame bracing.

Refer to Figure 10, Figure 27 and Figure 29.

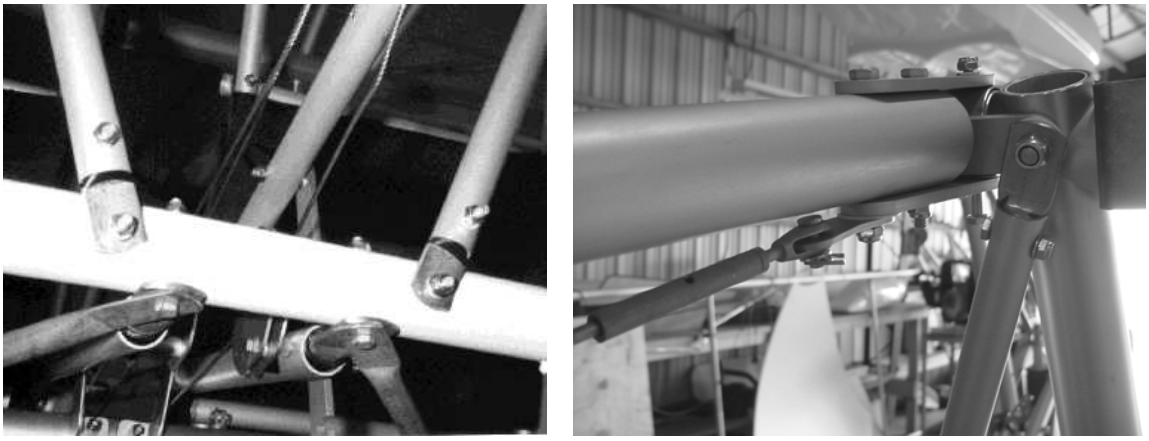


Figure 27; lower and upper ends of rear cabin frame diagonals.

a) Assemble the steel end pieces into the rear cabin frame diagonals ***tu27***.

The one with the 8mm hole goes at the upper end and the one with the 6mm hole goes at the lower end.

b) Install the bolt and spacer to support the seat a short distance above the lower ends of the rear cabin frame diagonals ***tu27***, Figure 28, or alternatively the small bracket pieces shown in Figure 29 (kit may be supplied with either option).

These should be oriented with the supporting part towards the front of the aircraft. Note that the spacer tube is also shown on Figure 29 as well as the small bracket piece. Only one or the other is required!

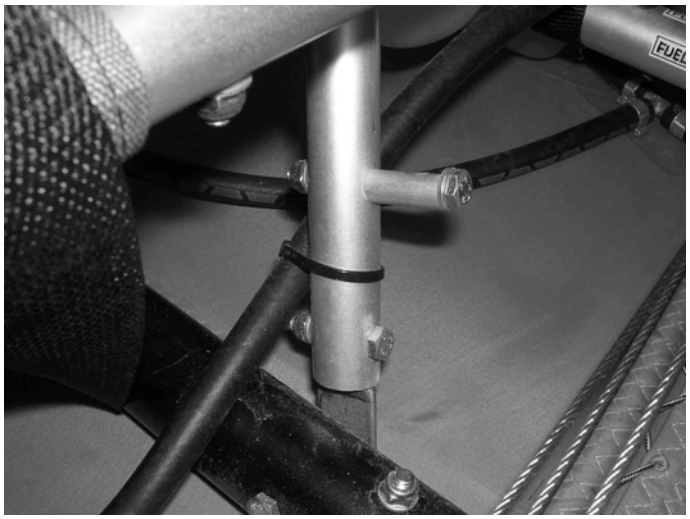


Figure 28; seat support peg.

c) Stiffen the cabin back with the two rear cabin frame diagonals ***tu27*** .

*These are positioned behind the rear cabin uprights **tu6**, with the seat supports pointing inwards and upwards, and their supporting part towards the front.*

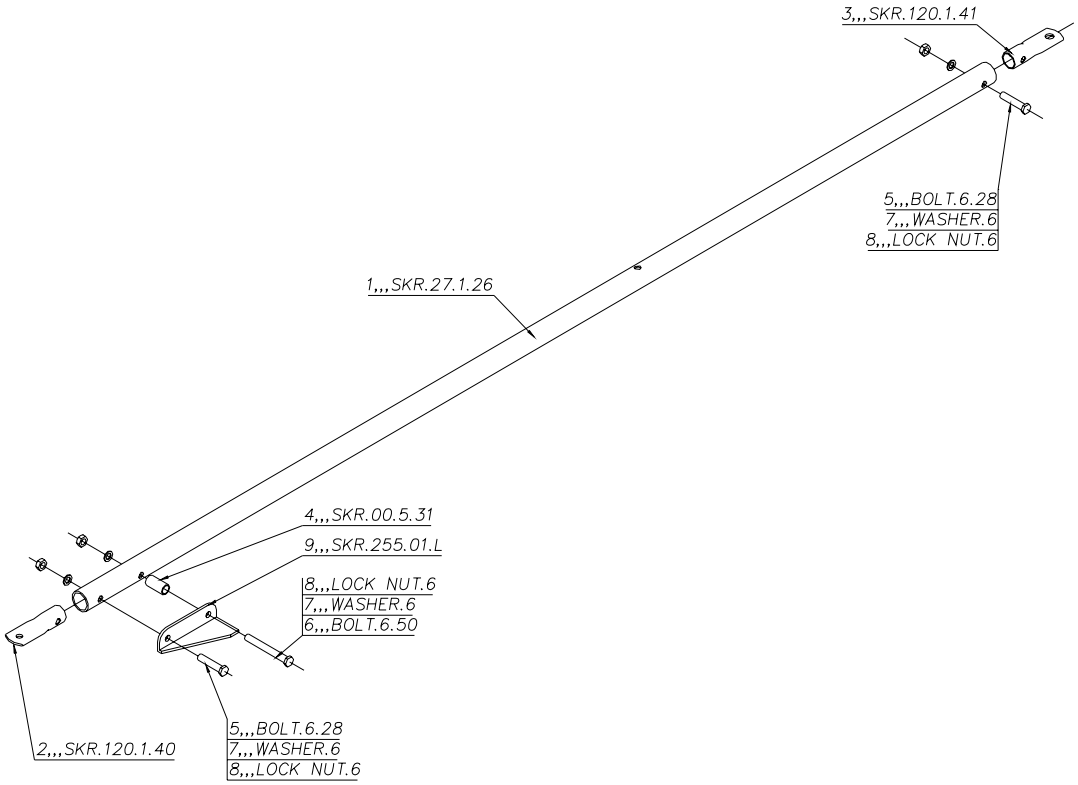


Figure 29; rear cabin frame diagonal, port side viewed from rear.

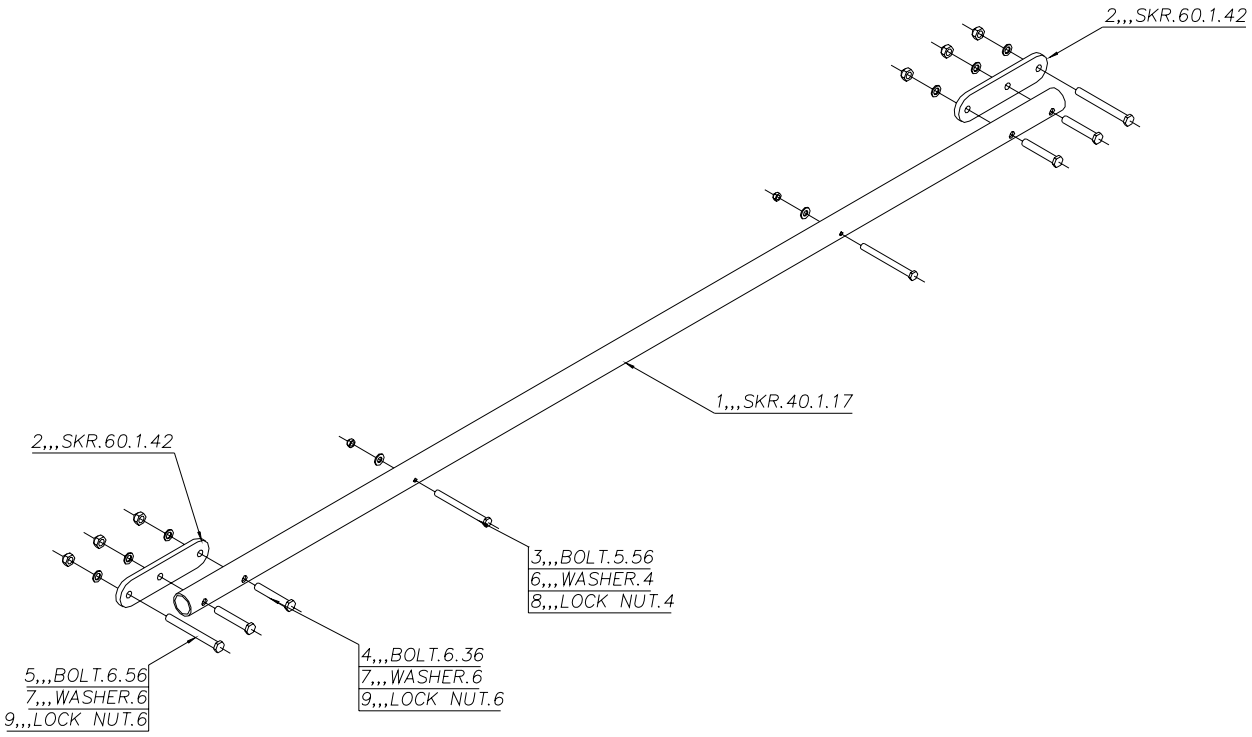


Figure 30; tu40, rear cabin frame cross-piece, looking from the front.

d) Fit the upper ends to the end of the 8mm bolts at the top of the rear cabin uprights ***tu6***.

> *It may be necessary to flatten or file the upper ends of the rear cabin frame diagonals **tu27** to clear the rear cabin uprights **tu6**. A steel washer may be placed between the steel end piece on the rear cabin frame diagonals **tu27** and the part they rest against in order to increase the clearance between the rear cabin frame diagonals **tu27** and the rear cabin uprights **tu6**.*

Attach the lower ends to the rear of the main undercarriage cross-beam ***tu9***.Refer to figure 27 and Figure 28.

e) Assemble the rear cabin frame cross-tube ***tu40*** and attach to the rear of the rear cabin uprights ***tu6***, but in front of the rear cabin frame diagonals ***tu27***.

> *The bolts should point rearwards, and pass through the upper ends of the steel drag link braces **tu144** before the rear cabin uprights **tu6** and finally the attachment plate on the rear cabin frame cross-tube **tu40**.*
>
> *Include a thin plastic washer between the steel drag link brace and the aluminium rear cabin uprights. Don't do up yet as these bolts are removed when fitting the coverings.*

2.4.4 Fuel tank upper mounting pieces.

Refer to Figure 31

a) Where the rear cabin frame cross-tube ***tu40*** crosses the rear cabin frame diagonals ***tu27*** they should be connected with a bolt, pointing backwards, Figure 31.

   The holes should be 6mm diameter, if not then drill them out to 6mm. Suitable 6mm bolts are included with the wooden spreader bar pieces.

b) Paint the wooden tank spreader pieces with fuel-proof paint.

   Fuel proof paint is available from model aircraft shops, an enjoyable but potentially expensive visit!

c) Assemble the wooden fuel tank load spreading pieces on the rear end of these bolts and tighten, but do not crush the wood excessively.

   Ensure that the end of the bolt is below the level of the rear surface of the wooden pieces.

Figure 31; fuel tank with wooden tank spreader pieces.

2.5 Engine Supports

2.5.1 Rotax 912.

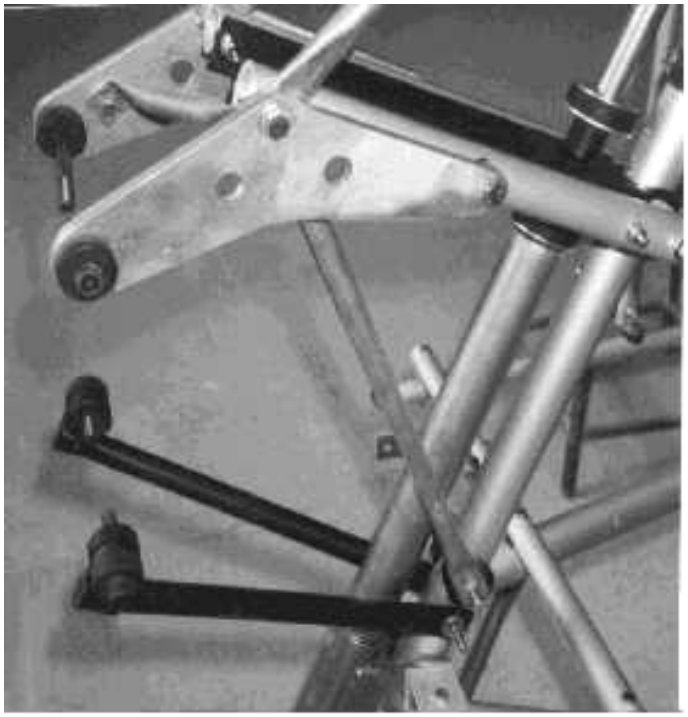


Figure 32; Rotax 912 engine mounts.

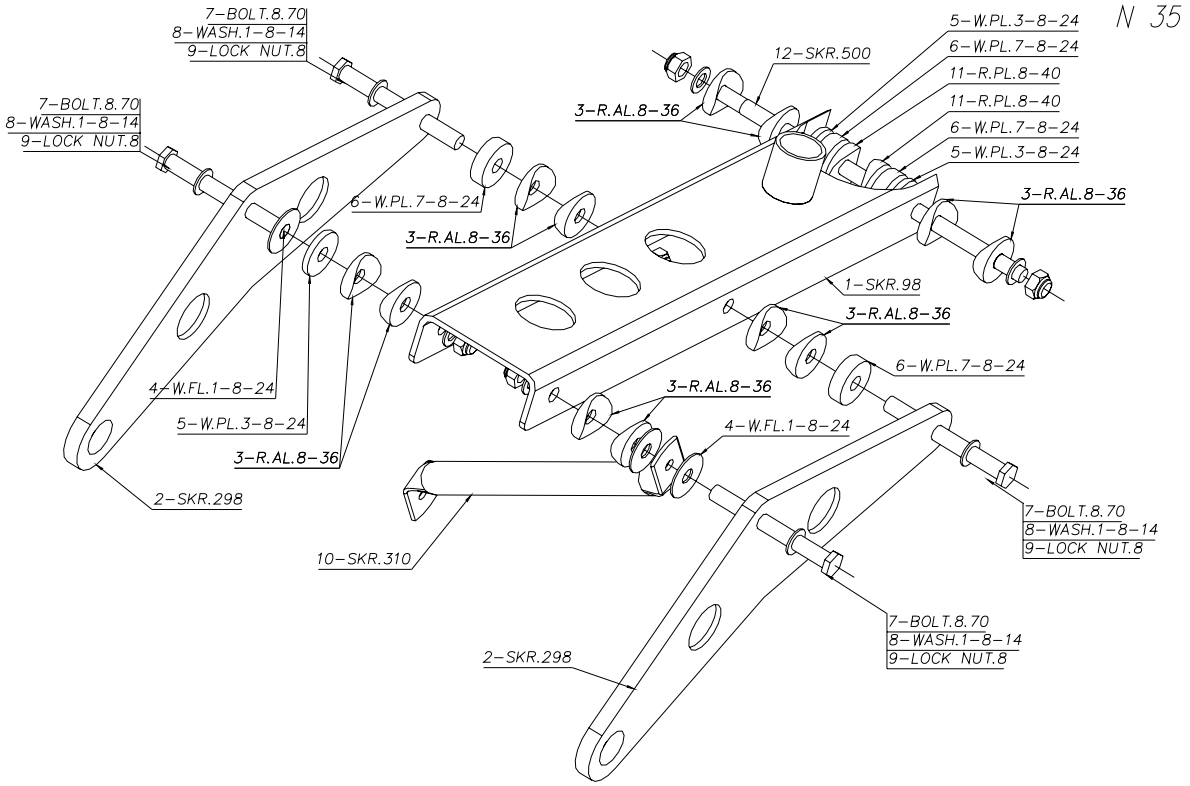


Figure 33; Rotax 912 mounting bracket.

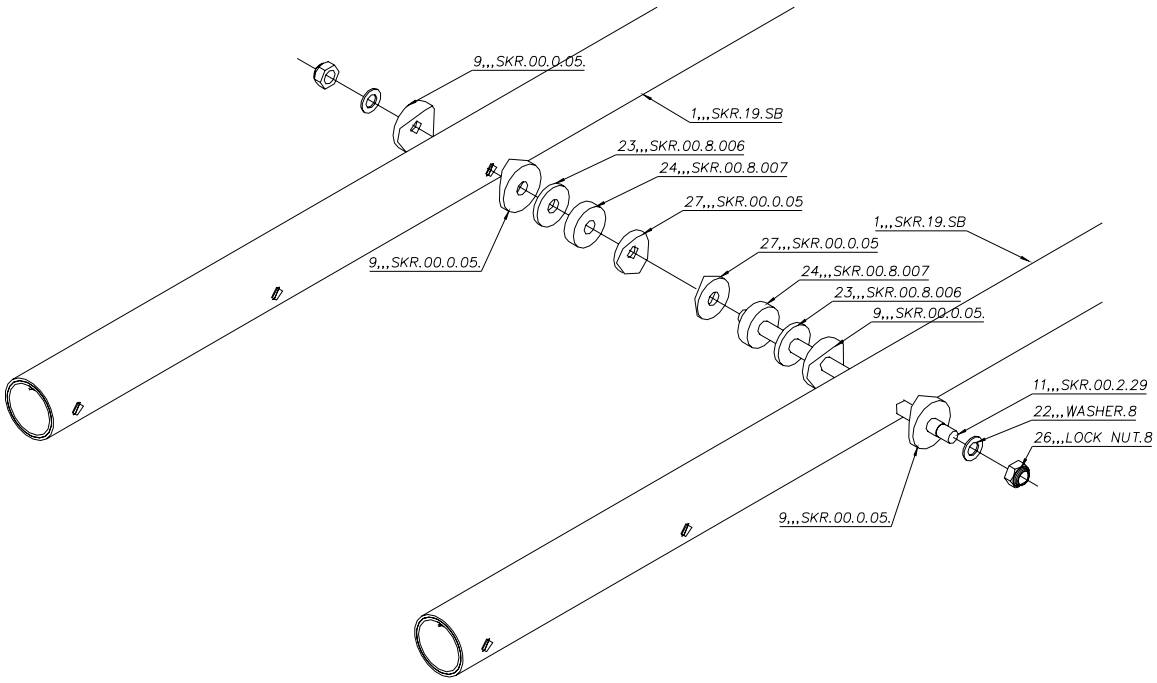


Figure 34; forward end of central cabin tubes tu19.

Refer to Figure 32, Figure 33 and Figure 34.

a) Locate the two central cabin tubes ***tu19*** onto the front vertical ***tu14*** including the steel engine mounting bracket ***98*** between them. Loosely bolt in place using the washers and saddle washers, Figure 34 and Figure 163.

   It is worth trial fitting the central cabin tubes to the underside of the main undercarriage cross-beam to allow the stainless steel brackets to be bent in a vice to align properly, see point (j).

   Before fitting the steel engine mount it saves time later if you drill a 6mm hole near the front to fit an earth connection, see Figure.

   *If the pulleys are already in place on the central cabin tubes **tu19**, they can be carefully removed and placed to one side for ease of handling the tubes if desired, noting the positions of the spacers etc.*

   *The two tangs projecting from the rear of the central steel bracket which connect with the bolt through **tu14** may have a slight curve, which can prevent the washers from seating flat against them. This causes the washers to be a tight fit. If this is a problem then insert the thicker washer from the underside against the inside of the tangs and file it to fit flat against it.*

   The two plastic rings which form the aileron stops may be slid over the tubes at this stage (see the section on the ailerons in the Wing chapter), although they may require removal later by cutting them off if adjustment of the aileron movement is required.

b) Loosely fix the two stainless-steel upper triangulation tubes ***tu24*** to the top of the front vertical ***tu14***, including saddle washers, Figure 23 and Figure 35.

c) Loosely attach the upper and lower stainless-steel triangulation tubes to the central cabin tubes and the engine mounting brackets, including the alloy side pieces ***298***, Figure 39 and Figure 33.

It will be necessary to tweak the ends of the steel triangulation tubes to position them flat against the engine mount and the front vertical tube ***tu14****.*

UKMOD: the front pair of mounting bolts should have a spacer tube fitted as they pass through the two central cabin tubes ***tu19****. This allows them to be done up reasonably tight, without ovaling the tubes. This should result in thread protruding from the Nylocs.*

If no thread is showing, the washers shown under the bolt-heads may be omitted.

Check the alignment of the stainless-steel parts, and tweak as necessary to get them to all lie flat against each other. This will reduce the space they occupy along the bolts.

Note the presence of the steel diagonal brace ***tu310*** *on the port side, and a corresponding additional thick plastic washer on the starboard side.*

One of the holes in ***tu310*** *may require drilling out to 8mm to fit the port mounting bolt. The other end, 6mm diameter, attaches to the starboard side of the mount, but should not be drilled until the engine is in-situ.*

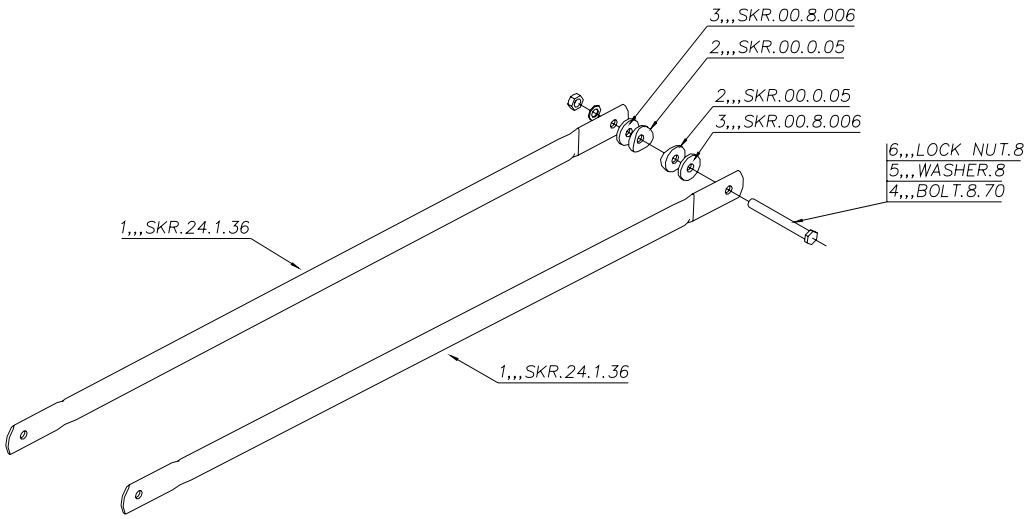


Figure 35; upper engine mount triangulation tubes.

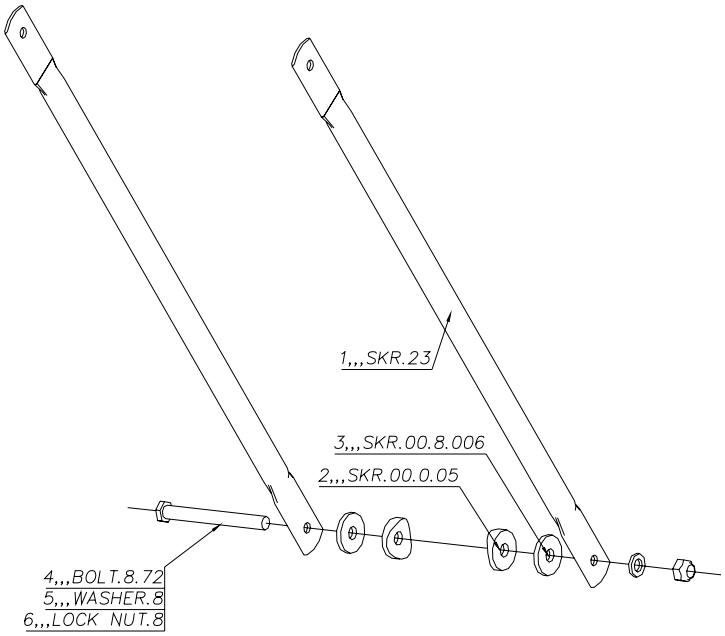


Figure 36; lower engine mount triangulation tubes.

d) Leave the bolt holding ***tu310*** slack enough to rotate it out of the way when fitting the engine.

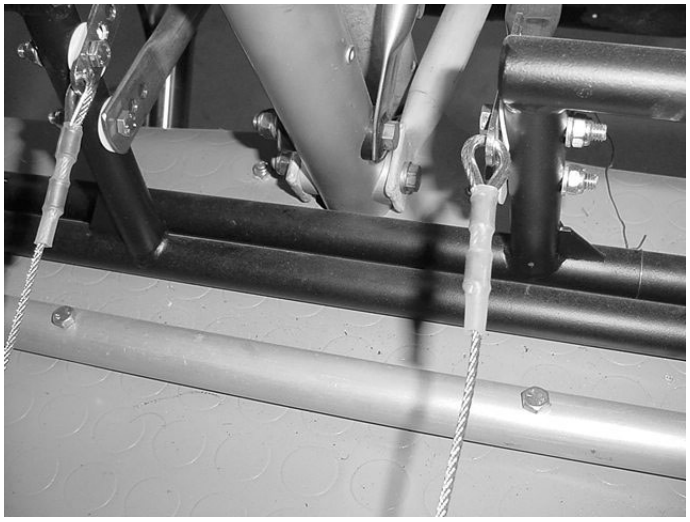


Figure 37; lower engine mounts and braces.

e) Loosely fix the two stainless-steel lower triangulation tubes ***tu23*** to the front vertical tube ***tu14***, including saddle washers, Figure 37 and Figure 36.

*It may be necessary to apply some weight to the engine mount to fit the bolt holding the lower triangulation tubes **tu23** to the front vertical tube, or to use a twisted rope as shown in Figure 38.*

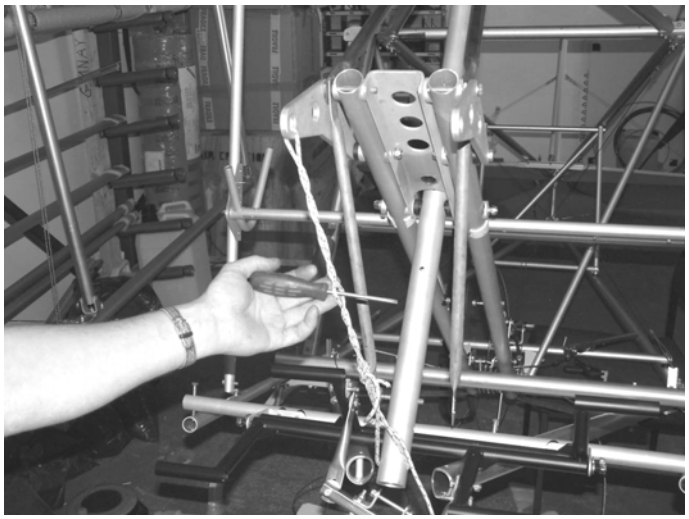


Figure 38; twisted rope used to pull down on engine mount.

f) The bolts around the engine mount may now be tightened, starting with those on the mount itself before tightening the bolts holding the top and bottom ends of the triangulation tubes.

*Leave the bolt holding **tu310** loose enough to turn it.*

g) Bend the steel diagonal brace ***tu310*** to fit between the engine mounting plates, Figure 39..

This should be done to set the distance between the plates at 175mm, measured at the front set of holes where the rubber engine mounts fit. Leave drilling the starboard engine mounting plate until the engine has been fitted.

h) Trial-fit a rubber engine mount and check the clearance between it and **tu310** held roughly in position.

tu310 *may be filed to clear the mount, or this may be left until fitting the engine when a definite position will be found.*

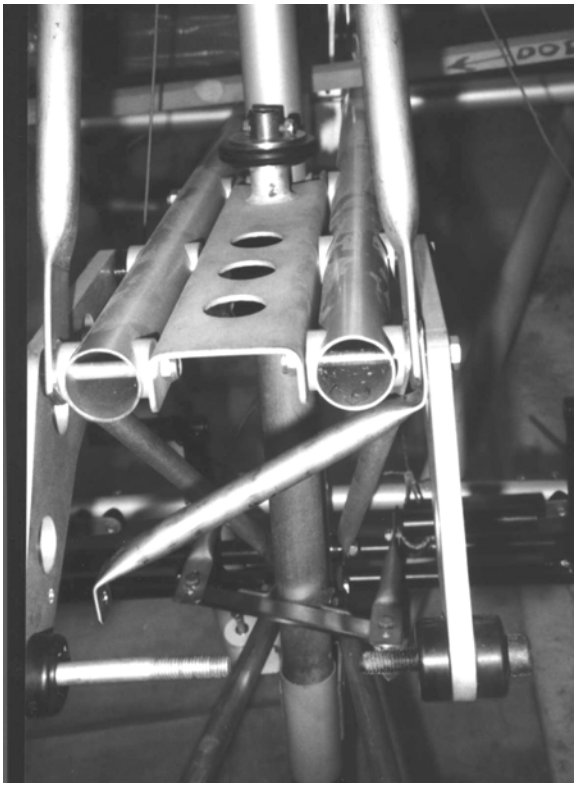


Figure 39; Rotax 912 engine mounts, front view.

i) Bolt the steel end pieces into the bottom ends of the central cabin tubes ***tu19***, including the plastic sleeves.

Orient the bolts with the nuts to the outside, to leave clearance on the inside for the flap handle detent lever.

j) Attach the two central cabin tubes ***tu19*** onto the main undercarriage cross-beam ***tu9***.

*Note the bolts through **tu9** should point upwards, and should pass through the stainless-steel under-seat diagonal tubes **tu42** (refer to Figure 27 and the tube numbering drawings at the start of this chapter) before passing through the central cabin tubes **tu19** and the main undercarriage cross-beam **tu9**.*

*The steel end pieces on the central cabin tubes **tu19** may require bending slightly to allow them to sit flat against the underside of the main undercarriage cross-beam **tu9**.*

It is useful to temporarily insert the long bolt which forms the pivot for the elevator cable pulleys, as this passes through both of the central cabin tubes, Figure 108. This will ensure that the tubes remain well aligned, otherwise this bolt will prove very difficult to insert later.

k) The lower engine mounts, Figure 40, should be attached to the front vertical ***tu14***, visible in Figure 37.

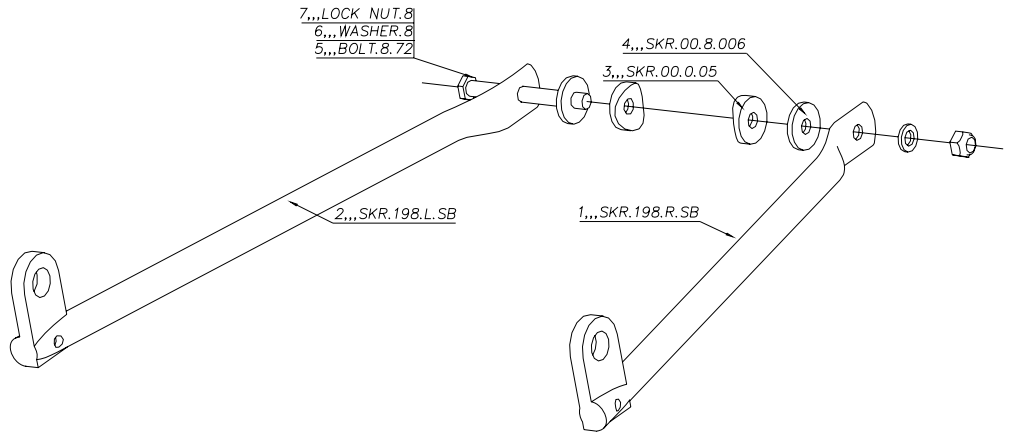


Figure 40; Rotax 912 lower engine mounts.

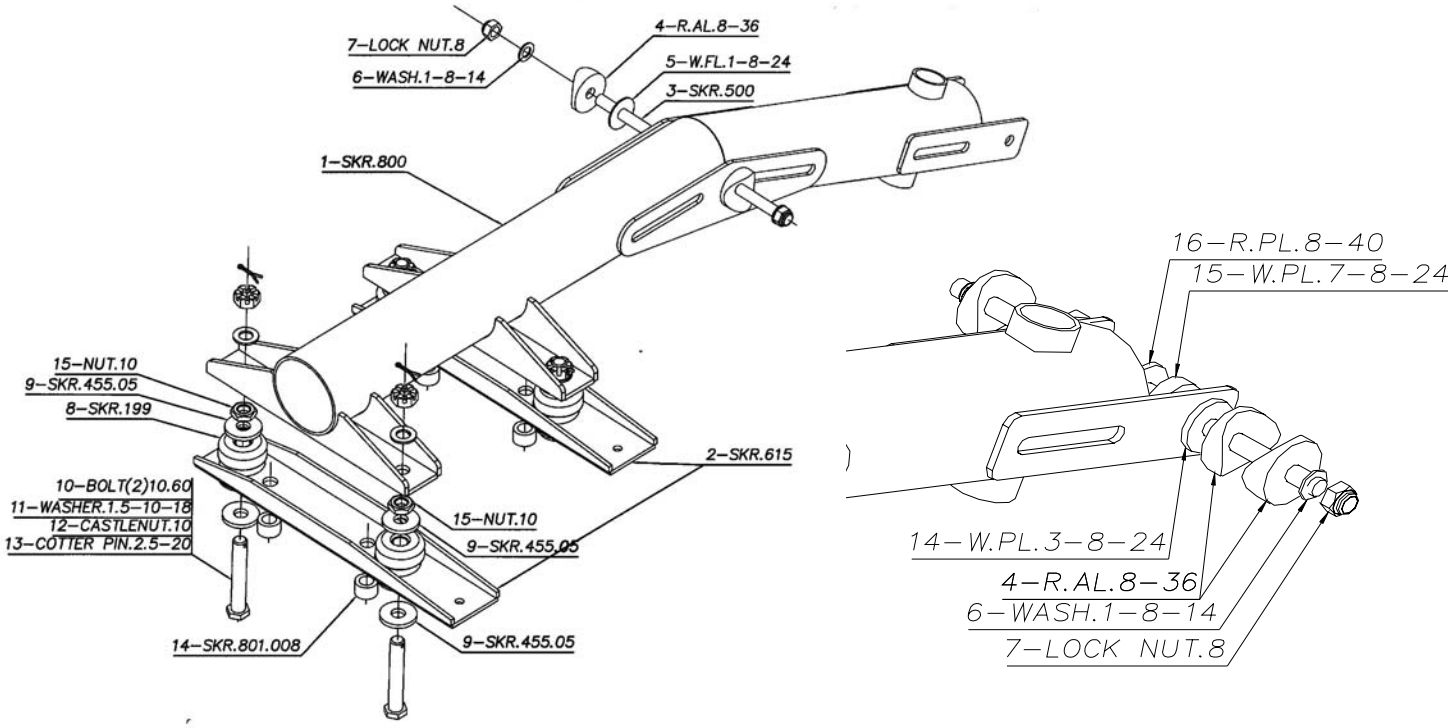
2.5.2 Rotax 582

a) Loosely fix the two stainless-steel upper triangulation tubes ***tu24*** to the top of the front vertical tube ***tu14***, including saddle washers, Figure 23 and Figure 35.

It is worth trial fitting the central cabin tubes to the underside of the main undercarriage cross-beam to allow the stainless steel brackets to be bent in a vice to align properly, see point (g).

*If the pulleys are already in place on the central cabin tubes **tu19**, they can be carefully removed and placed to one side for ease of handling the tubes if desired, noting the positions of the spacers etc.*

The two plastic rings which form the aileron stops may be slid over the tubes at this stage (see the section on the ailerons in the Wing chapter), although they may require removal later by cutting them off if adjustment of the aileron movement is required.



Rear detail

Figure 41; Rotax 582 type engine mount. The saddle washers between the mount and the central cabin tubes, on the bolt for the upper and lower triangulation tubes, may be omitted if this allows a better fit. Ignore the details of the rubber engine mounts for now.

b) Position the steel engine mounting bracket ***800*** between the central cabin tubes ***tu19*** and the front vertical ***tu14***.

c) Loosely bolt the rear end of the mount in place using the washers and saddle washers.

d) Loosely fit the upper and lower stainless-steel triangulation tubes between the central cabin tubes and the steel engine mounting bracket.

e) Loosely fix the two stainless-steel lower triangulation tubes ***tu23*** to the front vertical tube ***tu14***, including saddle washers, Figure 37 and Figure 36.

*It may be necessary to apply some weight to the engine mount to fit the bolt holding the lower triangulation tubes **tu23** to the front vertical tube, or to use a twisted rope in a similar manner to that shown in Figure 38.*

*It will be necessary to bend the ends of the steel triangulation tubes to position them flat against the engine mount and the front vertical tube **tu14**.*

f) Bolt the steel end pieces into the bottom ends of the central cabin tubes ***tu19***, including the plastic sleeves.

Orient the bolts with the nuts to the outside, to leave clearance on the inside for the flap handle detent lever.

Figure 42; Rotax 582 engine mount.

g) Attach the two central cabin tubes ***tu19*** onto the main undercarriage cross-beam ***tu9***.

*The bolts through **tu9** should point upwards, and should pass through the stainless-steel under-seat diagonal tubes **tu42** (refer to Figure 27 and the tube numbering drawings at the start of this chapter) before passing through the central cabin tubes **tu19** and the main undercarriage cross-beam **tu9**.*

*The steel end pieces on the central cabin tubes **tu19** may require bending slightly to allow them to sit flat against the underside of the main undercarriage cross-beam **tu9**.*

It is useful to temporarily insert the long bolt which forms the pivot for the elevator cable pulleys, as this passes through both of the central cabin tubes, Figure 108. This will ensure that the tubes remain well aligned, otherwise this bolt will prove very difficult to insert later.

2.5.3 Jabiru 2200

Refer to Figure 34 and Figure 43

a) Locate the two central cabin tubes ***tu19*** onto the front vertical ***tu14*** including the steel engine mounting bracket ***98*** between them. Loosely bolt in place using the washers and saddle washers, Figure 34 and Figure 163.

   It is worth trial fitting the central cabin tubes to the underside of the main undercarriage cross-beam to allow the stainless steel brackets to be bent in a vice to align properly, see point (h).

   Before fitting the steel engine mount it saves time later if you drill a 6mm hole near the front to fit an earth connection, see Figure.

   *If the pulleys are already in place on the central cabin tubes **tu19**, they can be carefully removed and placed to one side for ease of handling the tubes if desired, noting the positions of the spacers etc.*

   The two tangs projecting from the rear of the central steel bracket which connect with the bolt through tu14 may have a slight curve, which can prevent the washers from seating flat against them. This causes the washers to be a tight fit. If this is a problem then insert the thicker washer from the underside against the inside of the tangs and file it to fit flat against it.

   The two plastic rings which form the aileron stops may be slid over the tubes at this stage (see the section on the ailerons in the Wing chapter), although they may require removal later by cutting them off if adjustment of the aileron movement is required.

b) Loosely fix the two stainless-steel upper triangulation tubes ***tu24*** to the top of the front vertical ***tu14***, including saddle washers, Figure 23 and Figure 35.

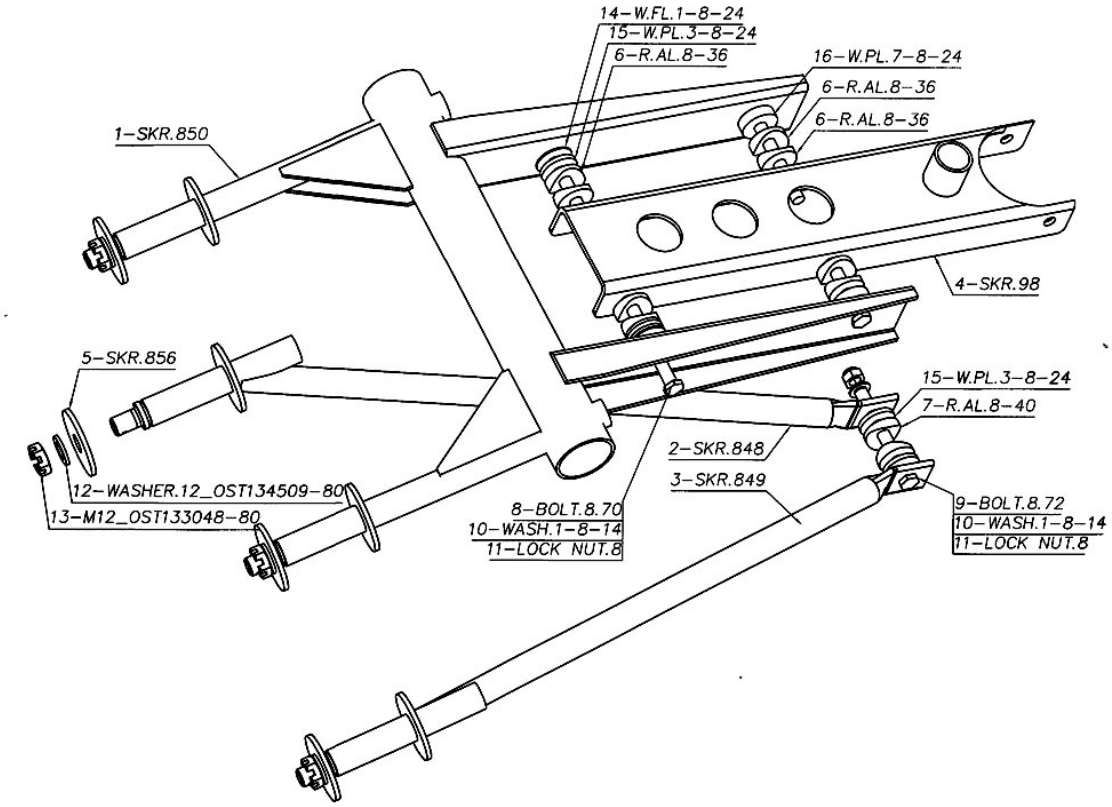
c) Loosely attach the upper and lower stainless-steel triangulation tubes to the central cabin tubes and the engine mounting brackets, including the Jabiru engine mount.

   *It will be necessary to tweak the ends of the steel triangulation tubes to position them flat against the engine mount and the front vertical tube **tu14**.*

   *UKMOD: the front pair of mounting bolts should have a spacer tube fitted as they pass through the two central cabin tubes **tu19**. This allows them to be done up reasonably tight, without ovaling the tubes. This should result in thread protruding from the Nylocs.*

   If no thread is showing, the washers shown under the bolt-heads may be omitted.

   Check the alignment of the stainless-steel parts, and tweak as necessary to get them to all lie flat against each other. This will reduce the space they occupy along the bolts.



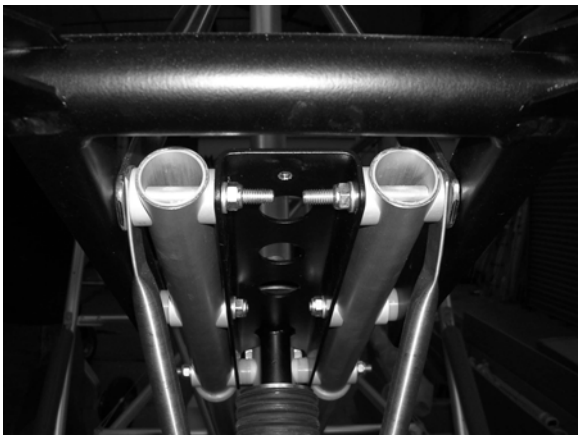


Figure 43; Jabiru engine mount.

d) The upper piece should be positioned either side of the central cabin tubes ***tu19***, to attach to the two forward pairs of holes.

The sequence on the forward pair of bolts is:

Bolt head
Mount
Upper triangulation tube
Lower triangulation tube
Aluminium saddle washer
Central cabin tube tu19
Aluminium saddle washer
Steel centre piece
Washer + Nyloc nut.

The sequence on the aft pair of bolts is:

Bolt head
Mount
Plastic washer(s) to fit
Aluminium saddle washer
Central cabin tube tu19
Aluminium saddle washer
Steel centre piece
Washer + Nyloc nut.

e) Apply weight as required, or tension using a twisted rope, to locate the lower ends of the stainless-steel lower triangulation tubes on their bolt through the front vertical ***tu14***.

f) Tighten the bolts, applying threadlock.

g) Bolt the steel end pieces into the bottom ends of the central cabin tubes ***tu19***, including the plastic sleeves.

Orient the bolts with the nuts to the outside, to leave clearance on the inside for the flap handle detent lever.

h) Attach the two central cabin tubes ***tu19*** onto the main undercarriage cross-beam ***tu9***.

*Note the bolts through **tu9** should point upwards, and should pass through the stainless-steel under-seat diagonal tubes **tu42** (refer to Figure 27 and the tube numbering drawings at the start of this chapter) before passing through the central cabin tubes **tu19** and the main undercarriage cross-beam **tu9**.*

*The steel end pieces on the central cabin tubes **tu19** may require bending slightly to allow them to sit flat against the underside of the main undercarriage cross-beam **tu9**.*

It is useful to temporarily insert the long bolt which forms the pivot for the elevator cable pulleys, as this passes through both of the central cabin tubes, Figure 108. This will ensure that the tubes remain well aligned, otherwise this bolt will prove very difficult to insert later.

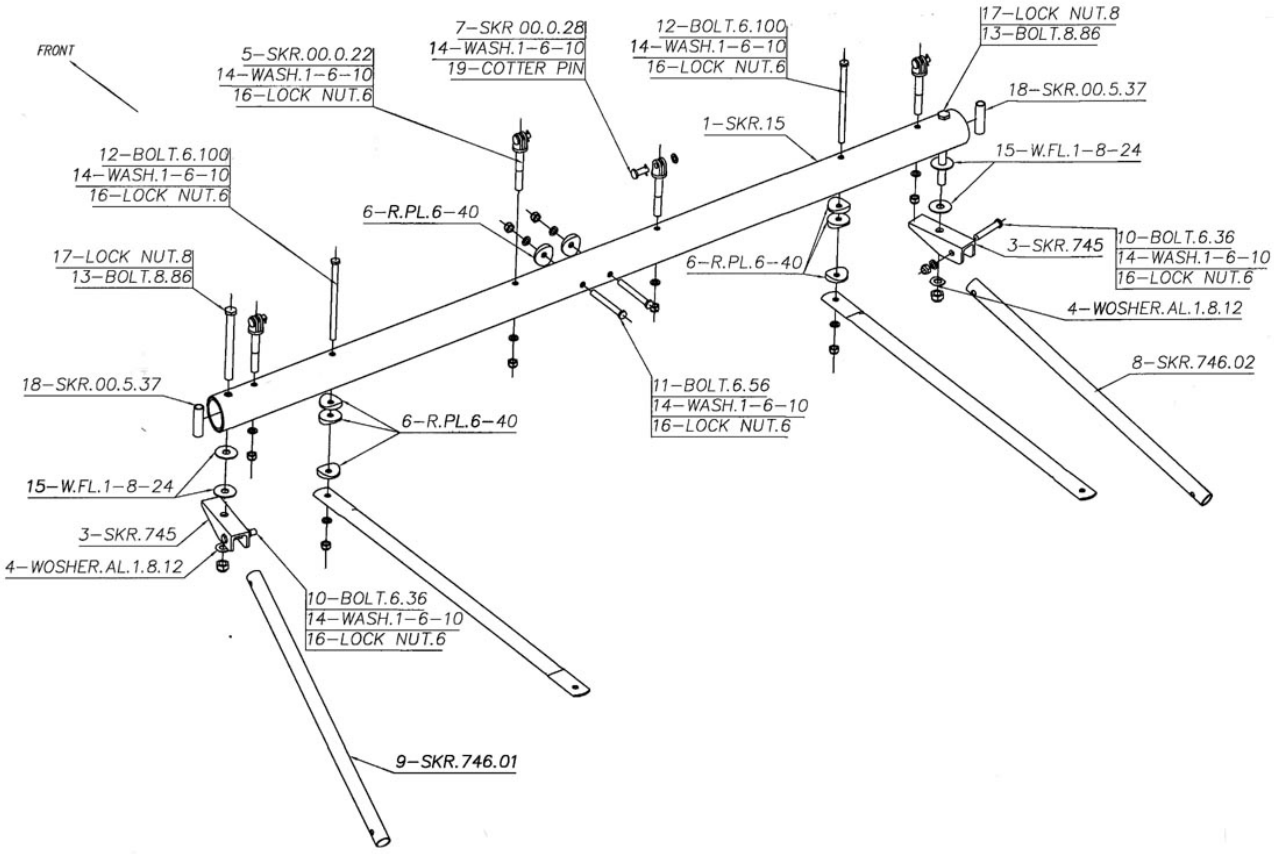
i) The lower engine mounts, Figure 40, should be attached to the front vertical ***tu14***, visible in Figure 37 (Jabiru version is slightly different but fits in the same manner).

j) Tighten the nuts, applying threadlock.

2.6 Floor

a) Fit the seat front support tube ***tu15***, above the lower cabin triangle tubes ***tu12*** with a pair of saddle washers per bolt between the two tubes, Figure 44.

Note the tapered ends of the tube taper towards the front.



b) The forward ends of the steel under-seat diagonal tubes ***tu42***, which were attached to the main undercarriage cross-beam, should be attached to the bottom of the bolts securing the seat front support tube ***tu15*** to the lower cabin triangle tubes ***tu12*** with a thin plastic washer or saddle washer between the steel tube and the aluminium tube.

Once fitted it is worth cutting off the protruding bolt end beneath the fuselage, to prevent it rubbing on the covering. Leave at least 1.5 threads showing, and coat the exposed end with a dab of paint to prevent rusting.

c) Fit the four eyebolts to mount the seats.

The outermost tubes in the picture are fitted later, with the main undercarriage.

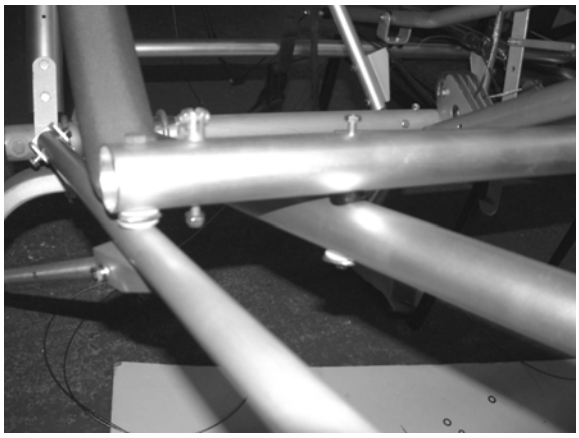


Figure 44; seat front support tube.

d) Cut a hole in the floor for the battery box.

*The hole is located on the centreline, approximately 1cm back from the rudder pedal mounting bar **tu18**. The hole is 15cm long by 9cm wide, Figure 45.*

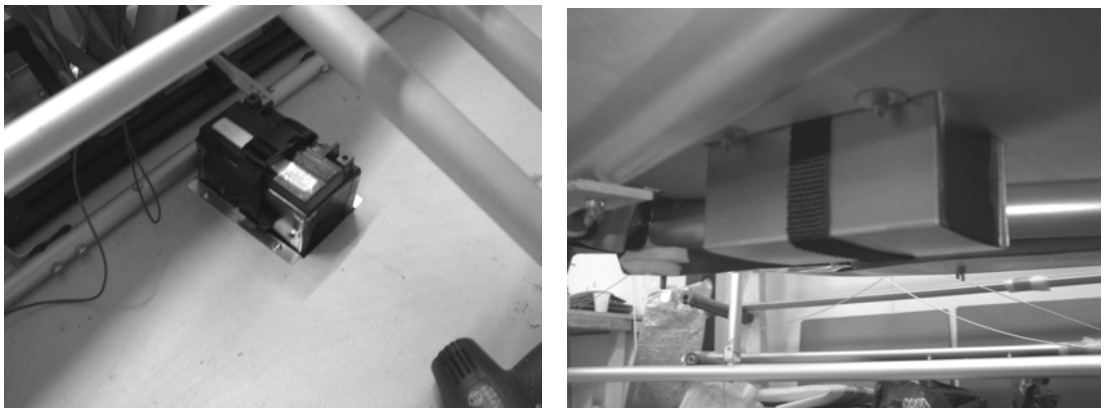


Figure 45; battery location.

e) Prepare the floor as required: vinyl or thin carpet may be used, or varnish with some sugar or sand to provide grip. Keep it light.

It is recommended that the entire floor be lightly varnished to seal the surface and prevent absorption of moisture, oil etc. even if carpet is to be fitted.

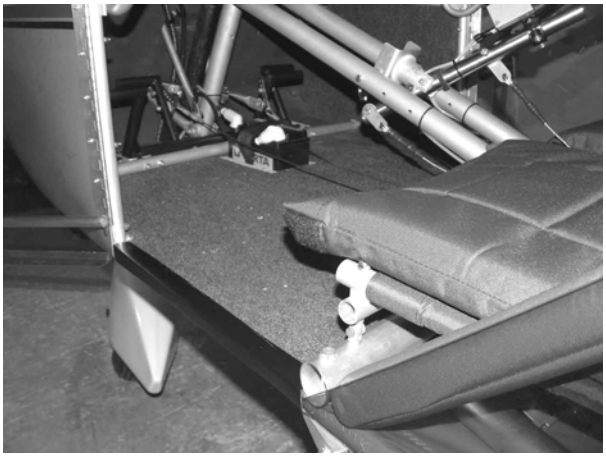


Figure 46; view of installed floor.

f) Position the floor against the front of the seat front support tube ***tu15***.

It should butt up against the underside curve of the tube, but not actually pass beneath it, thus preventing the floor from lifting upwards along its rear edge in negative-g situations. This can be seen in Figure 47.

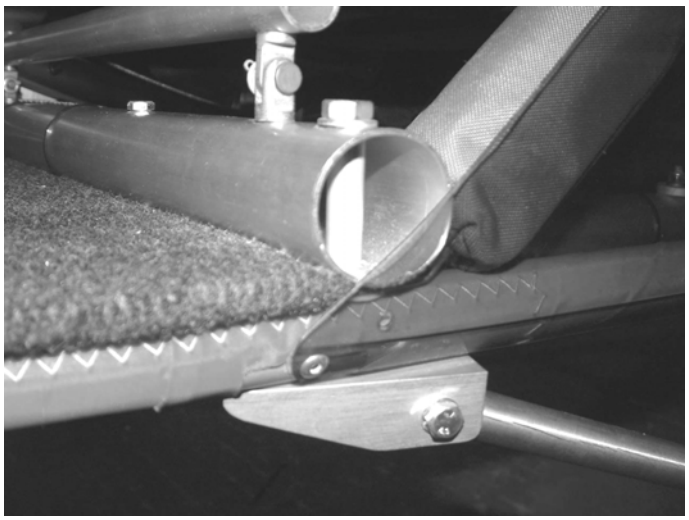


Figure 47; rear of floor against tu15.

g) Mark through from the bottom the positions of the holes for the rudder pedal mounting bar, and drill the floor to suit.

The floor passes beneath the rudder pedal mounting bar.

Apply the supplied self-adhesive foam strips along the tops of the tubes which the floor rests on, to prevent it rattling.

h) To further stiffen the floor in the middle of the cockpit, fit the small piece of L-section aluminium to support the floor, see Figure 52.

This is attached by the bolts which hold the central bracing pieces, which are fitted later.

i) Install the battery box, and secure it with four bolts with penny washers.

j) Fit the webbing strap, passing right around the box through the slots in the side of the box, with the buckle at the top.

Leave fitting the battery until later.

2.7 Rudder Pedals

Refer to Figure 48.

a) Fit the rudder pedals orientated as shown on the drawing, before attaching the second of the two L-brackets if they are not already in place.

b) Fit the rudder pedal mounting bar ***tu18*** to the top of the lower cabin triangle tubes ***tu12***, over the top of the floor.

c) If a floor is fitted, the saddle washers between the rudder pedal mounting bar and the lower cabin triangle tubes should be omitted.

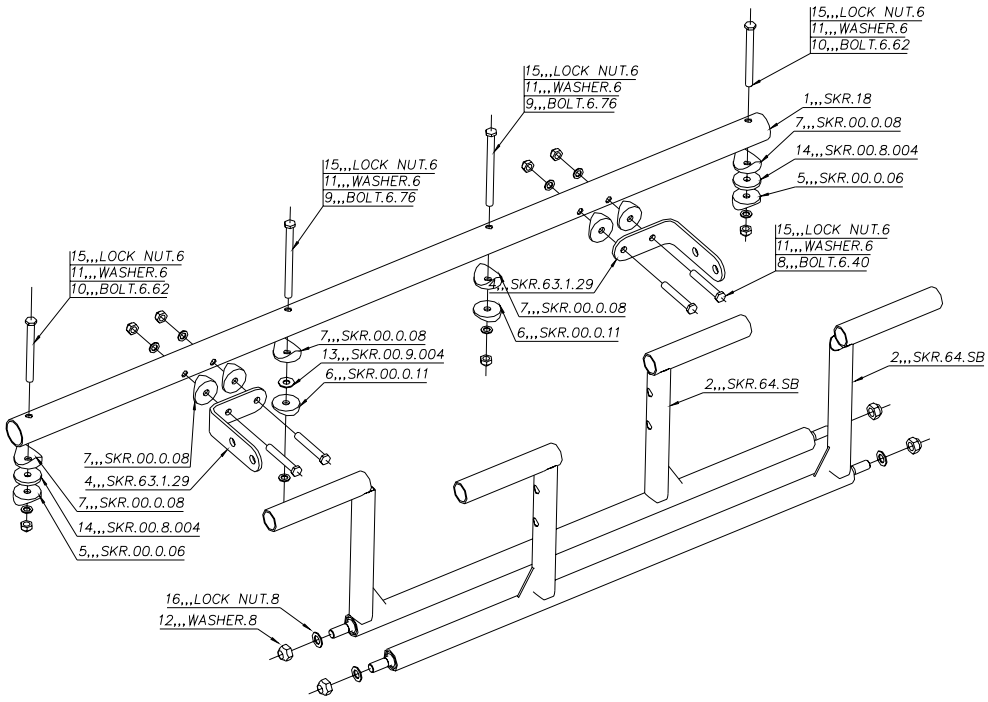


Figure 48; rudder pedals.

d) Attach the rear end of the steel diagonal-brace ***tu43*** to the bottom of one of the bolts, including a plastic washer between the steel brace and the aluminium tube.

e) If no floor is fitted, put pieces of prop-tape on the lower cabin triangle tubes ***tu12*** beneath the rudder pedals to protect the tubes from abrasion from the pedals when under load.

f) Cut off any protruding ends of the rudder pedal mounting bar bolts beneath the aircraft, to prevent them rubbing on the coverings. Nut caps may also be fitted.

2.8 Control Stick Assembly

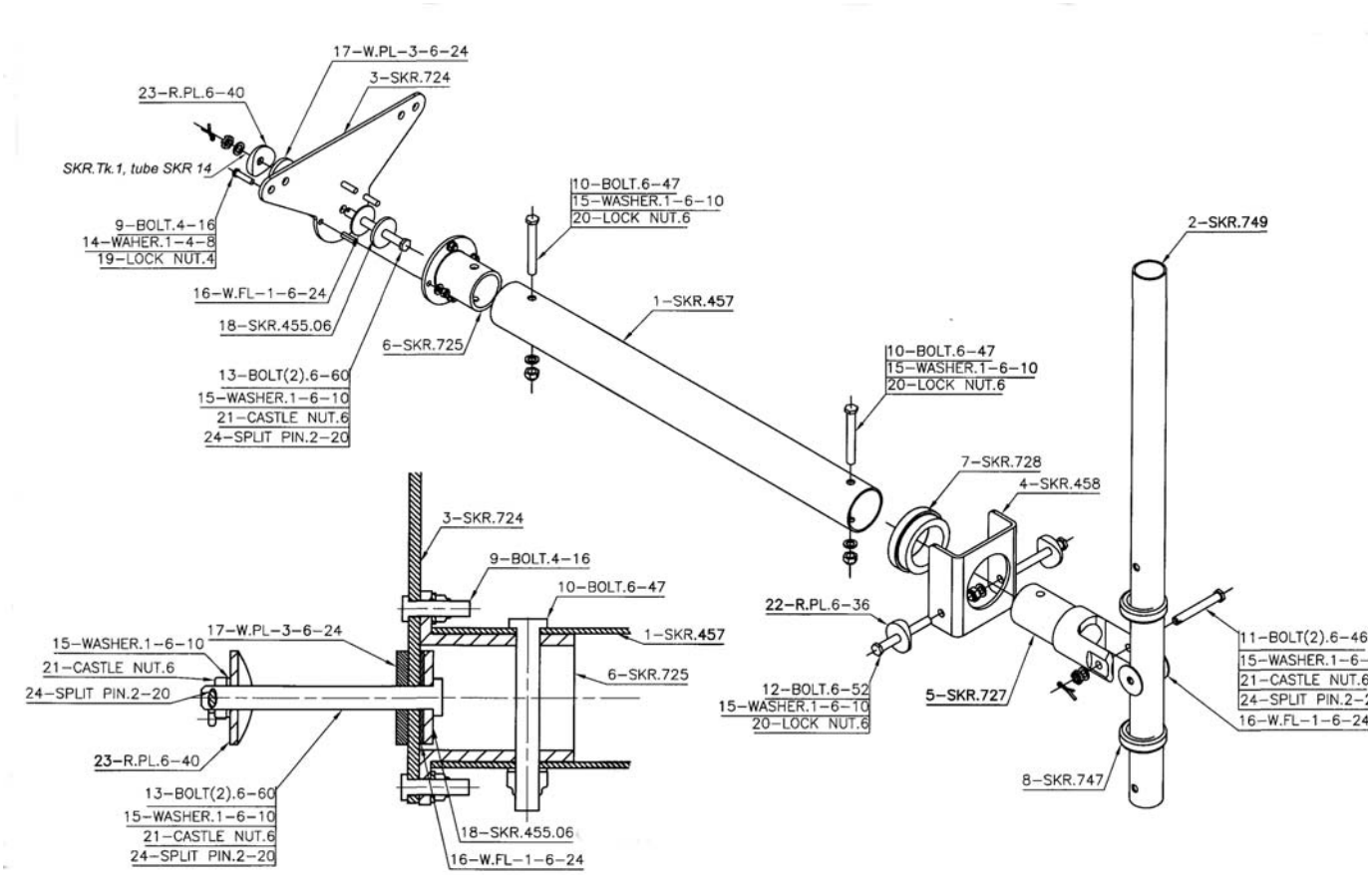


Figure 49; UK MOD control stick and torque-tube parts.

a) Attach the aileron horn to the machined ‘top hat’ with 4mm bolts.

Rivets must not be used here, as the fitting carries all the tension loads from the elevator controls. Use the bolts supplied, do not use any unknown strength bolts. Attach the top hat to the front vertical ***tu14*** *by the pivot bolt through the aileron horn, inserted from the rear.*

The pivot bolt must be assembled in the following order:

Bolt head
Large metal washer
Plastic washer
Aileron horn
Thin plastic washer and saddle washer
Front vertical tu14
Plastic saddle washer
Thin plastic washer (if desired)
Large metal washer
Small metal washer
Castle nut and split pin

b) This should be done up tight enough to remove all play but without discernable friction.

c) Fit the stick to the stick pivot fork with thin nylon washers either side of the stick in the stick pivot fork.

d) The pivot bolt should be done up just tight enough to remove any play but allow movement of the stick without discernable friction.

e) Rubber rings are is supplied to act as elevator stops. They should be positioned on the stick so as to engage on the edge of the fork jaws,

They may be secured by glue and/or cable ties above and below them.

f) Fit the plastic torque-tube bearing into the rear pivot support.

The bearing is inserted from the front, Figure 50. Then if the forward pivot bolt were to fail, the stick would still be held in place by this bearing.

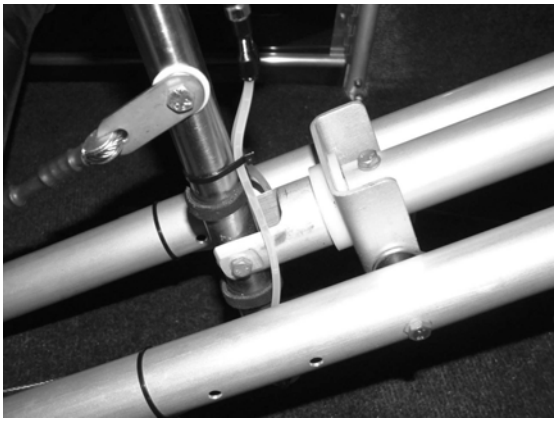


Figure 50; torque-tube bearing.

g) The stick pivot fork end should be fitted through the plastic torque-tube bearing and into the torque-tube.

Note that the plastic bearing fits over the fork end and is trapped in position by the torque-tube. This should be an easy fit with 0.5mm free play along the axis of the torque-tube. If this is tight it may be necessary to file the end of the torque-tube a little to prevent binding.

If the bearing is tight on the stick pivot piece when positioned correctly, the bearing should be abraded lightly until a smooth action is achieved.

h) The torque-tube can now be fitted onto the front pivot (attached to the aileron horn), and the rear pivot can be bolted to the central cabin tubes ***tu19***.

Note that the rudder stop cables will be fitted between the rear pivot support and the central cabin tubes, Figure 112. This is done in section 5.5.5. Do not tighten these bolts up without the stops in place.

*It may be necessary to slot the holes horizontally in the rear pivot where it attaches to the central cabin tubes **tu19** to allow it to take up the exact alignment of the torque-tube, but note the rudder stop cables will have some effect on this alignment.*

i) Insert and secure the bolts holding the fittings into the ends of the torque-tube.

2.9 Finishing the Forward Fuselage

2.9.1 Tightening bolts

At this stage it is permissible to tighten most of the bolts, as the cabin frame now forms a well braced structure. The exceptions are the bolts securing the lower ends of the rear verticals to the main undercarriage cross-beam, as these will be undone when fitting the undercarriage.

Check the basic alignment of the structure as you tighten the bolts, trying not to work in such a fashion as to introduce any unnecessary distortions into the structure (e.g. don't do all the bolts up along one side and then along the other).

Some slight misalignment is inevitable in a pre-drilled structure of this type, and unless this is severe it is probably best to live with it rather than to open out too many bolt holes. A slightly asymmetrical but well defined shape is preferable to a perfectly aligned shape with sloppy bolts.

Remember to apply threadlock, and do not over tighten the bolts. The tubes should not be visibly distorted. Remember the bolts are not relying on their tightness to stay done-up, they only need to be tight enough to avoid the parts rattling against each other. The Nyloc and the Loctite are responsible for keeping the bolts done-up.

2.9.2 Central brace

Refer to Figure 51 and Figure 52.

a) Fit the aluminium angles ***2*** and ***3*** linking the central cabin tubes ***tu19*** to the seat front support tube ***tu15***.

   These are not pre-drilled, as the exact hole positions are affected by the general alignment of the rest of the fuselage.

b) Bolt the angles to the seat front support tube ***tu15*** first, then drill them to match the holes in the central cabin tubes ***tu19***.

   *To aid clearance for the rudder and elevator cables, it is recommended that (if supplied) both the lower saddle washers on the seat front support tube **tu15** are omitted. This leaves only the side ones against the central cabin tubes **tu19**.*

   An additional thin plastic washer may be fitted between the central brace and the starboard central cabin tube to increase clearance for the rudder cable.

   The bolts should pass from the middle towards the outside, to clear the elevator cables.

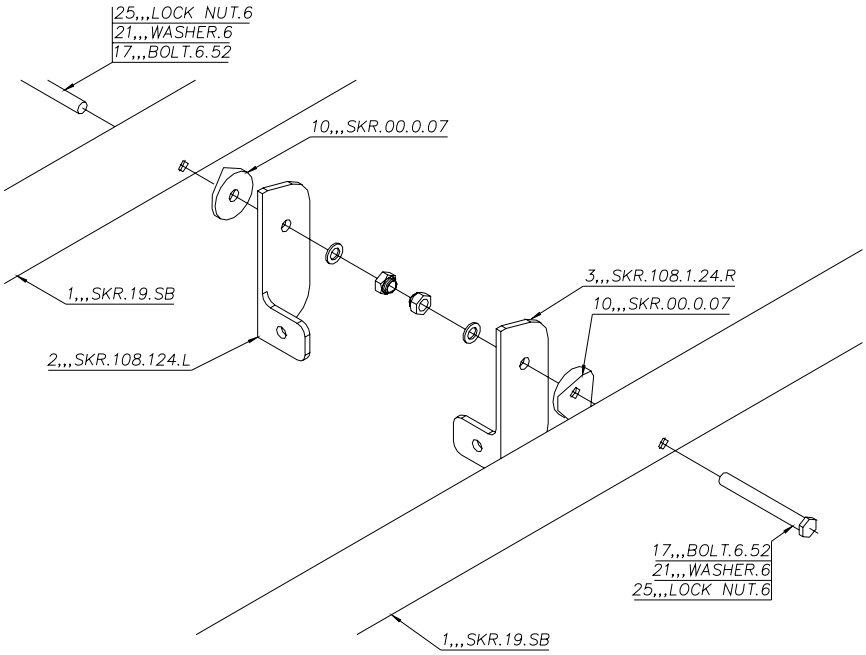


Figure 51; central bracing pieces. Note the bolts should be the other way around (as shown in photo fig 53).

Figure 52; central bracing pieces.

3 Rear Fuselage

The rear fuselage is composed of four longitudinal tubes, connected by the vertical fin at the tail end and braced by a single frame half way down. Four steel cables are used diagonally to stiffen the structure, with tension applied by turnbuckles fitted to two of the cables.

Once again, do not tighten the nuts until the assembly has been completed.

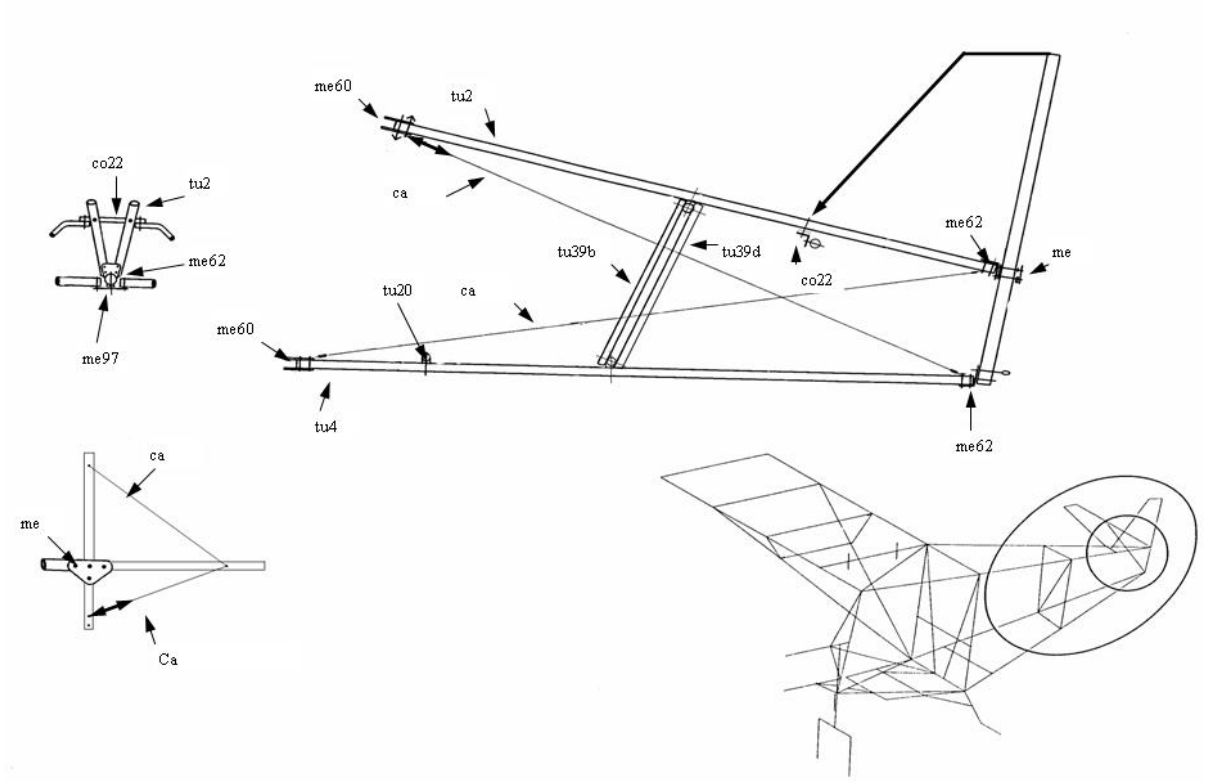


Figure 53; rear fuselage. Top left is top view of tailplane attachments, bottom left is rear view of half tailplane and fin.

Figure 54; rear fuselage on uncovered frame.

3.1 Tail End

a) Fit the rudder post (the trailing edge of the vertical fin) between the two pairs of saddle washers shown in Figure 55 and Figure 56.

Do not forget the steel T-piece to which the horizontal stabiliser halves attach, and the extra flat washer on the lower bolt, Figure 56.

Some difficulty may be encountered with access to the various nuts in this area. A useful trick to hold a nut to the end of a spanner is a piece of sticky tape placed over the end of the spanner.

Tighten these particular nuts now using Loctite, as they are very difficult to reach later.

b) Fit the stainless-steel bracket in front of the rudder post, and attach the upper pair of longitudinal tubes **tu2** as per Figure 56.

The cables are the ones without the turnbuckles. They have an end where the gap between the swages is purposely long (10cm or more). This end goes towards the lower front of the rear fuselage.

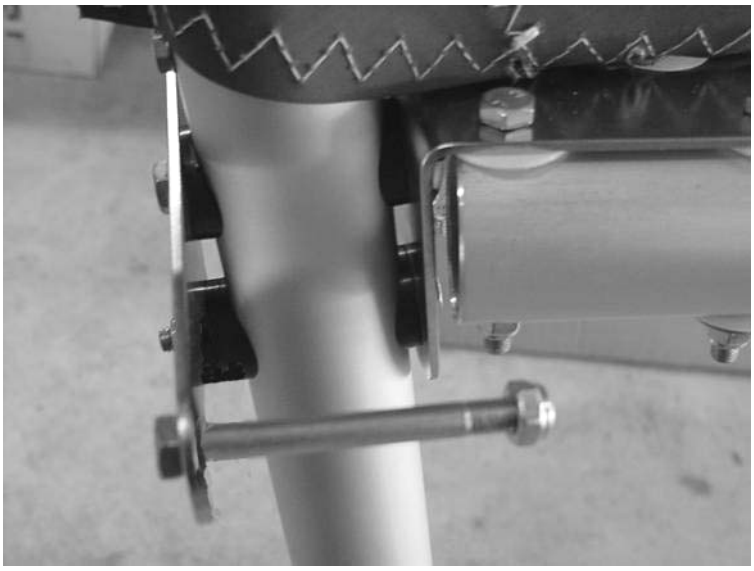


Figure 55; vertical fin and horizontal stabiliser rear mountings.

c) Attach the bottom end of the vertical fin to the bracket and longitudinal tubes ***tu4*** in a similar manner, Figure 57.

The cables are the ones fitted with turnbuckles at their forward ends.

If you do not have suitable supports or a helper to hold the front ends of the tubes at this stage it can be helpful to mount the bracing frame (as detailed below) to the lower pair of longitudinal tubes, followed by resting the upper pair of tubes on it whilst they are attached to the bracing frame and the rudder post is attached to the lower pair of tubes.

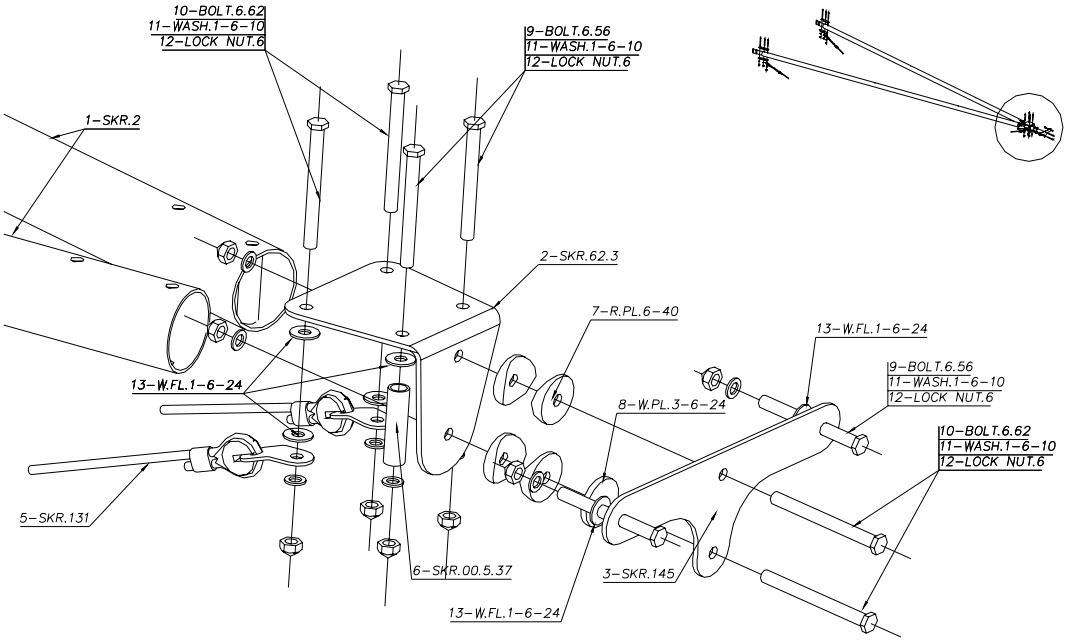


Figure 56; rear end of upper rear fuselage tubes.

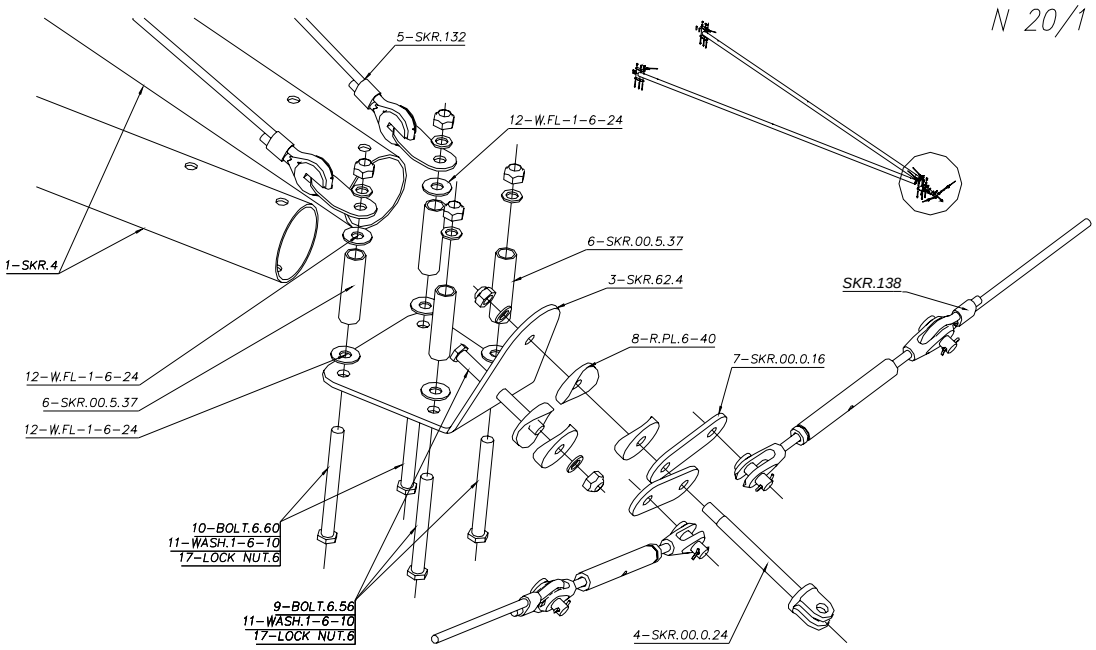


Figure 57; rear end of lower rear fuselage tubes.

3.2 Bracing Frame

a) Fit the rear fuselage bracing frame ***tu39*** to the upper and lower rear fuselage tubes using the holes approximately mid-way down the tubes, Figure 59 and Figure 58.

Check the orientation of this frame against the drawing below, as examples have been delivered assembled the wrong way around.

Figure 58; rear fuselage bracing frame, rear to left of photograph.

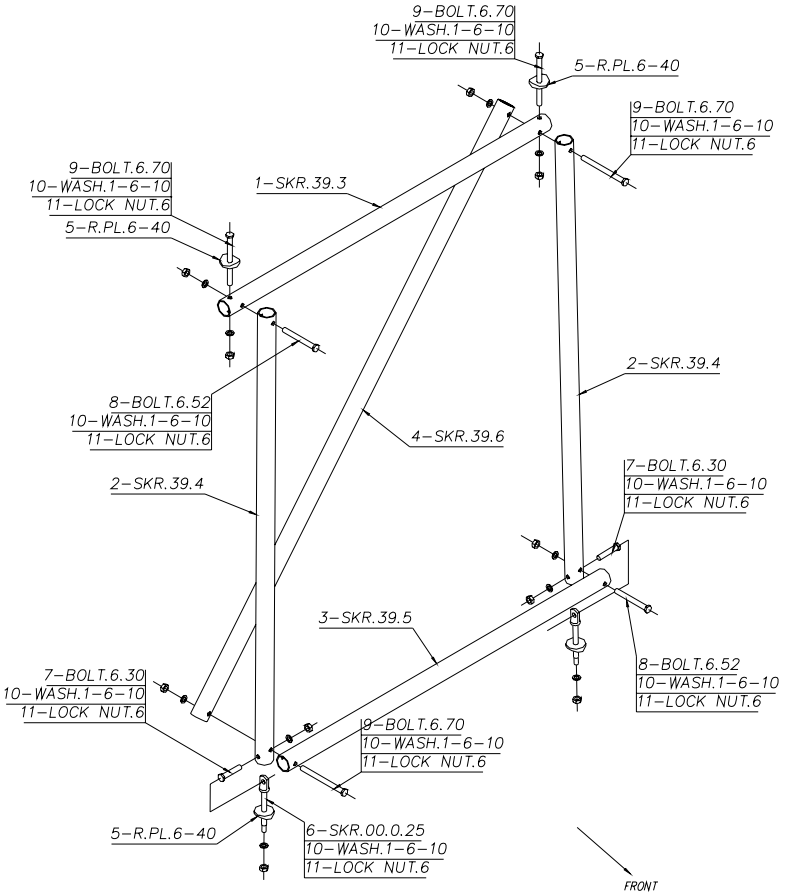


Figure 59; rear fuselage bracing frame. Note orientation arrow.

3.3 Front End

a) Prepare the front ends of the lower tubes, Figure 60.

Use a thin plastic washer between the steel cable tang and the aluminium brackets.

Note that the cable ends shown are from the rear end of the upper tubes, and that the cables swap sides. Therefore the cables make diagonals from upper rear starboard to lower front port tube ends, and from upper rear port to lower front starboard ends, Figure 61.

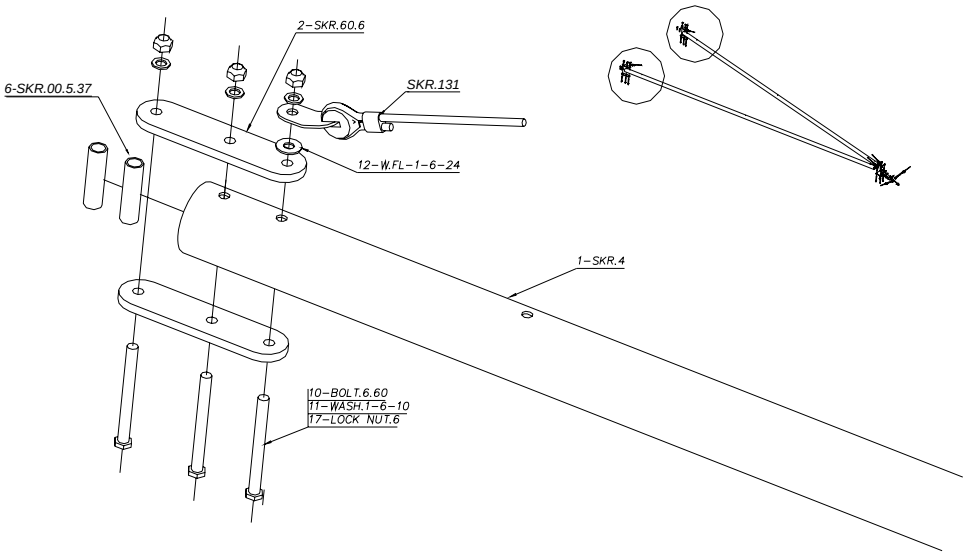


Figure 60; forward end of lower rear fuselage tubes.

Figure 61; crossed wires.

b) Prepare the front ends of the upper tubes, Figure 62.

Use a thin plastic washer between the steel cable tang and the aluminium brackets.

Do not fit the turnbuckle centre at this stage, leave the cables slack.

The pin holding the front of the turnbuckles to the tang should point downwards, to maintain clearance from the tube above it. Put the turnbuckle end piece in place and rotate the tang before tighten the bolt holding the tang.

Note again that the cables shown are from the rear ends of the lower tubes, and that they must cross each other.

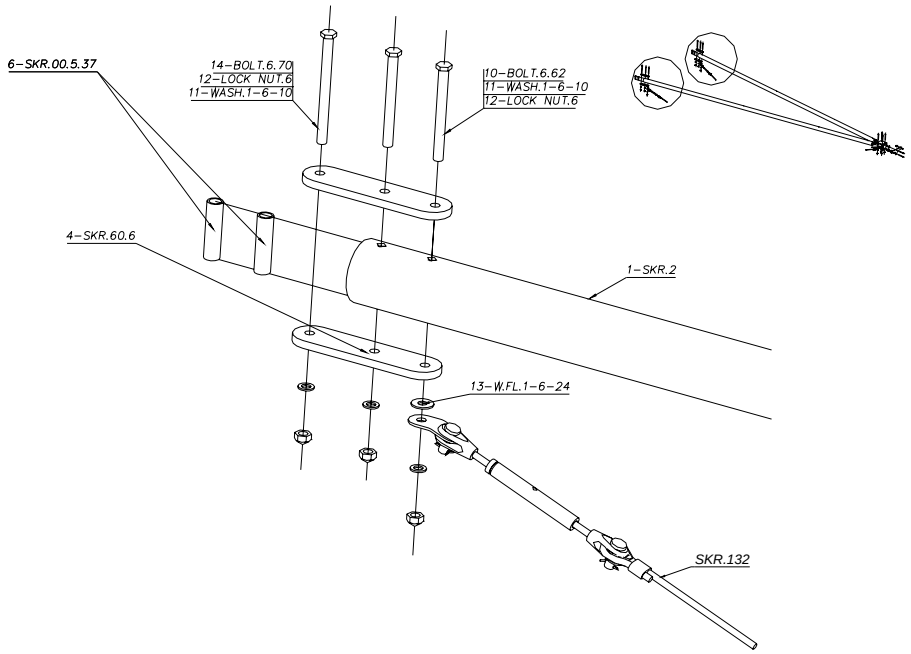


Figure 62; forward end of upper rear fuselage tubes.

c) Mount the front ends of the upper tubes onto the upper rear cabin cross-piece ***tu7*** on the forward fuselage assembly.

*Note that the mounting bolt should point upwards as per Figure 63. This is used to secure the rear of the Lexan windscreen later. Check that enough bolt protrudes to fit the rear ends of the cabin uprights / windscreen support tubes **tu34** and the Lexan onto these bolts. If they are too short, a 75mm long bolt should be used.*

Figure 63; forward ends of upper tubes, rear to bottom left of photograph.

d) Attach the lower tubes to the main undercarriage cross-beam, Figure 64.

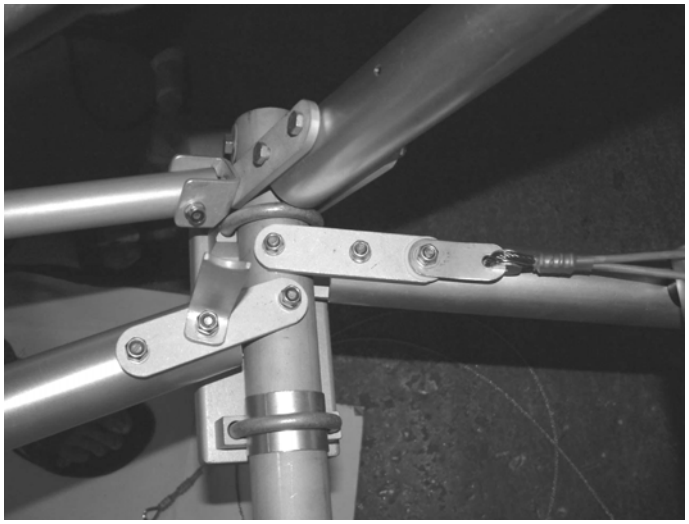


Figure 64; forward ends of lower tubes, rear to right of photograph.

3.4 Tailplane Front Mounting

a) Attach the aluminium corner section ***22***, Figure 65, to the upper rear fuselage tubes ***tu2***.

> *This provides a mounting point for the front of the vertical stabilizer, however do not attach it to the vertical stabilizer at this time as the position will change with the application of cable tensions later.*

b) Test fit the tailplane halves between this front mount and the rear mounts.

> *There should be a thin plastic washer at the rear, and a small saddle washer at the front. If the bolt head at the front of the tailplane contacts the front mount an additional plastic washer may be used.*

c) If the fit is too tight, shown by distortion of the metal T-shaped plate which forms the rear mounts, slot the uppermost mounting holes in the aluminium corner section ***22,*** Figure 65, towards the rear to allow the corner section to move forwards slightly.

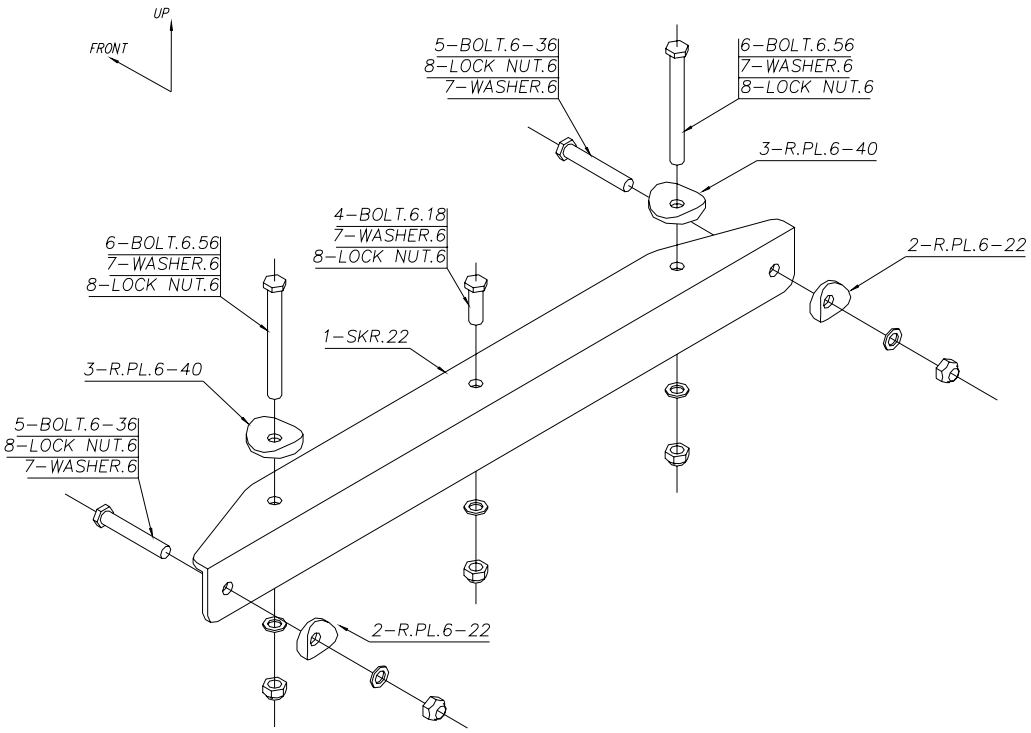


Figure 65; vertical and horizontal stabiliser front mounting.

3.5 Fuel Tank Support and Flap Handle

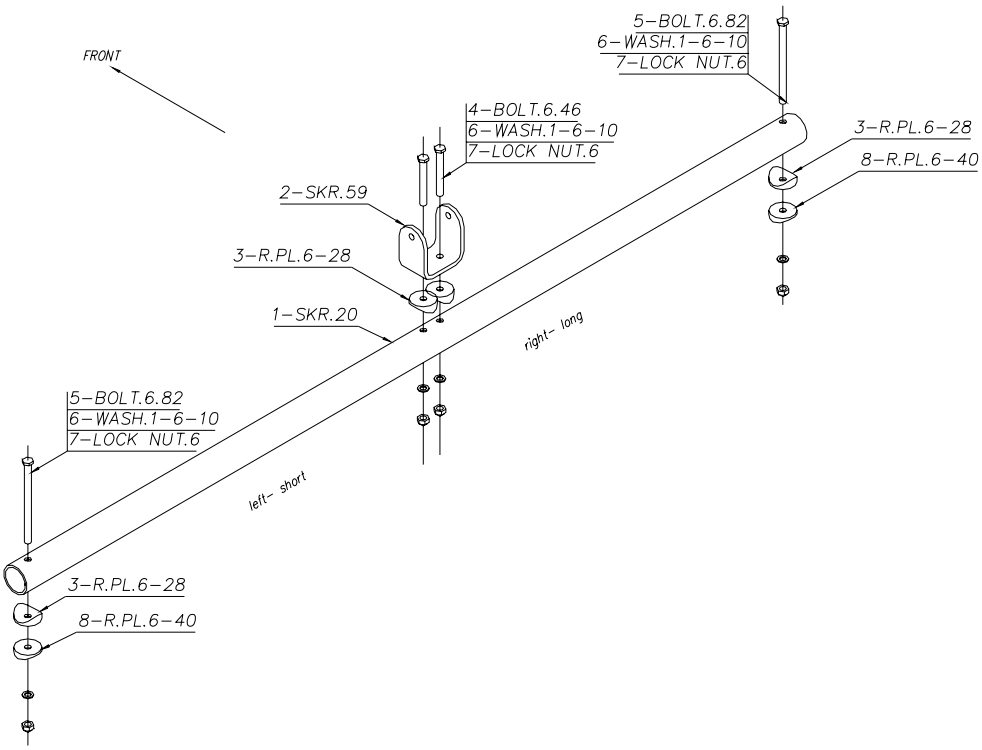


Figure 66; fuel tank support / flap handle mount.

a) Fit the fuel tank support ***tu20*** to the lower rear fuselage tubes ***tu4***, with the U-bracket located towards the port side of the fuselage and facing upwards, Figure 66 and Figure 67.

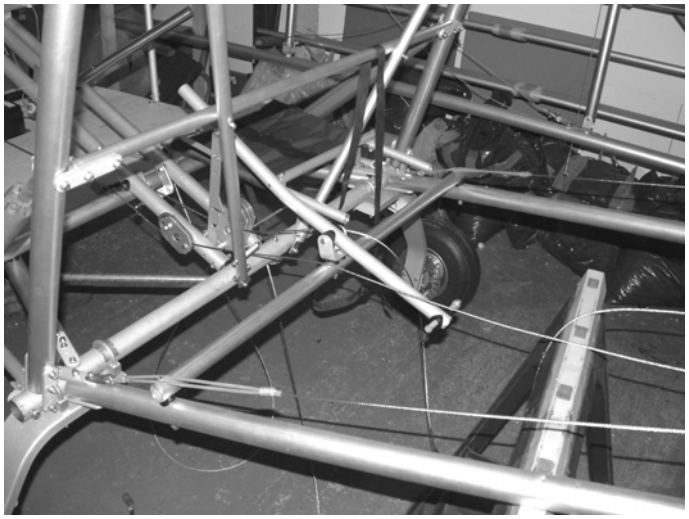


Figure 67; flap handle and fuel tank support bar.

b) The cables have a large gap between the swages which should be placed with one cable each side of the bolt head, visible in Figure 67.

c) Fit the flap handle to the U-bracket, biasing the flap handle tube as far to the starboard side of the bracket as possible, leaving only one saddle washer between the handle and the starboard side of the bracket, Figure 68.

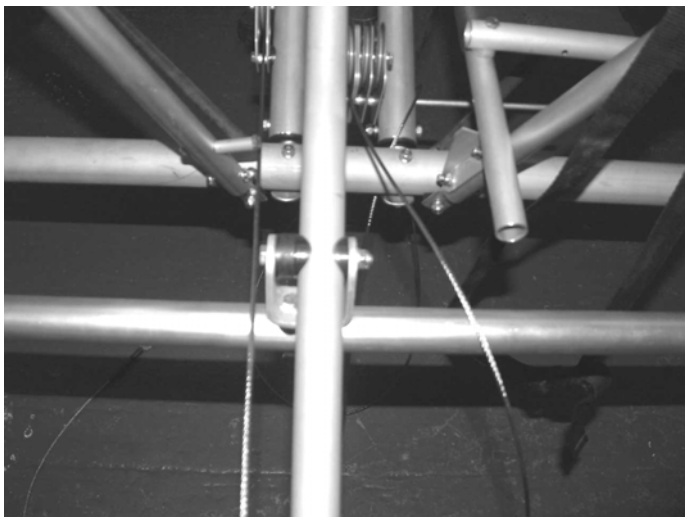


Figure 68; flap handle pivot.

Drill and split pin the three flap mechanism pivot bolts to guard against undoing due to rotation(if not already done).

Leave fitting the detent lever until the undercarriage and covering have been fitted, as it sticks out the bottom of the aircraft.

When it is fitted, to fit into the latching 'slot', which is formed when the pulleys are fitted, the lever must not be attached to the handle. It can then be 'hooked' into position, after which it can be bolted to the handle.

Do not space the detent lever away from the handle, use only one thin plastic washer or a single saddle washer between them. It is permissible to bend the lever slightly into a Z-shape to make it align with the flap handle and the latching slot.

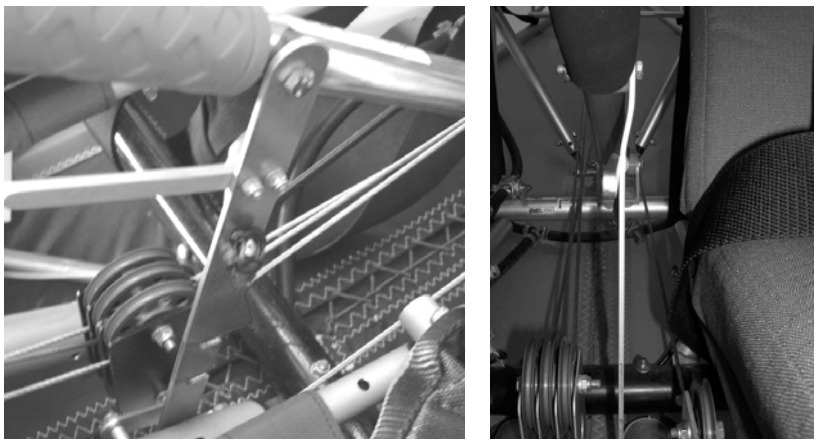


Figure 69; UKMOD flap detent lever, Z-bend shown on right.

d) Fit the bungee cord from the flap handle to the detent lever, visible in Figure 69. Adjust the tension as required.

This should be inserted through the hole in the flap handle, pulled out of the end, and have a knot tied in it. Pull the knot back into the handle, and attach the other end of the bungee to the detent lever, and tie another knot keeping tension in the bungee..

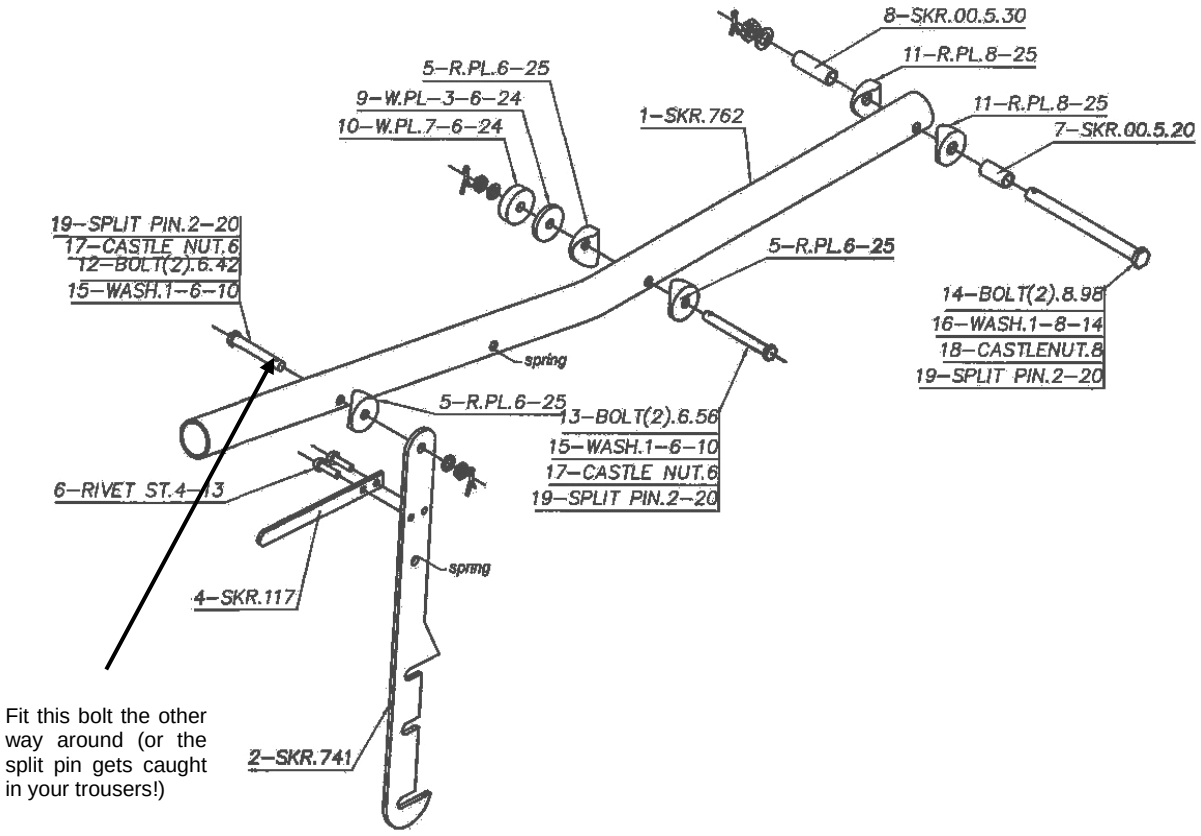


Figure 70; UK mod flap handle

3.6 Not Tightening the Bolts

Do not tighten the bolts around the rear fuselage at this stage.

Lightly tighten the cables to get the rear fuselage to sit approximately squarely, but the final alignment and tensioning is left until section 5.1 Tensioning the Rear Fuselage. This is to avoid building a “set” into the fuselage. If you cannot get the turnbuckles onto the cables, try propping-up the tail end.