

General>Tools and equipment

Before getting started we recommend that you acquire the following tools and equipment: these tools are **not** included in the kit and must be supplied by you.

Required tools

The following tools and equipment will be required as a bare minimum to complete this kit:

Allen keys: imperial set.

Aluminium angle: 3 or 4 straight lengths of 20x20x3 angle approximately 2m in length.

Clecoes: Clecoe pliers and at least 20 Clecoes.

Digital Kitchen Scales: (up to 5kg measured in 10 gram increments) for mixing resins by weight, using the mixing pots provided. Accurate measurements of small mixes can be made. Slip the scales into a clear plastic bag to keep them clean – the scale can still be read through the bag.



Disposable gloves: for handling of epoxy and resin.

Buy a large box from the supermarket or hardware supply store.

Drill bits: 1/8" to 1/2" normal shank, 5/32" and 3/16" extended shank.

Electric drill: 3/8" chuck, preferably cordless with a variable speed trigger.

Electric hot air (paint stripping) gun: used to 'adjust' some non - structural glass fibre airframe parts, like doorframes, door stop strips, etc.

Electric soldering iron: for general wiring as well as removing temporary screws.

Files: medium flat, medium and small rat-tail, medium half-round.

Hacksaw blades in holders for cutting in restricted spaces.

Hole saws: 1½" to 2" or metric equivalents.

Masks: disposable paper face masks and/or a half-face respirator with suitable filter elements.

Nylon spring clamps: these come in mixed size bags from hardware stores and you will use them in a multitude of ways. Get 2 or 3 bags plus 3 or 4 big individual clamps.

Ring-open ended spanners: 3/8", 7/16", 1/2" and 7mm

Padding: felt or old blankets for various uses.

Pop rivet gun: hand operated or pneumatic.

Sandpaper: various grades between 80 and 240 grit. Detailed in the [Painting](#) task.



Screwdrivers: Phillips: small & #2, medium flat blade.

Socket set: ¼" drive: at the very least 3/8", 7/16" and 1/2" sockets.

Torque wrench: for engine/prop fitting, etc. Check the torque settings in the *Technical Manual* that shipped with your kit to ensure you get one with the right range.

Trestles: at least 2 required, preferably 4 at about 800-900mm high with carpet covered tops.

Wet and dry bulb thermometer or calibrated hygrometer for the wall of your workshop.

Optional tools and equipment

The following tools are not essential, but they will certainly make the job more pleasant:

Air Compressor & Air Gun. You can probably do without this if you plan to contract out your filling and painting job, but if you intend to prime/fill/paint then you'll definitely need to use the air gun to clean out crevices and pinholes in the gel coat. If you intend to do all of your own painting then get a good quality spray gun and a compressor capable of at least 15cfm.

You will need to include a good quality water trap too – anywhere that compressors and air tools are sold will be able to advise you on brands and specifications.

Cordless Screwdriver with various bits (get some spare Phillips #2 bits: those self-tappers are really hard!)

Dremel Moto-Tool (or similar, cordless and multi speed if possible) used for grinding and drilling glass fibre in hard-to-get places. **Permagrit** make some very useful bits for these: the cut off disc and cylindrical grinding tools can be particularly handy.

Electric or Pneumatic Angle Grinder (4 - 5"), preferably with a vacuum cleaner attachment to keep dust to a minimum. This is for grinding parts like the trailing edge of the wing above the flaps. If you can get an adjustable speed one then so much the better. Fit a disc sander backing pad and use discs between 80 and 240 grit.

Electric or Pneumatic Jig Saw for cutting holes such as the aileron/flap fitting holes in the wing and other holes in wing/fuselage/empennage.

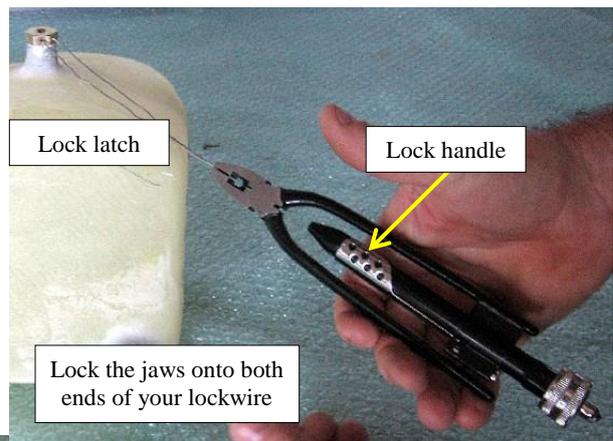
Electric or Pneumatic Orbital Sander for surfacing filler, preferably with a vacuum cleaner attachment to keep dust to a minimum.

Industrial Vacuum Cleaner with 'crevice tools' A domestic vacuum may not be up to the task, and as industrial units are readily available we suggest the purchase of a suitable machine. You will be surprised how difficult it is to get glass fibre dust out from behind the seats with just a brush! Get any fittings necessary to connect to your sanders and grinders. We use several of these units in our factories and the amount of glass fibre dust lying around at any time is minimal. A very worthwhile investment.

Lock Wire Pliers to put that professional twist on all of your lock wire.



To use: lock the jaws onto both ends of your lockwire using the silver lock handle, then simply pull the "twist" handle at the back of the pliers and presto, perfect lockwire!



Pedestal Fans to blow fresh air across work surfaces. We use plenty of these in our factory.

Permagrit-type Shaped Abrasive Tools for shaping/sanding glass fibre parts (try to get a set of various shapes). Or make your own **Sanding Blocks** as described further down the page.

Pneumatic tools are great if you have a compressor that can drive them – drills, jigsaws, various sanding tools are widely available. We use plenty of these in our factory too.

Scales for weighing the aircraft: must be capable of weighing up to 150kg. Regular bathroom scales are fine for this task. A single scale can be used, but these scales are quite reasonably priced (less than \$50 each in Australia currently) and the task is much easier with 3 scales.

Setsquare the long builders type with each side at least 500mm in length.

Silicone Sealer, *General Purpose* or *Roof and Gutter* sealer, must suitable for use on metal.

Spade Drill Bits as used in woodwork (pictured at right).

Used to recess the threaded inserts in the ventral fin and the lower strut fairings.



Straightedge in 2 lengths: a 1 metre builders level type is

good for aligning the flaps to wings and checking the control surface deflections, while a 3 metre long length of 100mm RHS (rectangular hollow section) aluminium is excellent for checking the rear of the wing and aligning the horizontal stabiliser: make sure that you buy a straight length with no dents.

Sanding Blocks - stapling 80 grit emery tape around the ends of a length of straight timber about 600mm long (shown below left) is very useful for achieving straight edges on items such as trailing edges, flaps, etc. Taping emery tape to a short length of tubing (shown below right) can be useful for things like the final sizing of the fuel filler body holes in the wing/tank and so on. You will use plenty of sanding blocks as you progress through your build, and with a little bit of imagination you can make them in almost any size and shape that you need.



TorqueSeal – brand name security sealing lacquer used to show that nuts have been tightened to safety or to the recommended torque setting and require no further work. Try aircraft parts or engineering suppliers for this product. Comes in several colours.

Loctite compounds

This brand name compound is considered essential in the construction of your Jabiru.

Purchase the following grades:

| Type | Use | Appearance |
|------|------------------------------------|-----------------------------------|
| 242 | Thread locker medium strength | Blue liquid |
| 262 | Thread locker high strength | Red liquid |
| 518 | Sealant, form-in-place gasket | Red gel |
| 577 | Thread sealer medium strength | Yellow paste |
| 620 | Thread retainer high strength | Green liquid |
| 7063 | Cleaner (can use Acetone in place) | Clear solvent, aerosol applicator |

Direction references

In all cases throughout this manual when any reference is made to direction (left, right, front, forward, rear, aft) it is made relative to the pilot's point of view, where the pilot is assumed to be sitting in the pilot's seat facing towards the front of the aircraft.

“Lateral” means something that it is oriented from *side to side* in relation to the aircraft.

“Longitudinal” or “Fore and aft” means something that it is oriented from the front to the back of the aircraft.

Preparation

We suggest that you get as much preparation done as possible before starting your build. Start with your workshop: give it a good clean out and consider upgrading the lighting and power with plenty of strip lights and extra sockets for power tools. Paint the walls and ceiling a

light colour to provide as light a work area as possible. This will also help if you plan to prepare the aircraft for painting preparation (filling/primer) and also the topcoat if you feel you are capable of doing so.

In preparation for storing the vacuum-sealed *Build Cards* that pack many of the small parts into convenient groups we suggest that you construct a large wallboard that you can place the *Build Cards* on, preferably in numerical order (each Card is numbered) – you will find that this is much easier and more pleasant than sorting through a box or pile of *Build Cards*!

For items such as fairings and instrumentation prepare as much protected shelf space as you can find (some shelving under a workbench can be particularly useful in this instance) and also make a vertical bin in a cooler corner of the workshop to stand long items like elevator, rudder and flaps in while building the relevant parts of the aircraft. Reserve an out-of-the-way area for windows and other fragile parts.

In our factory we use large mobile bench/racks that contain all of the parts for an aircraft and that rack stays with that aircraft all the way through production.

If you're going to do any painting, try to keep equipment and parts off the floor as much as possible so that you can sweep/vacuum/hose the place out thoroughly in order to minimise dust before you start any painting.

Get all of the tools and equipment on the list that starts on the next page.

Read this manual from start to finish to familiarise yourself with the work to come.

Consider getting extra insurance cover for your kit during the build to cover any risks (fire/damage/theft, etc). Most aircraft insurers will quote for this and many builders consider that the cost is worth it for the peace of mind that it brings.

Cold climate considerations

If you are building in a colder climate/during winter, some extra heating and insulation in your workshop will help, as well as keeping the humidity levels up to acceptable levels for epoxy work. Clearly, all workshops are different and your build inspector will advise.

Get a large roll of bubble wrap packaging sheet (1.5m x 15m) from your local garden centre or packaging company (usually cheaper). In low temperature environments you will use this to create an insulated tunnel by draping it over the work you've bonded/flocked and, with the careful application of warm air from a fan heater, you'll easily achieve the 24°C (or so) you need for a good epoxy cure.

General>Glossary

Here is a glossary of common composite terms that are used throughout this manual:

| <u>Term</u> | <u>Description</u> |
|------------------------|---|
| 5-Minute Araldite | Quick setting brand name epoxy glue. |
| AT133 (not supplied) | Fibreglass cloth with wide unidirectional strands, which provides great strength for weight. It is used in the fabrication of the spar and undercarriage legs. |
| AT244 | This is a standard bi-directional cloth that is used extensively for plates and other flat surfaces. |
| AT303 | This is a twill weaved cloth that can be moulded into curves and is therefore used for wing and fuselage skins, cowls, etc. |
| AT312 | A 2" wide glass tape. |
| AT313 | This 3" wide glass tape is used to joint other glass structures. The edges of glass tape do not fray like glass cloth. |
| Body Filler – (bog) | Lightweight automotive filler used in paint preparation. |
| Clecoes | Patented reusable fasteners used to align parts prior to flocking and fixing with pop-rivets. Store in Acetone to keep them clean. |
| Coremat | Lightweight core material used to make sandwich panels. |
| Flock | Low-grade short fibre reinforcement for resin. Also used as a verb: to "flock something into place" for example. |
| Gelcoat | White polyester resin film used on exterior of supplied fibreglass parts to provide a smooth finish. |
| Glass | Fibreglass cloth. Also describes the process of wetting fibreglass cloth into a mould or onto parts: to "glass something into place". |
| Joggle | Recessed step where 2 surfaces are to be flush joined. An example is the joggle around the windscreen and windows. |
| Lay-Up | Resin wetted fibreglass cloth laid into a mould or onto parts. |
| LC 3600 Epoxy | Epoxy system used on all structural parts. |
| LC 3600 Hardener | ¼ part of LC 3600 epoxy. |
| LC 3600 Resin | ¾ part of LC 3600 epoxy. |
| Peel Cloth | To provide a surface that requires minimal preparation before bonding, polyester cloth is included as the top layer of a glass lay-up. The cloth is simply 'peeled off' and the surface beneath is ready for bonding, hence the name. |
| Polyester Resin | Resin system that uses a catalyst to cure. Does not provide good structural properties like epoxies, and for this reason is not used on any structural parts in your Jabiru. |
| Q-Cells (not supplied) | Inorganic micro-spheres mixed with resin and used as a lightweight filler, usually used in paint preparation. |
| Resin | Generic term used to refer to the LC3600 epoxy/resin mix. |

General>Registration and certification

The accuracy of records and correct administrative procedures are just as important as the quality of workmanship in your project.

By now you should have established the regulations under which you will build your aircraft.

In Australia you have two options:

1. Experimental Rule
2. CAO 95.55 Amateur-built Ultralight Category

Option 1 is administered by the ***Sports Aircraft Association of Australia (SAAA)***

Option 2 is administered by ***Recreational Aviation Australia (RAA)***

Aircraft built under *Option 1* can only be General Aviation (VH-) registered and must carry "EXPERIMENTAL" markings.

Aircraft built under *Option 2* can only be registered with the RAA and must carry "19" series registration numbers.

You should consult the appropriate administrative association on their requirements for documentation, inspections and project administration.

Contact details are: ***Sports Aircraft Association of Australia (SAAA)***

PO Box 169
Clifton Hill, VIC 3068
Phone: 03 9482 4716
Fax: 03 9482 3936

Recreational Aviation Australia (RAA)

PO Box 1265
Fyshwick, ACT, 2609
Phone: 02 6280 4700
Fax: 02 6280 4775

Internationally you will need to establish the requirements for building your aircraft under the appropriate regulations governing amateur aircraft building in your particular country.

Your local Jabiru distributor can give you guidance on who to consult and how your project should be administered.

In all cases, however, it is your responsibility as an amateur builder to ensure that you are fully informed of the requirements and to ensure that you meet these requirements.

General>Reference documentation

The FAA Advisory Circular "*Aircraft Inspection, Repair and Alterations*" (publication AC 43.13-2A, ISBN: 1560270985) is an excellent reference work that covers all aspects of aircraft building and repair, and it can be downloaded or purchased online from several suppliers of technical publications.

The FAA Advisory Circular "*Amateur-Built Aircraft and Ultralight Flight Testing Handbook*" (publication AC 90-89A), addresses the topic in considerable detail and which may be obtained here: www.faa.gov/library/manuals/.

General>Unpacking and support

Unpack the wing box first and inspect the contents: there should be two wings. Inspect for transit damage then close the box and store, as the wings will not be required for some time. Unpacking the main box is a much more complicated task as there are hundreds of parts and they all have to be inspected for transit damage.

The first thing you should do is locate your packing list which is in with all the individual components that have been packed with your fuselage. This list will show you all of the components that have been packed, each of which should correspond with the specific type & model of aircraft that you have ordered.

Your kit was triple checked when it was packed in our factory, but PLEASE check off every single part as you unpack it: mark off every item so that YOU can be sure that you have received them.

You could also make a note of *where* you plan to store each part or group of parts.

Please notify Jabiru of any missing parts within 3 months of the receipt of your kit.

At this stage it would be a good idea to store your instruments in a low humidity environment.

Store your propeller in a horizontal position.

Treat all the steel components with an anticorrosive substance.

Fibreglass components will soften and change shape when heat is applied, so keep this in mind when deciding where to store your parts. For example: storing your flaps between the rafters in the heat of the roof is a very ***bad*** idea if you live in a hot sunny climate.

Here at Jabiru we pride ourselves on our after-market support, and if you have any difficulties through the building process we would be happy to help you to resolve them.

We provide product support via email, phone or fax.

Start by checking the resources on our web site at: www.jabiru.net.au and contact us:

Email: info@jabiru.net.au (please send us a fax or call if no read receipt is received)

Phone: +61 (0)7 4155 1778 - (8.30 am-4.30pm AEST (AAustralian Eastern Standard Time))

Fax: +61 (0)7 4155 2669

Spare Parts Department

Email: spares@jabiru.net.au

Phone: +61 (0)7 4155 2917 - (8.30 am-4.00 pm AEST)

Service Department

Email: engines@jabiru.net.au

Phone: +61 (0)7 4155 2811 - (8.30 am-4.00 pm AEST)

Postal Address:

Jabiru Aircraft Pty. Ltd.

P.O. Box 5792

Bundaberg West QLD 4670

AUSTRALIA

Location:

Airport Drive

Bundaberg West QLD 4670

AUSTRALIA

General>Composite standard procedures

Composite introduction

Composite construction techniques may seem mystifying to those who have never been involved with composites before but they are straightforward and require only a few basic procedures.

Composite surface preparation

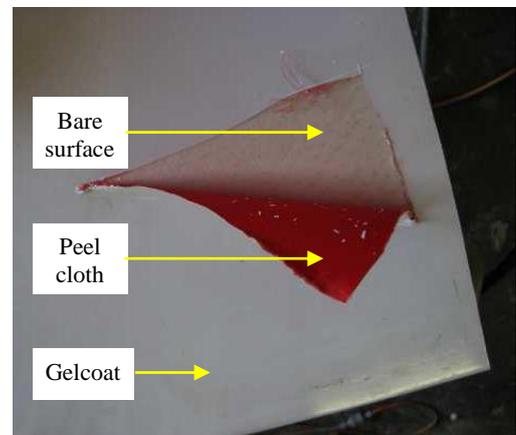
For bonding composite-to-composite or composite-to-metal the surfaces must be prepared in the following ways:

With peel cloth

Where it is known that a surface will be bonded to another surface, peel cloth is usually incorporated in the lay-up under the gelcoat to provide a bare, clean 'virgin' surface to aid the builder.

Typically peel cloth is included in the lay-up for all structural components: vertical fin, horizontal stabiliser, flaps, aileron pre-molds, etc.

To prepare the surface for bonding simply cut at the edge of the peel cloth with a knife and peel the peel cloth off as shown in the photo at right, then lightly roughen the surface by sanding to provide a good 'key' for the epoxy to bond to.



Peel cloth is typically red in colour as shown, although other colours are sometimes used. If you are in any doubt about the area that you intend to glass to, sand away the gelcoat and if you see anything that is *not* bare fibreglass then do **not** glass to it until it **is** bare fibreglass.

NEVER, NEVER, NEVER glass over the top of peel cloth!

Without peel cloth

Where there is no peel cloth for a bonding surface the surface must be free of gelcoat, grease and contaminants and must be sanded lightly to provide a good 'key' for the epoxy to bond to.

Metal

If it is necessary to bond to composite to metal, the metal surface must be degreased and roughly sanded to provide a good 'key' for the epoxy to bond to.

Summary

Careful surface preparation is *extremely important* when working with composites: all surfaces to be bonded must be absolutely clean and must be roughened in order to provide a good 'key' for the epoxy to bond to.

Epoxy measuring and mixing

Quality assurance and record keeping

Before starting the requirements for record keeping with regard to composites should be check with your local administering organization. For example in Australia it might be the SAAA or RAAus. A small sample of each mix or resin should be kept and inspected after 24 hours to ensure correct curing. The cured resin should be hard and “scratch-able”.

A good sampling device is a small plastic medicine measure cup: wipe the interior of the cup with wax before each use to facilitate easy removal of the sample. Samples should not exceed 10mm in depth otherwise the heat generated during curing may affect the result.

Measuring epoxy

The Epoxy system used for the production of Jabiru Aircraft is LC3600, which is mixed in a 3:1 ratio, which means that 3 parts of resin are mixed with 1 part of hardener.

The best method for ensuring accurate measuring is to use a digital kitchen scale as described in the section *General>Required tools and equipment* which is what we do in our factory.

Curing times

The LC3600 is a room temperature (24° Celsius minimum) curing epoxy so it requires no elevated temperature curing unless you are working in a particularly cold climate or perhaps during winter months. The recommended curing time depends upon temperature but a minimum of 24 hours is good rule of thumb. If the daytime temperature is below 15°C it would be a good idea use a heater to aid curing.

The epoxy resin used in the jabiru is not adversely affected by humidity, however it is best to avoid using it when the relative humidity is above 95%.

Mixing epoxy

When mixing the epoxy the mixture will initially appear 'cloudy' then as you mix the mixture will become clearer but 'stringy', keep mixing and finally you'll be left with a clear mixture with no sign of being 'stringy'.

Note: The smaller the mix the larger the possibility for errors, so consider combining several tasks and doing a larger mix wherever possible.

Mixing in flock

As a general rule, mix flock so you can take a sample with a mixing stick turn it over & it does not dribble off. If it is a little too runny, add more fibre flock.

Mixing epoxy and milled cotton flock together creates an excellent filler which is used in many places to form edges and fillets. The mixture is referred to as 'flock' but is often used as a verb, for example: "flock the bracket into the position shown..."

Mixing 5-minute Araldite

5-minute Araldite is a fast curing epoxy and is very useful for bonding non-structural items into place. If you find that your Araldite won't cure it is usually because 2 lots of the same part were used instead of 1 each. We have all made that mistake at least once.

Mixing 5-min Araldite with cotton flock creates a good paste for 'bedding' parts into place. Same rule applies as for mixing Epoxy.

Composite general

Glassing procedure

Any lay-up of glass fibre cloth should follow this general procedure: make a mix of resin and brush a coat of resin onto the entire area to be glassed, then lay the first piece of cloth on and carefully brush it into place, adding small amounts of resin to the brush as required to wet the cloth, until the resin has completely saturated the cloth: the cloth seems to change colour slightly from a silvery white to a colour close to that of the surrounding surface when it is saturated with resin.

Once the first layer of cloth has been successfully brushed on, apply the second layer and brush that on in the same manner, adding small amounts of resin as required to wet the cloth. Repeat for as many layers of cloth as the task requires.

Peel cloth

Peel cloth is supplied in the bags of glass fibre cloth in the kit. The intended use for this peel cloth is to brush it onto the top of a layed-up area of glass fibre cloth.

The peel cloth will smooth out the finished surface by allowing the resin to level off across the weave of the glass fibre cloth and provide a good surface for painting preparation.

Trimming edges of glass fibre cloth

There are two times for trimming edges, these are before curing while the epoxy is 'tacky' (approximately 2 to 4 hours after mixing) and when the structure is fully cured.

Various tools are used for trimming edges but for thin or 'tacky' lay-ups a sharp utility knife may be used. Thicker cured edges may require a jigsaw and a rough file to trim. A heat gun may be used to soften cured edges so that a utility knife can trim them.

Inspection and evaluation

Each lay-up will require an inspection and evaluation after curing.

Inspect for soft or wet patches after a reasonable time for curing has been allowed, as such wet or soft areas may indicated an improperly mixed batch of epoxy.

Care must be taken to check that areas have actually been bonded together and that there are no air gaps or bubbles between the layers of glass, especially in curves/radii.

Removing screws

Self-tapping screws are used to hold parts in place while epoxy is curing but once the epoxy has cured it can be difficult to remove the screws.

Use your soldering iron to heat the head of the screw and the composite around the screw will soften allowing the screw to be removed easily.

This is also a handy trick to use if any bushes are not perfectly in line and need a slight adjust.

Clecoes

Clecoes are used to hold hinges while they are being flocked into place prior to riveting and so they must be free of oil and grease that could contaminate the surface to be bonded, and they will inevitably get flock onto them during the bonding or flocking process.

To prevent these problems, keep your Clecoe fasteners stored in a sealed tin of Acetone to ensure that they remain clean and ready for use – the Acetone will dry off them in seconds.

General>Aircraft grade bolts and lock nuts

General

All bolts 3/16" or larger in diameter that have been supplied with your Jabiru kit are Aircraft grade bolts.

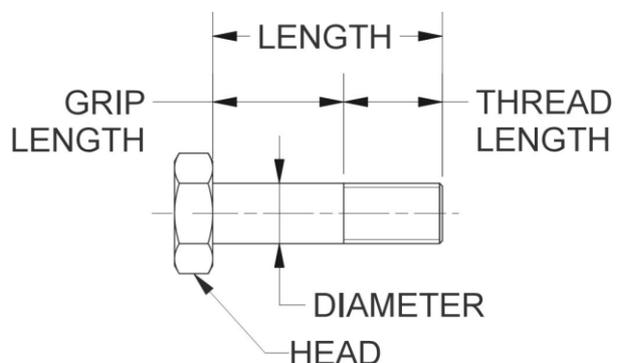
Under **no** circumstances must any bolts other than Aircraft grade bolts be used on your Jabiru. Aircraft grade bolts are significantly stronger than regular commercial grade bolts and have features such as corrosion resistance that have been designed specifically for aircraft use. Aircraft grade bolts are quite different in appearance to regular commercial grade bolts in several ways: Aircraft grade bolts are usually gold or silver in colour; they have a relatively short thread length and a longer plain shank or grip length.

In almost all cases the supplied and specified bolts will be the correct length for each task, but kit builders need to be aware of the correct method of determining and/or checking the correct length of bolts and also the correct method of tightening lock nuts.

The parts of a bolt

There are 2 variable lengths to an Aircraft grade bolt: the overall length, usually just referred to as the **length**, and the **grip length**, which is the length of the plain shank of the bolt, which is measured from underneath the head of the bolt to the beginning of the threads (see the drawing at right).

The **thread length** is generally fixed in relation to the diameter of the bolt.



Bolt identification

Aircraft bolts supplied with your Jabiru kit are identified in this Manual and in Jabiru drawings by the prefix letters "AN", the diameter (measured in 1/16" increments) and the length (measured in 1/8" increments) of the bolt and a suffix, which is usually "A".

Examples of bolt identifiers would be: AN3-6A, AN4-14A, AN3-22A, AN4-72 and so on.

For example, for an **AN3-5A** bolt:

- **AN** means the bolt has been manufactured to Aircraft (Military) standards
- **3** the diameter of the bolt in 1/16" increments: (3/16" in this case)
- **-5** (the dash number) the length of the bolt in 1/8" increments: (5/8" in this case)
- **A** not drilled for a lock pin. Bolts with no "A" here are drilled for a lock pin

If the dash number defining the length of the bolt has two digits, the first digit is the length in whole inches and the second number is the length in additional 1/8" increments. This can become complex and if you feel the need to delve deeply into the subject you can locate an AN bolt chart online or purchase an AN bolt gauge from suppliers of Aircraft grade fasteners. The last example given above (AN4-72) there is no "A" suffix, which indicates that the threaded end has been drilled during manufacture for a lock pin while the other 3 examples all have the suffix "A" and do not have provision for a lock pin.

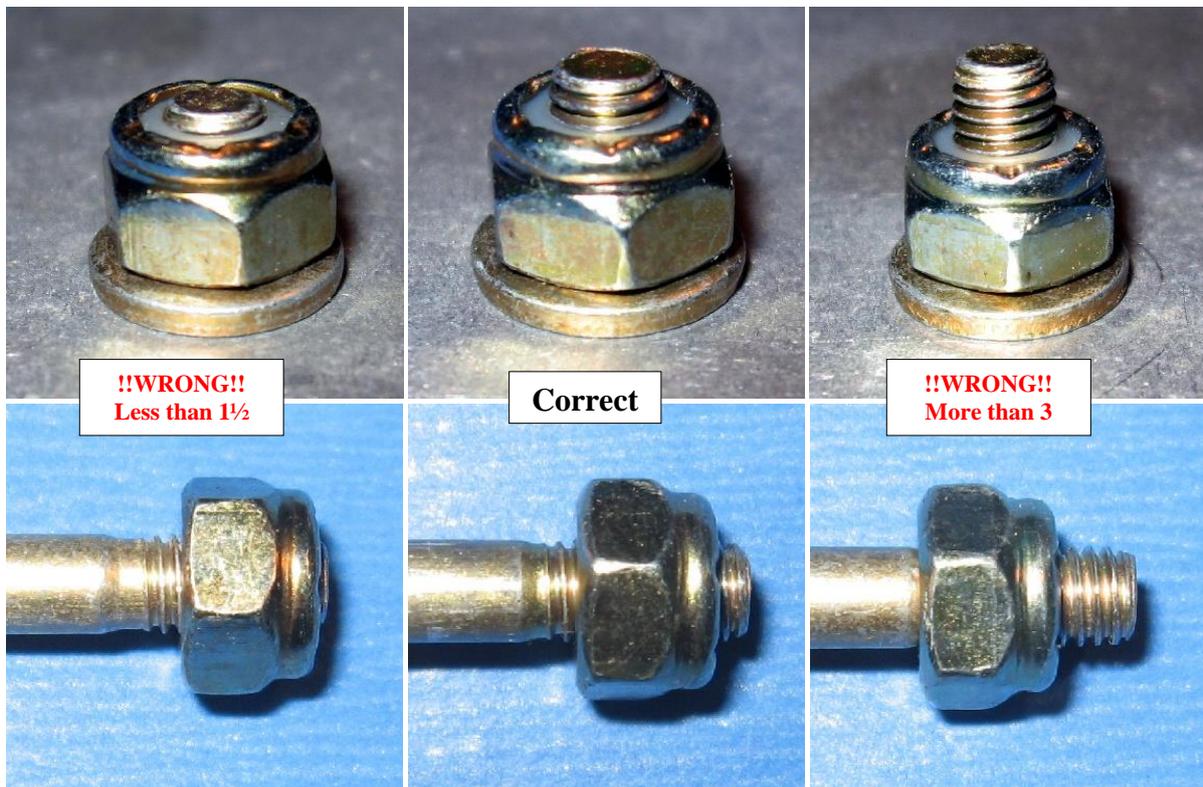
Determining and checking bolt lengths

A bolt must be long enough to ensure that no more than one thread will be inside the bolt hole when the bolt is fitted. This *grip length* should be equal to the material thickness that is being held by the bolt.

What this means is that **the correct bolt length must be used in every case**, and if a nut cannot be tightened to safety then measures must be taken to correct the length, either by packing with washers (an absolute maximum of 3 flat washers may be used for packing, starting with the required washer under the nut, then one washer under the head of the bolt and finally, if needed, another washer under the nut) or using a different length bolt.

Lock nuts

All bolted components on your Jabiru aircraft are held in place with lock nuts, either a *Nyloc* type fibre lock nut for most uses or a steel lock nut for hot areas such as in the engine bay. It is important to understand the procedure for tightening Aircraft lock nuts: each nut must be fitted with a flat washer under it and "**tightened to safety**", which is defined as having a minimum of 1½ threads and a maximum of 3 threads showing beyond the end of the lock nut.



This is considered **critical** for load-bearing bolts and good practise for all other bolts. Any less than 1½ threads showing beyond the end of the lock nut means a risk of the nut not locking correctly while any more than 3 threads showing beyond the end of the lock nut could mean that the lock nut is bottoming on the thread and there is a risk overstressing the bolt and nut and/or not gripping the joined material correctly. Examples of each case are shown above.

In general all nuts should be fitted so that they face outward so that they can be easily inspected. Nuts inside the cabin should face out and towards the pilot if at all possible. Nuts that have been tightened to safety should be marked with a dab of *TorqueSeal*.

General>Rod ends

It can truthfully be said that the rod ends are the sole connection between the pilot and the control surfaces of your Jabiru.

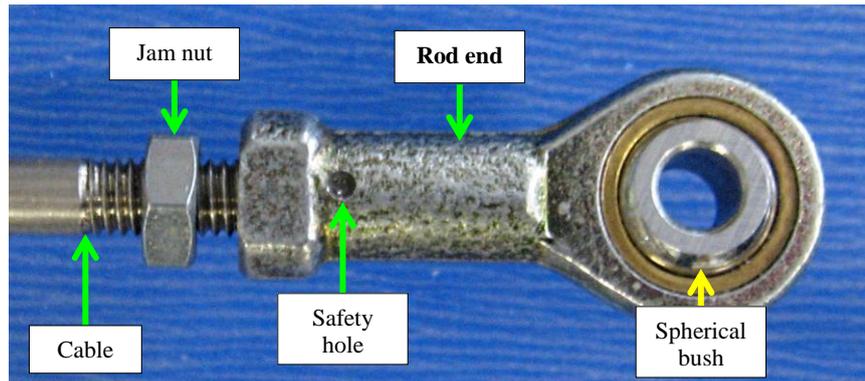
A very important item of hardware indeed!

Given the vital role that each and every rod end performs in your Jabiru it is equally important that you familiarise yourself with the correct method of connecting rod ends.

There are 2 parts to connecting a rod end: the *cable connection* and the *drive connection*.

Cable connection

All cable rod ends are female rod ends, which is to say that the cable (the male end) is screwed into the rod end (the female end) the cable length can be adjusted by screwing the rod end further onto the cable or further off the cable, and then the cable



is fixed to the rod end by means of a jam nut on the cable that locks the threads from turning. There must be enough cable thread length in the rod end to provide strength and security, and each female rod end has a small hole, called the *safety hole*, part-way along one side through which the cable threads **must** be visible – if you cannot see the cable threads through the safety hole, then you **must not fly the aircraft** until adjustments have been made so that the cable threads are visible through the safety hole.

This is of the utmost importance and cannot be overstated!

Drive connection

Most of the rod ends on your Jabiru are driven by a 3/16" bolt through the spherical bush, and they must be connected in the following manner: between the rod end and the drive lever, fit one 3/16" flat washer (or more in the case of the flap drive arms – details in the *Flaps* task). Between the rod end and the retaining nut (or the head of the bolt, depending on which way the bolt is fitted) fit one 1/4" flat washer (one size larger than the bolt).

The purpose of this larger flat washer is that should the spherical bush in the rod end fail, the large washer will provide a margin of safety by preventing the rod end from leaving the drive bolt. In the photo at right you can see the way that the washers are fitted.



In practical terms, should a rod end fail internally in flight the rod end will still remain connected to the drive bolt and the control will continue to function.

Thus the correct fitting of the flat washers to rod ends is extremely important.

General>Health and safety

Working with composites is no different than working with other chemicals and flammable materials, and caution and common sense should prevail at all times.

NO SMOKING

Do not smoke or have any exposed flames near your kit or resin storage area. Epoxy **will** burn.

Warning: the fumes from burning epoxy are **extremely** toxic!

Epoxy

Long term exposure to epoxy can lead to an 'epoxy allergy' so suitable safety precautions should be taken as follows:

Contact

Do **not** expose your skin to epoxy. Neoprene, latex or nitrile rubber gloves (with pure cotton gloves worn underneath to wick away sweat from your hands) and protective (industrial) clothing should be worn when handling epoxies.

If epoxy is spilt onto the skin, wash off with warm water and soap immediately.

Barrier cream can help the skin to avoid becoming sensitised. Note: if barrier cream is used take care to keep it away from any surfaces to be bonded by wearing gloves – the cream could contaminate and weaken the join so keep the cream inside your disposable gloves at all times.

Fresh Air

Epoxy fumes should **not** be inhaled. Blow fresh air across the work face at all times.

The use of an external fresh air source and facemask is strongly recommended along with the use of a fan for blowing the epoxy fumes away. In our factory we use several industrial pedestal fans to blow fresh air across the work surfaces at all times.

Dust

Always wear a dust mask when sanding or cutting composites. Cutting and sanding composites creates a lot of dust and the extremely fine glass dust should **not** be inhaled.

A half-face respirator with suitable filters is highly recommended and should be worn at all times when sanding fibreglass parts.

Ok lets get building!