



Welcome to Arion Aircraft, LLC

Welcome to the Arion Aircraft family, and a family it is. Arion Aircraft is a small aircraft kit manufacturer located in Shelbyville, Tennessee. The city has a population of 18 000 and until recently its most renown product has been the famous Tennessee Walking Horse. The Arion Aircraft factory is located on the airport on the edge of town where a staff of craftsmen, employees and contractors, turn out these fine aircraft kits.

All of our products are original and have been designed, prototyped and produced in house, so we can support you like no other kit manufacturer can. Our dealers are fully supported by us and are a ready source of spares and free advice.

You need not have a degree in electrical engineering, an intimate knowledge of hydraulics or a garage full of tools to complete this aircraft. There are no complex or complicated systems on this aircraft. The gear stay down, the prop pitch is fixed and the flaps are electrically operated. The brakes are hydraulic but the simplicity will delight you. Your Arion Aircraft Lightning kit is designed to be simple to complete and finish; and will provide you with many years of safe flying.

Once completed you will find the aircraft extremely economical with costs more associated with a car than an airplane, and the ease of maintenance will increase your flying time. If you're ever in our area call in for a coffee, we'll show you what we're up to and how we make our aircraft kits.

Safe Aviating and Happy Landings.

PS. When you've completed your aircraft please send us a photo so we can add it too our aircraft photo library.



Construction Manual

The construction manual is provided to help you with step by step explanations of every construction procedure. If any area of the manual leaves you short or confused please call your local dealer for assistance or send them an Email.

Any questions you ask help us to provide you with a better understanding of this aircraft and if appropriate, sections of the manual may be rewritten for clarity and a better all around understanding. The manual is a bulky document but contains a host of features all designed to improve understanding and builder confidence. The major features are:

Procedures

The manual is divided into procedures covering each major component or assembly stage. **The stages are not necessarily in sequential order and many variations are possible, if in doubt call your local dealer for help.**

Pictures

Pictures are a great tool for helping to understand and identifying parts and locations.

Most of the procedures incorporate a photo.

Check Box

As some procedures may be performed out of sequence, the check boxes are provided to help you keep track of your progress. Once you have completed a task or procedure, check the box off as finished.

Dimensions

All dimensions in this manual are in inches or millimeters unless otherwise stated. Bolts are in SAE imperial dimension and are standard AN aircraft quality.



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The stages are not necessarily in sequential order and many variations are possible, if in doubt call or email your local dealer for help.

Important!!

Read the build manual in its entirety before starting kit construction. It is important to have a full understanding of how the components come together while the project ins under construction.



3. Definitions

NAME DEFINITION

BODY FILLER – *Automotive Lightweight Fiberglass body filler used for paint preparation*

FLOCK (Cotton Flock) – (Fiberflock) *Low Grade Short Fiber Reinforcement for Resin*

PEEL CLOTH *To provide a surface, which requires minimum preparation before bonding, polyester cloth is included as the top layer of a glass lay-up. The cloth is merely 'peeled off' and the surface beneath is ready for bonding.*

EPOXY 2 Part Resin System *that provides better structural performance than polyesters*

Aeropoxy *Epoxy system used on all structural parts*

Aeropoxy PR2032 *Resin Part of Aeropoxy Epoxy*

Aeropoxy PH3660 HARDENER *Hardener Part of Aeropoxy Epoxy*

5-MINUTE EPOXY *Quick Setting Epoxy Glue*

AT244 *This is a standard by-directional cloth and is used extensively for plates and other flat surfaces.*

AT303 *This twill weaved cloth can be easily molded into curves and is therefore used for wing and fuselage skins, cowls etc.*

POLYESTER RESIN (Polyester) – (Poly) *Resin system that uses a catalyst to cure. Does not provide good structural properties like epoxies. (Not used on any structural parts in the Lightning kit).*

GELCOAT *Colored Polyester Resin Film used on exterior of fiberglass parts to provide smooth finish.*

LAY-UP *Resin wetted fiberglass cloth layed onto mold*

GLASS *Fiberglass cloth also describes the process of wetting fiberglass cloth into mould or onto parts.*



4. Health and Safety

Working with composites is no different than working with other chemicals and flammable materials. Caution and common sense should prevail.

NO SMOKING

Do not smoke or have any exposed flames near your kit or resin storage area.

Epoxy will burn.

Warning:

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:

Contact.

Do not expose skin to epoxy. Rubber neoprene gloves and protective (industrial) clothing should be worn. Barrier cream will help to avoid becoming sensitized. If epoxy is spilled onto the skin wash off with warm water and soap immediately.

Fresh Air

Epoxy fumes should not be inhaled. Blow fresh air across the work piece. The use of an external fresh air source and face mask is strongly recommended along with the use of a fan for blowing the epoxy fumes away.

Dust

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

5. Standard Procedures

5.1 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 simple procedures.

5.2 Surface Preparation

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

Peel Cloth

Where it is known that a surface will be bonded to another layer, peel cloth is incorporated in the lay-up. To prepare the surface for bonding simply peel the peel cloth off.

No Peel Cloth

Where there is no peel cloth for a bonding surface the surface must be free of grease and contaminants and must be sanded lightly. Gel coat is not a structural element and must be removed (sanded off) down to the glass layer to provide a good bond. Take care not to sand through any glass fibers as those fibers provide the structural strength of the aircraft and should not be damaged.

Metal

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

5.3 Mixing Epoxy and 'Flock'

Epoxy should be mixed at a normal room temperature of 65 to 75 degrees F. In hot weather it would be good to store the resin and hardener in a cooler place. Initial curing of the epoxy will take place over night at normal room temperatures. Full cure may take several days at 70 degrees F.

Flock (finely chopped cotton fibers) is mixed with epoxy and used as a structural filling agent to help get a good bond to the molded fiberglass pieces. Flock can be added to epoxy in varying amounts.

Note As a good rule, mix enough flock into the epoxy 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. A good analogy might be to mix it to a consistency of peanut butter.

Measuring

The Epoxy system used for the production of Arion Aircraft is Aeropoxy, which is mixed in a 27:100 ratio. 100 parts of resin to 27 parts of hardener. The best method for ensuring accurate measuring is to use a postage scale.

Mixing

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 yellow mixture with no sign of being 'stringy'.

Note: The smaller the mix the Larger the possibility for errors



Curing

The Aeropoxy is a room curing (70 F min) epoxy so it requires no elevated temperature curing. The recommended curing time depends upon temperature but a minimum of 24 hours is good rule of thumb to get a 75% cure. Full cure may take several days at room temperature.

'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, "flock the bracket into the position shown..."

5.4 Mixing 5 minute epoxy

5-minute epoxy is a fast curing epoxy and is very useful for bonding non-structural item into place. Mixing 5-min epoxy with cotton flock creates a good paste for 'bedding' parts into place

Same rule applies as mixing Epoxy.

5.5 Removing Screws

Self-Tapping Screws are use for holding parts in place while curing but once the epoxy has cured it can be difficult to remove the screws. By using a soldering iron to heat the screw the composite around the screw will soften allowing the screw to be removed easily. This is also a handy trick to use if any metal parts are not perfectly in line.

5.6 Trimming Edges

There are two times for trimming edges, these are before curing while the epoxy is 'tacky' (approximately 2-4 hours after mixing) and when the structure is fully cured. Various tools are used for trimming edges but for thin or 'tacky' layups a sharp utility knife may be used. Thicker cured edges may require a jigsaw and a rough file to trim.

5.7 Inspection and Evaluation

Each layup 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 radii.



6. 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 under which regulations you will build your aircraft.

In the USA you have one option: -

1. Experimental Amateur Built Rule

Advice and documents to register your aircraft and obtain an airworthiness certificate are available from EAA. www.eaa.org

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

Arion Distributors can give you guidance on who to consult and how your project should be administered.

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

7. Getting Started

Overview

The first thing you should do is find your packing list which is in with all the individual components that have been packed with your fuselage. This List will tell you all the components that have been packed which should correspond with the type & model aircraft you ordered.

Your kit was triple checked as it was packed, PLEASE check off every part as you unpack it. (Mark off every item so that YOU know that you received them)

This will save you calling Arion Aircraft in 3 months time and telling us that it's MISSING because you have misplaced it, which happens quite a lot.

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 you steel components with an anticorrosive substance.
- * By applying heat, all Fiberglass components will soften and can change shape, bear this in mind when storing your parts, For example storing the flaps between the rafters in the heat of the roof is a **bad** idea in Hot Climates.

Here at Arion Aircraft we pride ourselves on our after market support, If you have any difficulties through the building process we would be happy to help.

We do product support via PHONE, FAX OR E'MAIL.



Identification of aircraft components

In you kit you should find a Kit packing list that look like this list below.

I.E. KIT PACKING LIST

Description Serial #

Sorting and Unpacking

Unpack the wing box first and inspect the contents. There should be two wings. Inspect for 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 bits and all have to be inspected for transit damage.

Note: As the thickness of composite lay-ups can vary the bolts supplied may be too long or too short, some packing or another bolt may be required from your Local Aircraft Supplier or purchased from Arion Aircraft.

Tool List

The following tools will be required to complete this kit. They are **not** included in the kit and must be supplies by you.

- ◆ Screwdrivers - Phillip's Head (medium)
 - Phillip's Head (small)
 - Flat Blade (medium)
- ◆ Wrenches - Box (3/8", 7/16", 1/2", 15/16)
 - Open Ended (3/8", 7/16", 1/2" and 7mm)
- ◆ Sockets - 1/4" drive (3/8", 7/16", 1/2") 3/8 drive 15/16
- ◆ Ratchet Drive - 1/4"
- ◆ Electric Drill
- ◆ Drill Bits - (3/32" to 1/2")
 - 5/32" Extended Shank
 - 3/16" Extended Shank
- ◆ Hole Saws - (1 1/2" to 2")
- ◆ Files - Flat (medium)
 - Rats Tail (medium, small)
- ◆ Pop Rivet Gun
- ◆ Allen Keys -
- ◆ Electric Soldering Iron
- ◆ Automotive Body Filler - Light Weight
- ◆ Paint - Matt Vinyl Interior (1 qt)
 - (Your choice of color for the aircraft interior)
- ◆ Saw Horse Trestles - 2 Required
- ◆ Padding - Old Blankets etc.
- ◆ Sandpaper - Various Grades 80g, 120g etc
- ◆ Epoxy Scale



Handling Precautions

Caution

Aeropoxy products are generally quite harmless to handle provided that certain precautions normally taken when handling chemicals are observed. The uncured materials must not, for instance, be allowed to come into contact with food stuffs or food utensils, and measures should also be taken to prevent the uncured materials from coming into contact with skin, since people with particularly sensitive skin may be affected. The wearing of impervious rubber or plastic gloves will normally be necessary; likewise the use of eye protection. The skin should be thoroughly cleansed at the end of each working period by washing with soap and warm water. The use of solvents is to be avoided. Disposable paper - not cloth towels - should be used to dry the skin. Adequate ventilation of the working area is recommended.

First Aid

- If the material enters eyes, flood with water for at least 15 minutes, then consult a doctor.
- If skin rashes or allergic responses (such as wheezing, swelling) occur, consult a doctor.
- If swallowed, **DO NOT** induce vomiting. Drink copious amounts of water and contact a doctor or the Poisons Information Center.

If more specific information on toxicity and safe handling is required, the following publications are available from Aeropoxy on request.

Material Safety Data Sheet - "Epoxy Resins - Instructions for Use, Handling and Disposal"



8.0 Build Procedures Index for Lightning

- 1. Preparing Fuselage
- 2. Seat Bulk Head Assembly
- 3. Opera Window Installation
- 4. Instrument Panel Support
- 5. Fuselage Assembly
- 6. Flap & Trim Motor Install
- 7. Seat belt Installation
- 8. Seat Installation
- 9. Fuel system final installation
- 10. Wing Prep
- 11. Spar box install and Wing alignment
- 12. Outboard Aileron Hinge
- 13. Inboard Aileron Hinge
- 14. Wingtip Vents
- 15. Fuel Sending Unit Installation
- 16. Wing Final Installation
- 17. Horizontal Tail Prep
- 18. Elevator Hinge Fabrication
- 19. Elevator Balance Modification
- 20. Horizontal Tail Installation
- 21. Elevator Final Installation
- 22. Vertical Tail Prep
- 23. Rudder Installation
- 24. Master Cylinder Installation
- 25. Pedal Assembly
- 26. Pedal Support Beam
- 27. Flute tube fabrication
- 28. Flute tube support
- 29. Pedal Assembly final install
- 30. Firewall layout and preinstall
- 31. Firewall final install
- 32. Engine mount install
- 33. Installing the Engine
- 34. Fitting the Cowl
- 35. Oil Cooler Inlet Install
- 36. Firewall Forward Systems Install
- 37. Spinner & Prop
- 38. Nose gear assembly
- 39. Main gear axle and brakes
- 40. Set Main Gear Alignment
- 41. Canopy Hinges
- 42. Canopy Latches
- 43. Fitting the Canopy

9.0 Recommended Build Sequence

Note: This is a recommended build sequence, and does not match the build index.

1. 1. Preparing Fuselage
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30. 34. Fitting the Cowl
31. 35. Oil Cooler Inlet Install
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35. 43. Fitting the Canopy
36. 36. Firewall Forward Systems Install
37. 37. Spinner & Prop
38. 15. Fuel Sending Unit Installation
39. 6. Flap & Trim Motor Install
40. 16. Wing Final Installation
41. 9. Fuel system final installation
42. 7. Seat belt Installation
43. 8. Seat Installation