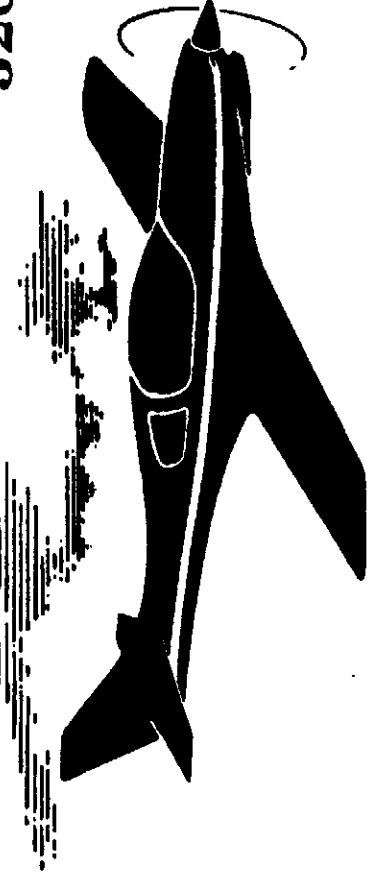


FB # 482

**LANCAIR  
KIT ASSEMBLY MANUAL**

**FOR MODEL 320 FAST-BUILD KIT**

**LANCAIR® 320**



**LANCAIR® 320FB**

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Preface

REV.

0 / 11-1-91



Dear Future Lancair Flyer,

Welcome to the world of kit built aircraft. The name Lancair has become synonymous with industry leadership in both design and materials use and we thank you for choosing Lancair.

Building a kit plane is both educational and recreational and is without question, one of today's most active areas of general aviation. If you're new to homebuilding, then you will be pleasantly surprised by the warm fraternity of friends you'll soon be making since "homebuilders" are truly a special breed of people. In fact, many builders find the building process and the new friends they make, as rewarding as the eventual and spectacular hours of flying.

Your Lancair 320 Fast-Build kit is composed of advanced composite materials. Virtually all Lancair molded parts are produced under high pressure (about 2000psf) and cured at 250°F± 5°s. This high temperature process is the commercial aviation industry standard and produces the strongest possible parts with extremely high strength to weight ratios. With such high temperature cures, dimensional stability is also far superior to room temperature cured parts produced by many other kit manufacturers. With these advanced materials, the longevity of your investment will also be greatly enhanced.

Your Lancair Fast-Build kit is designed for ease of construction, with many hours of the work already performed for you. By following this manual along with information from recommended sources and our builder hotline, even the novice builders should finish their Lancair Fast-Build kits in about a year of dedicated spare time effort. We are always working to simplify assembly techniques as periodic revisions to the assembly manuals reflect. We encourage you to join a local EAA chapter if one is near you and also suggest you subscribe to the Lancair Mail newsletter which serves as a conduit for builder ideas, shortcuts, flying tips, etc.

With a dedication and conscientious effort, you'll soon have a fine example of the Lancair 320 flying that you can be proud of for years to come. Once again, welcome from all of us at Neico.

We look forward to seeing you and your new Lancair 320 at a future fly-in.

Sincerely,

Lance A. Neibauer  
Neico Aviation Inc.

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## PREFACE

This manual provides detailed step-by-step instructions for assembling the Lancair 320 Fast-Build Kit.

Hands on experience with fiberglass construction techniques and various hand tools is assumed. If you do not have that background knowledge, the study of other, more basic texts will be necessary. Suggested references are given on the following pages.

Although one person might build this kit alone, there will be times when an extra pair of hands or eyes will be very helpful and will speed assembly. Besides, working with a friend can be a great deal more fun.

If you do not already belong to the local chapter of the Experimental Aircraft Association (EAA), you may want to join. The EAA chapter nearest you will probably have members already building aircraft who will be happy to help you. Contact the EAA at the following address for the location of the nearest chapter:

### EAA

Whittman Airfield  
Oshkosh, WI 54903-3065  
(414) 426-4876

## WARNING

**IF DURING CONSTRUCTION YOU HAVE ANY QUESTION OR DOUBT ABOUT A CONSTRUCTION PROCEDURE, DO NOT CONTINUE UNTIL YOU HAVE OBTAINED THE NECESSARY INFORMATION OR SKILL. IF YOU ARE NOT KNOWLEDGEABLE IN FIBERGLASS OR OTHER REQUIRED CONSTRUCTION TECHNIQUES OR TOOLS, OBTAIN THAT KNOWLEDGE BEFORE STARTING CONSTRUCTION.**

**NO CHANGE TO THE AIRCRAFT DESIGN OR SPECIFIED CONSTRUCTION PROCEDURES IS PERMITTED. SUCH CHANGES MAY ADVERSELY EFFECT THE AIRCRAFT'S STRUCTURAL INTEGRITY OR AIR- WORTHINESS.**

**FAILURE TO FOLLOW THIS WARNING AND OTHERS IN THIS MANUAL COULD RESULT IN COMPONENT FAILURE AND LOSS OF AIRCRAFT CONTROL CAUSING SERIOUS INJURY OR DEATH.**

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## RECOMMENDED BACKGROUND INFORMATION

**COMPOSITE MATERIALS PRACTICE KIT:** This kit contains various materials with which to practice and develop your fiberglass construction technique. It also contains a copy of Burt Rutan's **Moldless Composite Sandwich Homebuilt Aircraft Construction** book described below. This kit is recommended for all newcomers to fiberglass construction and is a good refresher for others.

49.95 @ ACF Spruce

**MOLDLESS COMPOSITE SANDWICH HOMEBUILT AIRCRAFT CONSTRUCTION:** by Burt Rutan. Though the hot wire shaping technique covered by this book is not used on the Lancair, this book has a great deal of other excellent, basic fiberglass construction information. Highly Recommended. 14.50 @ ACF Spruce

**BUILDING RUTAN COMPOSITES:** This is a video tape by Burt Rutan. Although it covers some techniques not used on the Lancair, it shows you how the experts handle fiberglass construction. Highly recommended. 24.50 @ ACF Spruce

**COMPOSITE CONSTRUCTION FOR HOMEBUILT AIRCRAFT:** by Jack Lambie. This book is an additional source of useful construction information and goes into the theory of aircraft design as well. His Chapter 9, Safety in Working With Composite Construction, is particularly worth reading. This book would be a useful addition to the above. 19.95 @ Zenith  
19.95 @ ACF Spruce

The above publications, practice kit and video tape are available from:

**Aircraft Spruce & Specialty Company**

**Box 424**

**Fullerton, CA 92632**

**Phone: 1-800-824-1930 or 1-714-870-7551**

**FAX: 1-714-7289**

The following recommended books largely describe aspects of aircraft construction other than working with fiberglass:

**FIREWALL FORWARD:** by Tony Bingelis is packed with vital info about engine installation. You'll need this when you're getting ready to install the engine.

19.95 @ ACF Spruce

**THE SPORTPLANE BUILDER:** by Tony Bingelis has a lot of useful information on aircraft construction in general such as electrical systems, instrumentation and fuel systems. The chapter entitled "You and the FAA" gives important information on the procedures that you will need to follow during construction on order to get your homebuilt's airworthiness certificate.

19.95 @ ACF Spruce

These two books can be obtained from:

**EAA Aviation Foundation**

**Wittman Airfield**

**Oshkosh, WI 54903-3065**

**Phone: 1-414-426-4800**

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## MANUAL LAYOUT AND USE

For ease of understanding and use, this assembly manual is laid out in a logical progression of assembly steps. The first section explains the technique used to prepare and join mating parts. This technique is used throughout the kit assembly process, and is shown in detail.

Following that, actual construction instructions begin with center main spar assembly. Directions are provided for preparing and installing landing gear and control hardware and other components.

Assembly instructions for the remaining parts are given in a sequence that either makes for convenient construction or is necessary due to the kit design.

Each chapter is begun with a "Description" of the work that will be performed in that chapter, to give you an overview of what is to be done. This is followed by a second section, "Equipment Required", detailing all of the necessary or desired tools for accomplishing the work to be performed. Then the section titled "Procedure" will give more detailed instruction on how to best perform the tasks outlined in "Description". Each chapter should be read through entirely and understood before beginning the work it describes. The equipment called for in each chapter should be on hand and ready for use.

### WORK AREA

Your work area should be well lit, clean and uncluttered, and have at least one large table to cut on and work with the fiberglass. Since parts will be placed on the floor occasionally, oil, grease and dirt must be removed from the floor to prevent contamination of the parts.

One of our builders has old carpeting on the floor in his work area. The carpeting not only covers the soiled concrete floor, it is also much more comfortable to stand on for long periods of time.

If work is to be done when the outside temperature is less than 70°F, a heat source may be necessary. Working with adhesive or fiberglass resin at temperatures lower than 70°F is difficult and cure times are longer. After turning on the heater, allow time for the materials to come up to room temperature before using.

The following drawings will help you determine the size of the working area required for various stages of construction.

Initially, the fslg portion can be assembled within a relatively small work area. However, the outer portion of the wing must be assembled while attached to the stub wing so you'll need added space when the time comes to assemble the outer wing.

The outer wings can be assembled one at a time or both at once. If you have enough space to assemble both wings at one time, do so since it is more convenient and time-saving.

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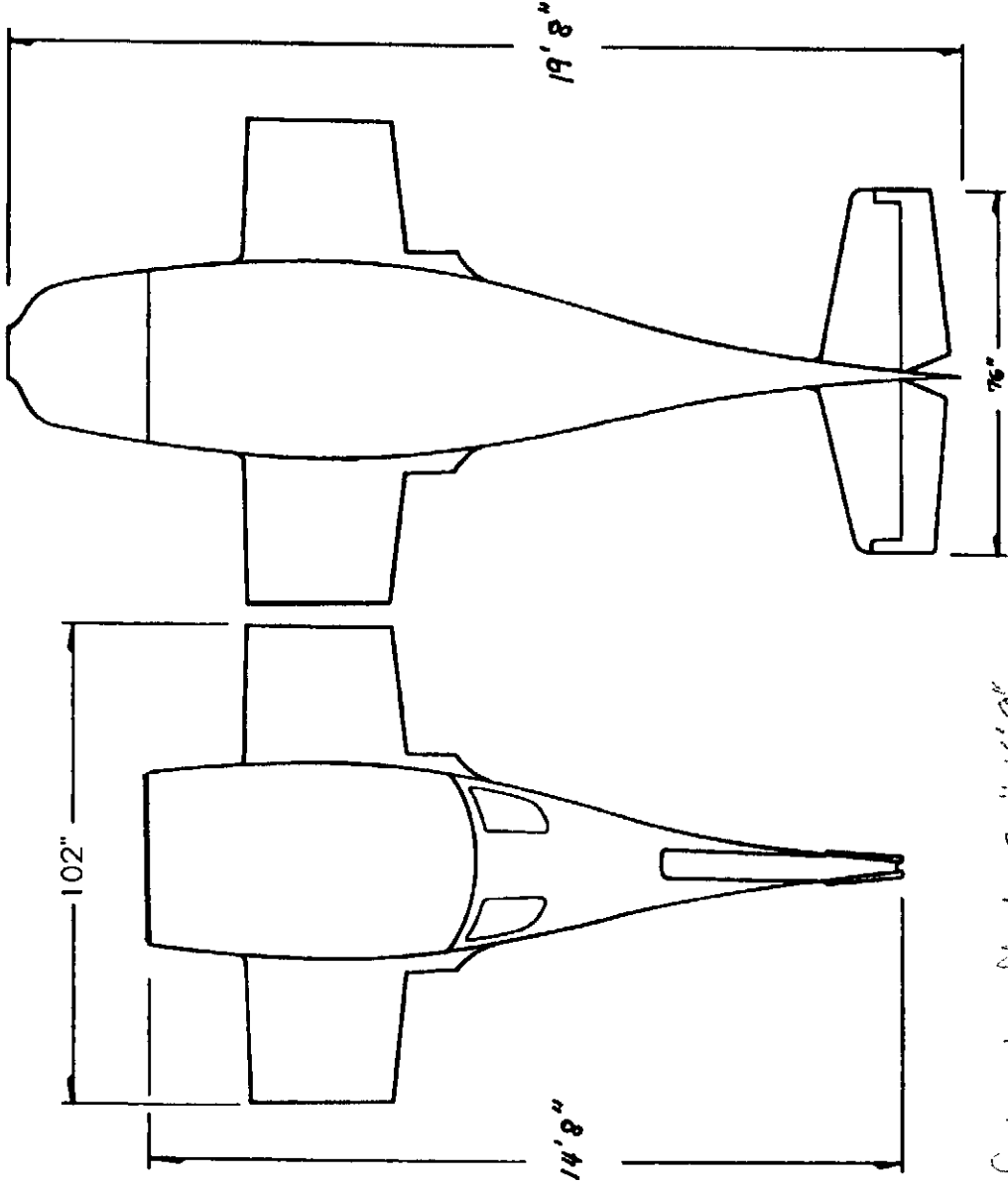
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AREA DRAWING  
FIGURE a-1



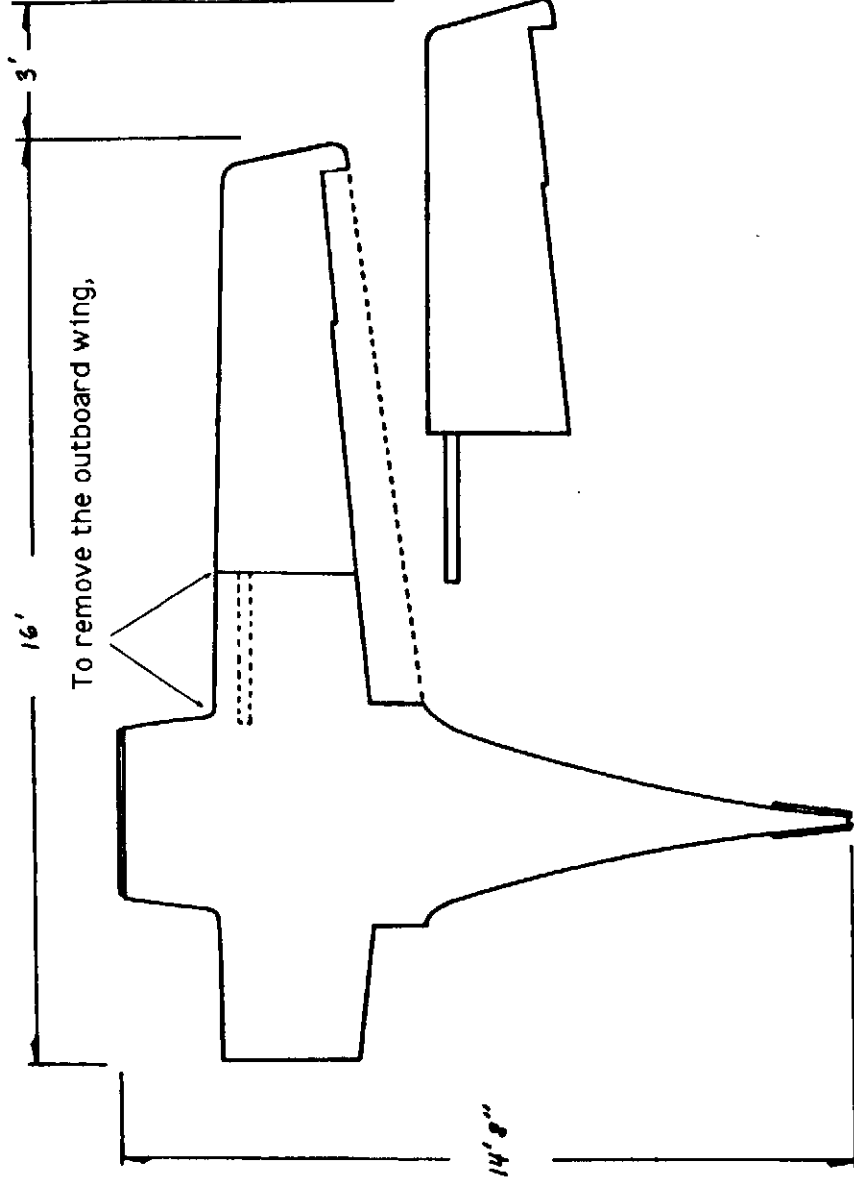
Survived to suborbital, 201" = 16' 9"

$l_{oz} = 21'$   
 $b = 23' 6''$   
 $h = 6' 7''$

**NOTE:** Once the outer wing is assembled in position on the stub wing, it's removal requires at least a three foot clearance beyond the wing tip. Unless your doorway is large enough to allow removal of the plane with the wing(s) on, make sure you have that clearance. Even if you can remove the outer wings, make sure your doorway will clear the 102" width of the stub wing. You do not want to have to cut a hole in the wall to get your plane out (as others have done!).

### WING REMOVAL AREA REQUIRED

Figure a-2



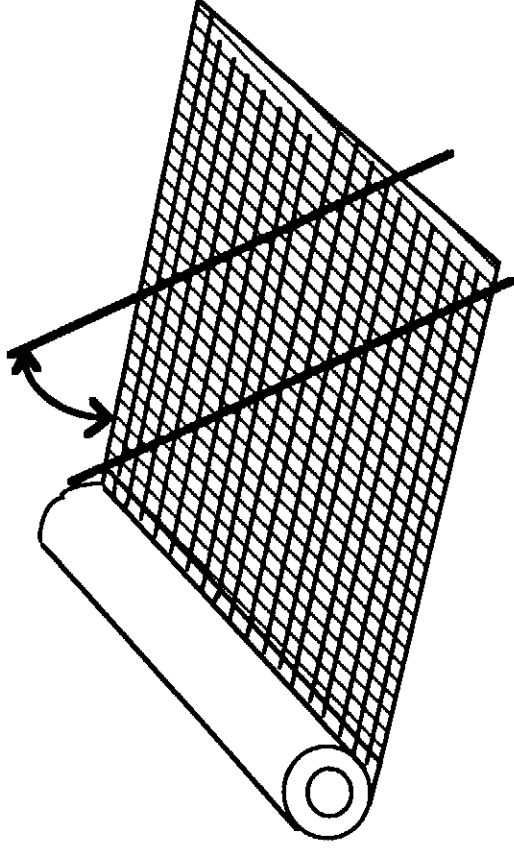
## TERMS AND DEFINITIONS

**Aft** Back side or measured back

**BID tape** A strip of BID cloth cut on the bias, usually 2-4 inches wide.

**Bidirectional** Bidirectional glass cloth (BID) means that it has 50% of the fibers glass cloth running in one direction and 50% running 90° in the other direction.

**Cutting on the bias** Cutting BID cloth on the bias is to cut in such a way as to leave the fibers on a 45° angle to the edge. See Drawing. You can wrap a smaller radius corner when the fibers are running on a 45° angle to the corner.



**Chord** Length of the airfoil; from the leading edge to the trailing edge of the wing.



**Cotton Flox** Finely chopped cotton fibers which are in appearance nearly as fine as micro balloons. The big difference is that flox is structurally stronger than micro when combined with epoxy. **USE:** Mixed similarly to micro and used for strengthening glass to glass areas where BID tapes can't be used. Can fill small gaps where pure epoxy might run out and leave a void, also large amounts of pure epoxy is heavier and too brittle. Flox is slightly heavier than micro. **Should be used sparingly - can add a lot of weight if used without discretion.**

**Ctr** Center

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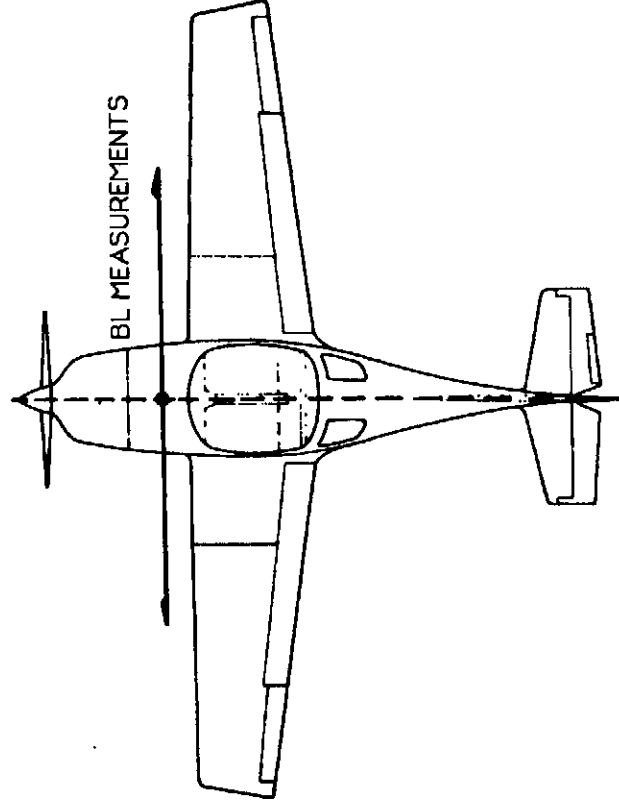


## TERMS AND DEFINITIONS (Continued)

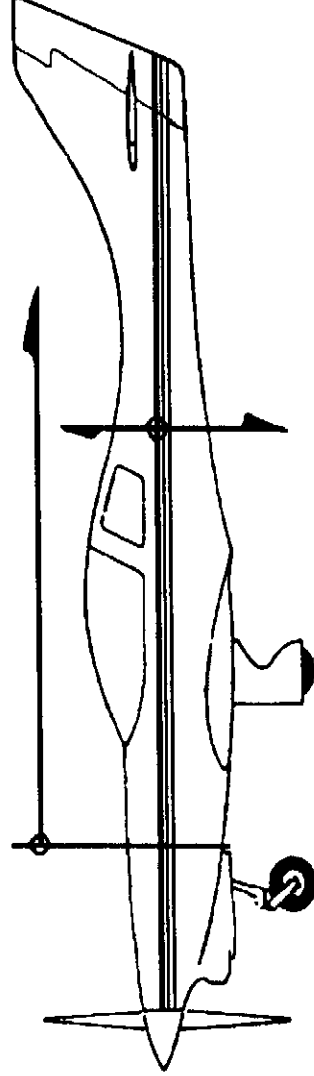
- BL** Butt line. This is used to measure distances outward from the centerline of the fuselage. Thus butt line 0 (BL-0) is the actual center line.
- WL** Water line. This is an imaginary line used to measure vertical distances on the airplane. On the Lancair 320, water line 100 (WL100) is established at the top of the longeron with the longeron level. Thus WL 90 would be 10" below the top of the longeron, WL102 would be 2" above the top of the longeron.
- FS** Fuselage Station. This imaginary line is used to measure distances forward or aft on the fuselage. FS-0 is established at the aft side of the firewall. Thus FS-28 is 28" aft of the back of the firewall.

### BL & FS MEASUREMENTS

Figure a-3



BL & WL measurement drawing



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**Dihedral** Looking at the front of the aircraft, most non-swept wings form a positive angle to the horizontal. That is called dihedral. The Lancair 320 has 3° of dihedral, meaning that the wings are slanted upward at a 3° angle from the horizontal. Dihedral improves roll stability on non-swept wing aircraft.



**FSLG** Fuselage

**Ftg** Fitting

**Fwd** Forward

**Inbd** Inboard

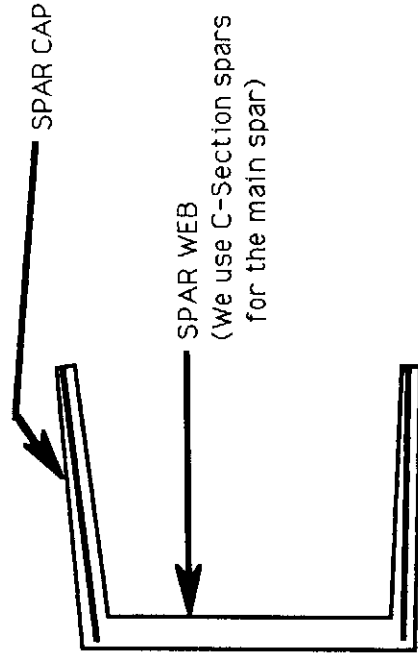
**Longeron** A lengthwise structural member of the fuselage. Some planes have top and bottom longerons. The Lancair 320 has only partial length top longerons.

**Micro** Micro-balloons; they are very small thin-walled glass air-filled bubbles. Being extremely light for their volume, they can be added to resin to produce a very light-weight filler material that is easy to shape and sand. They do not add strength to the mixture however, and should be used where 'cosmetics' is the consideration, not strength.

**Outbd** Outboard

**Shearweb** Typically the part of the wing spar that runs vertically.

**Spar cap** The top and bottom members of a spar, held in proper relation by the shear web.



**Typ** Simply means "typical" when seen on a drawing.

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## CAUTION

**DURING AIRCRAFT ASSEMBLY TWO TYPES OF EPOXY ARE USED: A STRUCTURAL PASTE ADHESIVE AND A LAMINATING RESIN.**

**THE LAMINATING RESIN IS USED TO MAKE FIBERGLASS LAYUPS OR IS MIXED WITH FLOX OR MICRO.**

**THE STRUCTURAL PASTE ADHESIVE IS USED TO STRUCTURALLY BOND MOLDED PARTS TOGETHER.**

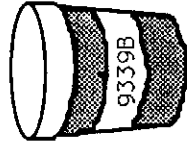
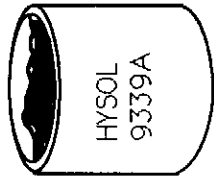
**THESE EPOXIES ARE NOT INTERCHANGEABLE. FOLLOW THE INSTRUCTIONS CONCERNING WHICH TO USE.**

**NOTE:** Although Hysol 9339 Structural Adhesive and laminating resins from Hexcel and Shell are illustrated, other structural adhesives may be used instead of this type if deemed appropriate. Mixing ratios will also differ.

**BE SURE TO CHECK FOR PROPER MIXING RATIOS OF STRUCTURAL ADHESIVES AND LAMINATING RESINS SUPPLIED. FAILURE TO PROPERLY MIX STRUCTURAL ADHESIVE OR LAMINATING RESIN COULD RESULT IN BOND FAILURES.**

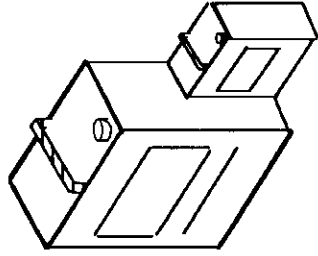
**HYSOL 9339 ADHESIVE**

**Mix: 44.5 parts (blue)  
to 100 parts (white)**



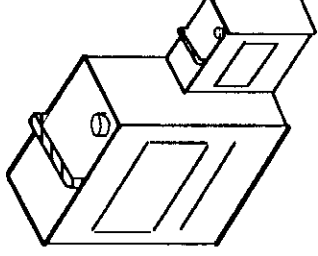
**EPOLITE 2410/2184**

**Mix: 44 parts 2410  
to 100 parts 2184**



**SHELL DPL 862/Teta**

**Mix: 18 parts Teta  
to 100 parts DPL 862**



SAMPLE ILLUSTRATIONS, OTHER SYSTEMS MAY BE SUPPLIED AS STANDARD WITH YOUR AIRFRAME KIT. SEE ABOVE WARNING.

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






















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
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## AN - BOLT AND HARDWARE GUIDE

This a guide to AN hardware can be helpful if you are not familiar with the code number system

AN 3 thru AN 20 BOLT - HEX HD, AIRCRAFT	
AN 21 thru AN 36 BOLT - CLEVIS	
AN 42 thru AN 49 BOLT - EYE	
AN 73 thru AN 81 BOLT - DR HD (engine)	
AN 100 - THIMBLE - CABLE	
AN 115 SHACKLE - CABLE	
AN 116 - SHACKLE - SCREW PIN	
AN 155 BARREL - TURNBUCKLE	
AN 161 FORK - TURNBUCKLE	
AN 162 FORK - TURNBUCKLE (for Bearing)	
AN 165 EYE - TURNBUCKLE (for pin)	
AN 170 EYE - TURNBUCKLE (for cable)	
AN 173 thru AN 186 BOLT, CLOSE TOL.	
AN 210 thru AN 221 PULLEY - CONTROL	
AN 253 PIN - HINGE	
AN 254 SCREW - THUMB, NECKED	
AN 255 SCREW - NECKED	
AN 256 NUT - SELF LOCK (Rt. Angle Plate)	
AN 257 HINGE - CONTINUOUS	
AN 276 JOINT - BALL & SOCKET	
AN 280 KEY - WOODRUFF	
AN 295 CUP - OIL	
AN 310 NUT - CASTLE (Air Frame)	
AN 315 NUT - PLAIN (Air Frame)	
AN 316 NUT - CHECK	
AN 320 NUT - CASTLE, SHEAR	

AN Hardware (continued)

AN 335 NUT - PL. HEX (NC) Semi-Fin	
AN 340 NUT - HEX, MACH. SCREW (NC)	
AN 341 NUT - HEX, BRASS (Elec.)	
AN 345 NUT - HEX, MACH. SCREW (NF)	
AN 350 NUT - WING	
AN 355 NUT - SLOTTED (Engine)	
USAF 356 NUT - PAL	
AN 360 NUT - PLAIN (Engine)	
AN 362 NUT - PLATE, SELF-LOCK. (Hi-Temp.)	
AN 363 NUT - HEX, SELF-LOCK. (Hi-Temp.)	
AN 364 NUT - HEX, SELF-LOCK. (Thin)	
AN 365 NUT - HEX, SELF-LOCK	
AN 366 NUT - PLATE, SELF-LOCK	
AN 373 NUT - PLATE, SELF-LOCK. (100° CTSK)	
AN 380 PIN - COTTER	
AN 381 PIN - COTTER, STAINLESS	
AN 385 PIN - TAPERED, PLAIN	
AN 386 PIN - THREADED TAPER	
AN 392 thru AN 406 PIN - CLEVIS	
AN 415 PIN - LOCK	
AN 416 PIN - RETAINING, SAFETY	
AN 426 RIVET - 100° FL. HD., ALUM.	
AN 427 RIVET - 100° FL. HD., Steel, Monel, Copper	
AN 430 RIVET - RD. HD., ALUM.	
AN 435 RIVET - RD. HD., Steel, Monel, Copper	
AN 442 RIVET - FL. HD., ALUM.	
AN 450 RIVET - TUBULAR	
AN 470 RIVET - UNIVERSAL HD., ALUM.	

AN Hardware (continued)

AN 481 CLEVIS - ROD END



AN 486 CLEVIS - ROD END ADJ.



AN 490 ROD END - THREADED



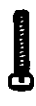
AN 500 SCREW - FILL. HD. (NC)



AN 501 SCREW - FILL. HD. (NF)



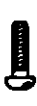
AN 502 SCREW - DR. FILL. HD. (Alloy Stl.) (NF)



AN 503 SCREW - DR. FILL. HD. (Alloy Stl.) (NC)



AN 504 SCREW - RD. HD. SELF TAP.



AN 505 SCREW - FLAT HD., 82° (NC)



AN 506 SCREW - FLAT HD., 82° SELF TAP.



AN 507 SCREW - FLAT HD., 100° (NF & NC)



AN 508 SCREW - RD. HD. BRASS (Elec.)



AN 509 SCREW - FL. HD. 100° (Structural)(ALLOY STEEL)



AN 510 SCREW - FLAT HD. 82° (NF)



AN 515 SCREW - RD. HD. (NC)



AN 520 SCREW - RD. HD. (NF)



AN 525 SCREW - WASHER HD. (Alloy Stl.)



AN 526 SCREW - TRUSS HD. (NF & NC)



AN 530 SCREW - RD. HD., SHEET METAL



AN 531 SCREW - FL. HD. 82° SHEET METAL (Type B)



AN 535 SCREW - RD. HD. DRIVE (Type "U")



AN 545 SCREW - WOOD, RD. HD.



AN 550 SCREW - WOOD, FLAT HD.



AN 565 SCREW - HDLESS., SET



AN 663 TERMINAL - CABLE, DBLE, SHK. BALL (FOR SWAGING)



AN 664 TERMINAL - CABLE, SGLE, SHK. BALL (FOR SWAGING)



AN 665 TERMINAL - CABLE, THDED. CLEVIS



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AN Hardware (continued)

AN 666 TERMINAL - CABLE, THDED (for swaging)



AN 667 TERMINAL - CABLE, FORK END (for swaging)



AN 668 TERMINAL - CABLE, EYE END (for swaging)



AN 669 - TERMINAL - CABLE, TURNBUCKLE (for swaging)



AN 737 CLAMP - HOSE



AN 741 CLAMP - TUBE



AN 742 CLAMP - PLAIN, SUPPORT



AN 900 GASKET - COP. - ASBESTOS, ANGULAR



AN 901 GASKET - METAL TUBE



AN 931 GROMMET - ELASTIC



AN 935 WASHER - LOCK, SPRING



AN 936 WASHER - LOCK TOOTH (Ext. & Int)



AN 960 WASHER - FLAT, AIRCRAFT



AN 961 WASHER - FLAT, BRASS (Elec.)



AN 970 WASHER - FLAT, LARGE AREA



AN 975 WASHER - TAPER PIN



AN 986 RING - LOCK

































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AN804 TEE, Flared tube with Bulkhead on run 	AN824 TEE, Flared Tube 	AN842 HOSE ELBOW, Pipe Thread 90° 
AN807 ADAPTER Hose to Universal 	AN825 TEE, Flared Tube with Pipe Thread on side (MS20825) 	AN844 HOSE ELBOW, Pipe Thread 45° 
AN814 PLUG AND BLEEDER, Screw Thread 	AN826 TEE, Tube with Pipe Thread on Run (MS20826) 	AN911 NIPPLE, Pipe Thread 
AN815 UNION, Flared tube 	AN827 CROSS, Flared Tube 	AN912 BUSHING, Pipe Thread Reducer 
AN816 NIPPLE, Flared Tube and pipe thread 	AN832 UNION, Flared Tube, Bulkhead and Universal 	AN913 PLUG, Square Head, Pipe Thread (MS20913) 
AN818 NUT, Coupling 	AN833 ELBOW, Flared Tube, Bulkhead and Universal, 90° 	AN914 ELBOW Internal and External Pipe Thread, 90° 
AN819 (MS20819) SLEEVE, Coupling 	AN834 TEE, Flared, Tube, Bulkhead and Universal 	AN915 ELBOW, Internal and External Pipe Thread, 45° 
AN821 ELBOW, Flared Tube, 90° 	AN837 ELBOW, Flared Tube, Bulkhead and Universal, 45° 	AN919 REDUCER, External Thread 
AN822 ELBOW, Flared Tube and Pipe Thread, 90° (MS20822) 	AN838 ELBOW Hose to Universal, 90° 	AN924 NUT, Flared Tube, Bulkhead and Universal Fitting 
AN823 ELBOW, Flared Tube and Pipe Thread, 45° (MS20823) 	AN840 HOSE NIPPLE, Pipe Threaded 	AN929 CAP, Flared Tube Fitting 



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