IMPORTANT: READ CAREFULLY

Inasmuch as Ken Brock Manufacturing, Inc. has no opportunity to supervise the installation or maintenance of parts supplied by it, nor any opportunity to participate in the construction or maintenance of a KB-2G (towed version) or a KB-2 gyroplane (powered version), the purchaser by placing or utilizing an order with Ken Brock Manufacturing, Inc. agrees that all materials purchased will be used solely at purchaser’s risk and that the purchaser will indemnify and hold Ken Brock Manufacturing, Inc., its owners and employees, free and harmless from all loss, liability or damage resulting from claims brought by reason of any alleged failure or defect of any part or parts supplied by Ken Brock Manufacturing, Inc. Buyer and user assume full responsibility as well as all liability and risks for proper assembly, maintenance, preflight inspections and operations of the KB-2G (towed version) and KB-2 gyroplane (powered version) both on and above the ground.
CONSTRUCTION MANUAL
FOR THE
KB-2G (towed) AND KB-2 (powered) GYROPLANE

EXTREMELY IMPORTANT: Most people enjoy the experience of assembling their KB-2 kits, since the pre-cut, pre-drilled components go together easily and quickly. There’s nothing really tricky about following the plans and the instructions in this manual. HOWEVER, to avoid the possibility of error, misalignment or damage, PLEASE take the time to carefully unpack your kits, check the parts against the inventory list and inspect for any damage that may have occurred in shipment. Then sit down with the plans and this manual and carefully study every step of the construction process BEFORE you start putting pieces together. Being familiar with the sequence will spare you a lot of frustration.

WORK AREA: You will need a minimum 10′ x 12′ floor space with at least 7′ of headroom. Keeping the area clean and well illuminated will certainly help. This will see you through the basic airframe assembly. When you’re ready to attach the rotor blades, you will need 23 feet for clearance. Remember, if you are working indoors, you will need a door opening at least 4′ wide to maneuver the completed machine (without rotors) outside.

TOOLS: You will need an electric hand drill with 1/4″, 3/16″, #20, and 5/32″ bits. Hard tools include pliers, screwdriver, small socket wrench set, some open-ended wrenches, a file, a hacksaw and C clamps.

PROCEDURE: Someone once quipped that building an airplane isn’t a big job — it’s a whole bunch of little ones. And that’s the way a gyroplane goes together: one piece at a time. You begin by joining the mast and keel. The sequence is carefully spelled out. Photos will show you how the parts are oriented, which way the angle extrusions face and where the bolt holes go. With very few exceptions, the photos for this manual were taken from the pilot’s left side of the machine (as he faces forward). Thus, the front of the machine is usually to the left side of the photo, aft is to the right. Always check the instructions and photos against the plans to verify part numbers, dimensions, placement, etc. We assume, in the construction manual, that you are working from a kit, so there is little information about fabricating fittings or some sub-assemblies — you’ll have to rely more heavily on the plans if you choose to scratch-build your KB-2. Some parts, like the rotor blades and rotor head, must be ordered from the factory.

In the first 18 steps of assembly, all nuts are simply finger-tightened to allow for hole alignment. When you get to tightening the bolts, be careful to avoid over-tightening. With few exceptions, you’re working with aluminum tube and it will collapse or bend inwards if you go too far with a wrench.

Bolt tightening or “torque values” can be found at the end of this manual, along with information on measuring bolt lengths, bolt grip, and safety wiring.
1. BOXES. Wow! The UPS man isn’t out of the driveway yet and the rudder and horizontal tail have already been unpacked.

2. Open all of the boxes carefully. Note that most metal pieces are identified with marked masking tapes. Do not remove the tape until installation.

3. Empty the large plastic bags so you can identify the pieces in each of the smaller bags. Use caution to avoid mixing the parts of different bags. This is the time to run an inventory check on the gyroglider. Make sure that no parts have been damaged in transit. IF ANYTHING IS MISSING, contact the factory immediately and advise them of what’s not there.

4. Store the components neatly where they won’t be in your way or within reach of small children. Organize your tools and you are ready to begin.

5. KEEL. As with a boat, we begin to assemble the gyroglider by securing the keel (part #202-2). Note: the first two numbers for each part have been dropped for simplicity, since they are all the same; thus, 202002-2 reads 202-2. Make sure the cut out section of the keel (which accommodates the tailwheel) is facing downward. In this photo the front of the glider is to the left. Fit the cluster plates (202-1) in place with bolts from 201 HDW-4. (Note: in this and nearly all other cases, and unless otherwise specified, there are two washers for each bolt. One will go under the bolt head and the other goes under the nut.) Finger-tighten nuts.

6. MAST (202-4). IMPORTANT: mast consists of two matching parts taped together for symmetry. They must always retain this relationship. Untape the bottom end only and set in place so mast leans aft (note the angle cut at the end of the mast to permit the mast to lean).

7. Tap bolts through mast holes and add washers and nuts. Finger-tighten nuts.

8. AXEL (202-3). Place axle in position, making sure brace holes (for 203-8 angle) are forward. Slip two AN4- bolts from 201 HDW-6 through keel and axle. Finger-tighten nuts.

9. AXEL TO KEEL BRACES (203-8 L/R). Install angles between axle and keel on right and left sides using AN4-bolts from 201 HDW-5. (Note position of cut out on braces — inspect angle braces to make sure there are no burrs left from the stamping process — ends may have to be filed so the tangs will fit flush against the square tubes.) Finger-tighten nuts.
10. **SEAT FRAME ANGLE (203-9)**
Slip bolts, AN 4-26A from 201 HDW-3, through seat frame angle and mast.

11. **AXEL TO MAST STEEL BRACES (203-2L/R)**
Note: these two braces will require drilling with 1/4” bit. Square up and insert mast and axel with C clamps so they are at a 90° angle.

12. Place one 203-2-angle brace on the rear of the mast over the threaded end of the bolt that holds the seat frame angle to the mast.

13. Note that the brace will have to be removed and each end will have to be bent to allow brace to fit in place. (Study plans carefully.)

14. Secure upper end of brace to mast and tighten nut to hold brace snug and flush (brace should still be movable).

15. Slide a 1/4” drill bit backwards through the keel hole. Swing brace past end of bit, lightly marking an arc on face of brace.

16. Mark center of arc and drill.

17. Bolt brace into position (for keel use AN4-25A bolts from 201 HDW-5). Finger-tighten nuts. Duplicate on the other side (don’t reverse the angles). Remove C clamps and brake.

18. **KEEL TO MAST BRACES (203-7)**
Bolt braces to mast and keel, paying close attention to how angles face each other (do not reverse). NOW TIGHTEN ALL NUTS (see torque chart for tightening values — do not overtighten).

19. **UPPER SEAT CLAMP (203-10L/R)**
Attach clamp pieces to sides of mast with AN4-26A bolts from 201 HDW-5. Make sure the 3/15” holes are toward the front of the glider. Tighten nuts.
20. FRONT BOOM ASSEMBLY (consisting of 203-611 long upper front boom assembly, pre-assembled in a factory kit, plus 203-3L/R front seat attach angle braces). Place AN4-30A bolt (201 HDW-2 front boom mounting hardware) through front seat attach angle; then through 203-6 boom angle, then through keel, then the other side of the boom assembly and the other 203-3 front seat attach angle brace. Finger-tighten nut.

21. Attach 203-511 lower boom sub-assembly (203-5L/R angles and 203-11 gusset) to keel (lower hole) with AN4-26A bolt (201 HDW-2). Note position of angles.

22. TOW BLOCK (201-5). Install AN4-30A bolt (201 HDW-2) through upper boom, lower boom, tow block, support cable (201-7). Note: fork end of cable will attach to rotor head later. Temporarily tie off cable to keep out of your way until step 56).

23. BOOM BRACE 203-411 (sub-assembly made up of 203-4L/R angles and 203-11 gusset). Install between keel and upper edge of boom using AN4-26A bolt (through keel) and two AN3-5A bolts (from 201 HDW-2).

24. TOW HITCH (kit 902-1). Attach tow hitch (902) to tow block using AN8-12 bolt. Finger-tighten and use cotter pin to hold nut in place. Tow hitch should swivel freely.

25. AIR SPEED BRACKET (201-2). Clamp bracket to upper nose boom assembly just above upper gusset plate. Drill holes through boom with #20 drill bit and attach bracket with AN 515-8.10 screws (201 HDW-1). Slip AIR SPEED INDICATOR (901) in place. NOW TIGHTEN ALL BOOM ASSEMBLY NUTS. (See torque chart for tightening values — do not over-tighten.)

26. SEAT (203-12 seat back and 203-14 seat bottom). Cut wood dowel into four equal lengths and place in the ends of seat tubes. (This is to prevent collapsing of tube ends — do not over-tighten.)

27. Lay seat bottom tube on top of seat brace (203-9) and C clamp tube to ends of seat brace. Drill up through seat brace hole to make attachment holes in seat bottom. Then bolt in place with AN4-15A (201 HDW-3).

28. Drill 3/16" holes through front edge of seat bottom using the seat braces 203-3 for hole guides. Attach with AN3-14A bolts (201 HDW-3). File upper corners of seat brace. Notice the seat brace angles are angled out per Print-20201 Air Frame Assembly.
29. Clamp seat back to seat bottom and drill a ¼” hole through both. Make every effort to drill these holes in the center of the tubes. Bolt together with AN4-24A (201 HDW-3). Do not overtighten nuts. Do not crush tube.

30. Clamp seat back to upper seat clamp (203-10) on mast. Drill 3/16” hole up through holes in clamp. Bolt in place with AN3-14A bolts (201 HDW-3). Apply seat webbing and install seat belts in location indicated on plans. Drawing number 20201.

31. WHEELS. Attach axle clamp blocks (202-6) to axle. (Note that blocks are mated pairs — do not mix.) Use AN4-40A bolts. It’s usually a good idea to keep all the mated numbers pointed in the same direction.

32. Install wheel axle (202-7). Tighten nuts, but leave some looseness for adjustment in step 34.

33. Main wheel installation — pack all wheel bearings with grease prior to installation. Put inner wheel bearing on axle, then add wheel, then outer bearing. Tighten castellated nut (912) finger tightening. Back off to the first hole and install cotter pin (MS24665-289). Bend protruding ends of pin. Make sure wheel moves freely. Refer to proper cotter pinning information in back of this manual.

34. Adjust wheel axle inwards so wheel clears square tube by 1/8”-1/4”. Tighten wheel axle clamp block nuts. Repeat on other side.

35. TAILWHEEL (907). Insert the 301-5 bushing in the tailwheel bearing. On each end of the -5 bushing place one AN 960-816 and one AN 960-816 L (thin) washer. 35a. Slip this assembly into the cut out provided on 202-2 keel tube. Secure with AN 5-24A bolt, washers, and nut provided.

36. RUDDER BAR (201-3). Slide into place so bar holes and keel holes are aligned. Do not put bolts in place yet.

37. NOSEWHEEL BRAKE ASSEMBLY 203-17. Attach brake braces (203-19L/R) to nosewheel fork (301-2). Use AN4-6 bolts.

38. Bolt tube (203-18) to angle braces (203-19L/R) per print using AN 23-19A bolts. Center plywood foot plate (203-20) atop angle brace and firm up against the 18 tube. Clamp and transfer holes from angles to the foot plate. Secure with AN520-10-16 screws. Do not crush the wood.
39. BRAKE CHAIN AND SPRING INSTALLATION. Drill 3/16" hole in center of footplate and attach chain (906-2) with round head screw AN520-10-16.

40. NOSEWHEEL. Put four (4) AN4-25A bolts down through keel and nosewheel attach plate. Note that the two forward bolts go through rudder pedal bar. Tighten nuts. Nosewheel should swivel.

41. RUDDER PEDALS. Slide pedal springs (904 L/R) onto rudder bar and secure with AN3-14A bolts. The bolt loop side of the spring should be located toward the keel tube. (Ref. 20201 DRW)

42. Slide on rudder pedals (201-8L/R). Be sure rudder horns are on inboard side. Slide nylon spacers (201-4) over end of tube and secure with AN3-16A bolts.

43. JOY STICK. File the ends of one of the pillow blocks (502-15) to fit between keel and mast cluster plates. Attach blocks to keel with AN4-30A bolts.

44. Attach the other pillow block (502-15) forward on the keel. At the same time, secure the spring clip (203-21) to the underside of the keel and hook up the spring (905) that connects to the brake assembly (203-17).

45. Slide the joy stick (501-2) into control socket (502-13) and secure with AN3-17A bolt.

46. Lightly grease the pinions (502-16) and back them off so the control tube assembly (502-7) can be positioned. Advance each pinion an equal distance so tube is supported without end play (caution: do not overtighten — control assembly should rock back and forth from side to side without binding. There should be equal clearance between control tube and each of the pillow blocks.)

CRITICAL: Now tighten the lock nuts on the pinions so the pinions will not move.

47. RUDDER (540). (See plans for detail on construction of rudder assembly (520) using angle braces and wood surfaces if you are going to build your own — this manual assumes you will opt for the factory fabricated, all-metal rudder.) Position rudder on keel and secure with five (5) AN4-25A bolts.
48. RUDDER CABLES (201-6). Note: one cable is longer than the other. Put long cable on the pilot's left side (McCulloch installation). Slip fork end of cable onto rudder pedal and attach with AN3-4 bolt with washers under bolt head and castellated nuts (forcks should swivel freely). Secure with cotter pin.

49. Bolt other end of rudder cables to rudder horn on rudder.

50. Slip cable into cable guides.

51. Install rudder cable guides on each side of keel aft of main axle. Make sure cable passes "through" the guide. Adjust aluminum sleeve so that the cable never touches it.

52. HORIZONTAL TAIL (542). Remove the two keel-to-mast angle braces (203-7). Put horizontal tail (542) in place and secure with two (2) AN3-33A bolts (at leading edge) and two (2) AN3-25A bolts (at trailing edge). Caution: do not crush tail when tightening nuts.

53. Replace keel-to-mast angle braces.

54. ROTOR HEAD (400). Position the two head plates (403-8) and secure to top of mast with four (4) AN4-26A bolts.

55. Attach rotor head assembly to head plates with four (4) AN4-26A bolts. Note: install nose cable (201-7), fork end, into slot on forward side of rotor head. Secure with upper bolt. To get cable in place, you will have to compress the space between the tip of the nose boom and the rotor head. This can be accomplished by running two ropes between each point and using a screwdriver to twist them on each other. Don't overdo it — only enough to install the bolt.

56. Connect beam (502-14) and spring clip (403-14) to rotor head with two (2) AN4-25A bolts. Note position of clip — it comes down around forward side of beam.

57. ROTOR HEAD SPRING (926). (Note: one is used on towed version, two are used on gyroplane.) Attach single spring to center hole of clip (403-14). Spring should run down between head plates, forward of mast, to center hole of clip (403-15), which is bolted to mast with two (2) AN3-25A bolts and clamp 403-15.
58. Hook control rod ends (501-3) inside beam (502-14), making sure spacing washers center rod ends in cut outs on beam. Use AN24-17 bolt.

59. Slide bolts through joy stick horn and lower control rod ends. Do not apply nuts. Push rotor head to full back position. Level the beam on the rotor head and check to see if control stick is centered over keel. If beam is level and joy stick leans to the side when viewed from the front, adjust the rod ends until stick is perfectly vertical. When adjustments are made, move the rod ends an equal amount at each end of control rod so equal amounts of thread show at each end.

60. Now move stick forward and back. If control rods hit seat brace, the rods will need to be adjusted so the rotor head stop halts forward motion of joy stick. To achieve this extend all four control rod ends an equal amount, until forward motion of stick is arrested by rotor head stop. Next, check rear stop to see that joy stick does not hit seat frame before it hits the rotor head stop. Stick should move freely to stops on rotor head without interference.

61. ROTOR BLADES. The rotor blades (420) and the hub (440) have scribe marks to show proper factory-set pitch angle. Attach blades to hub with AN6-24 bolts; tighten with wrench before inserting cotter pins. Refer to torque table page 17.

62. Place hub in rotor head and fasten with AN6-45 bolt assembly. Tighten with wrench before inserting cotter pin. Refer to torque table page 17.

63. Now check every nut on the machine for tightness or cotter pins.

64. Dig out your camera and get a friend to take your picture beside the KB-2G. Send a copy to the factory.

*By George, you did it!*

The KB-2G towed version is now finished and ready for its first pre-flight.

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See the flight manual for pre-flight and flying instructions.

As we said before: If at all possible, plan to visit a Ken Brock Gyroflight Center for instructions.

*It could be the best investment you’ll ever make in flying!*
CONVERTING YOUR KB-2G TOWED VERSION TO A GYROPLANE with the McCulloch Engine

1. Remove rotor blades.

2. Remove top bolts from control rod ends (501-3). (Bottom bolts can stay in unless you’d like to get rods out of the way.)

3. Remove upper end of nose cable (201-7). You will need to compress distance between tip of nose boom and rotor head. Use rope.

4. Remove rotor head.

5. Remove head plates and spring clip/clamp (403-16 and 403-15) from mast.

6. Install new power head plates (403-7) which are smaller than the glider head plates. (This is necessary for proper center of gravity positioning which will shift with the addition of the engine.)

7. Reinstall rotor head assembly and put spacer link (201-11) in nose cable fork and rotor head assembly.

8. Reinstall spring clip/clamp (403-16 and 403-15), but this time put the clip on the back side of the mast. Install TWO springs using outer holes of clip. Tighten clip/clamp with rotor head full back and no tension in springs. (Note: during flight tests you may wish to adjust spring pressure by sliding clip/clamp up or down mast — this serves as an adjustable ground trim.

9. Remove glider seat.

10. Saw 3/4” off each end of seat brace (203-9).


12. SEAT TANK (605). Slosh tank with water to make sure inside is clean of any foreign matter that may have gotten into the tank during shipment. Install fuel drain in bottom of tank. Caution: Do not overtighten brass fittings, do not stand tank on fuel drain. Be sure tank has had sufficient time to dry after sloshing.
13. Attach upper seat back bracket (20605-7) to rear of seat tank.

14. Mount seat tank to airframe. Straddle the mast and clamp the upper seat tank bracket to the modified 203-10L/R seat clamps. Place the tubular seat frame on top of the 203-9 seat mounting angle. Position seat tank to have an average 3/8 of an inch between seat back and forward face of the mast. Clamp and drill per illustration.

15. Drill both sides of the upper seat back bracket and clamps (203-10L/R) with 3/16” drill and secure with two (2) AN3-14A bolts.

16. Drill forward seat supports (203-3L/R) with 3/16” drill and secure with two (2) AN3-14A bolts. Caution: do not drill into the tank. Install seat belts per plans.

17. ENGINE MOUNT. Secure angles 602-14L/R to mast with AN4-26A bolts.

18. Attach angles 602-16 to aft end of seat clamps (203-10L/R) and angles 602-14L/R with AN4-6A bolts.

19. Attach angles 602-15L/R to 602-16L/R with AN4-6A bolts.

20. Connect bottom section of engine mount (602-9) to angles 602-15L/R with AN 24-26A round head bolts.

21. Lower engine mount: braces (602-25) are bolted to lower mount (602-9) and angles (602-15L/R) with AN4-16A bolts (bottom) and AN4-6A (top). Make sure angle points out or engine will not fit! Note: these engine mount braces will have to be bent at both ends.

22. Reinstall control rod ends (501-3) and adjust for joystick movement (see gyroglider steps 50-61; obviously, this time the bolts will be fastened on top). When adjusted, add spacer washers and nuts.

23. Remove keel-to-mast angles (203-7R/L). Remove horizontal tail.

24. Attach angle braces (602-26) to lower engine mount outside of 602-25 braces. Bend braces to fit against keel and transfer holes from keel to brace ends (use scribbling technique in steps 15-16 for the towed version).

25. Remove angle braces (602-26) and reinstall horizontal tail. Then keel to mast.
braces, then keel to engine mount braces. Bolt through keel must now be changed to an AN4-30A.

26. Install upper engine mount (602-2) with two (2) AN4-15A bolts.

27. Place the rubber grommets (920) in the three engine mount bosses and slide 601-3 bushings into center of grommets. Place 601-4 washers on each side of grommets. (An extra set of hands will help here.) Compress with C clamps.

28. Set engine in place, remove C clamps as washer-bushing assemblies slide between the welded ears on the engine mount. Insert AN 6-24A bolts. At the same time, attach the mag grounding strap and engine mount bolt. Torque per chart.

29. Install mag ground switch (930). Switch goes on seat brace (203-9) and is grounded by attaching short wire to bolt connecting seat brace and seat tube. Attach the long wire to the magneto. Secure wires to the airframe so they don't dangle.

30. FUEL REGULATOR KIT (601-10). Remove all screws from fuel regulator and attach mounting bracket (602-27).

31. Turn fuel regulator over. Port marked "in" should be on left side as shown here.

32. Using spacer tubes (602-28), attach fuel regulator to upper engine mount angle brace (602-16) with AN3-20A bolts. (Set fuel regulator on #2)

33. FUEL PUMP KIT (933). Position two (2) adel clamps on lower engine mount (on pilot's right) and run two (2) AN3-10A bolts through adel clamps and fuel pump mounting brackets.

34. Install elbow (608-5) from fuel fitting kit on engine. NOTE: With this and all other fittings, you should use teflon tape or some other thread sealant. Tighten snugly but do not over-torque.

35. Remove 1/4" fuel line (607-2) from fuel line bag (607). Screw one end into elbow (608-5) and slip other end onto fuel pump (933), fitting directly over the diaphragm.
36. Install combination of elbows (608-5), junction block (608-2), short nipple, and fuel valve (608-4) per illustrations.
Illustration 36 using both mechanical and pressure fuel pump.
Illustration 36A using pressure pump only.
CAUTION: Fuel valve is on outside of regulator.

37. Attach the 13" hose assembly (607-2) between fuel valve and carburetor inlet.

38. Attach the 27" hose assembly (607-5) between the "OUT" port of pressure fuel pump to the "IN" port of the regulator.

39. Install two 608-3 elbows into the bottom of seat tank. Do not overtighten.

39A. Attach the 23" hose assembly (607-6) between one of the 608-3 elbows to the "IN" port of the pressure fuel pump.

40. Attach the 16" (607-4) hose assembly between elbow (608-3) installed in the "OUT" port of the engine-driven mechanical fuel pump (located on bottom of McCulloch engine) to the junction on the "IN" port of the pressure regulator.

41. Install elbow (608-5) into the "IN" port of the engine-driven fuel pump. Attach 27" hose assembly (607-7) between this and the remaining 608-3 elbow on bottom of the tank.
   A section can be removed from this hose to install the in-line filter.

42. THROTTLE (925). Mount throttle control on bracket.

43. Remove the forward bolt holding seat tank to tube on underneath left side. Position throttle assembly and replace bolt. Then drill two 5/32" holes up through mounting bracket and lower side of seat tube. Caution: do not penetrate tank. Screw in two sheet metal screws.
44. Feed cable through braces to carburetor. Position throttle against stop or full closed position (as shown). Clamp cable between washers. Slip cable nose around the bushing on throttle arm of carburetor. Tighten nose with micropress sleeve and crimp sleeve. Bushing should rotate freely on bolt. Make sure carburetor can be opened and closed completely by the throttle. In some cases the cable housing may need trimming.

45. ENGINE COWLING (602-30). One of the cowl pieces is longer than the other. This is necessary because of the staggered cylinders. When installed properly, they should be about even at the trailing edge. The vertical surfaces of the cowl section between the first two fins inside and outside. Attach with bolts and cyl. wedges. Do not over-tighten.

46. INSTALL PROPELLER. This step must be done on a drill press, making sure the spindle is 90° to the work table.

   Enlarge the smaller 5/16" holes in prop hub and face plate to 1/2" diameter. Deburr holes. Lay propeller on a flat, smooth surface with the radius side of the hole up. Lay one 20601-2 crush plate on prop. Insert hub through prop, line up key way in hub with center line of prop. Turn prop over. Lay another crush plate over hub. Put face plate on hub spline with the marks on the face plate. Carefully center the crush plates and clamp. Position clamps between holes. Drill 1/2" dia. holes approximately half way through prop. Turn prop over and drill 1/2" dia. holes to meet holes drilled from first side. Do not remove the clamps yet.

   Insert AN8-43 bolts through hub and prop from engine side. Should be a light tap fit. Take four (4) bellville washers, number 20919, place two of them cup face to cup face and insert on prop bolt. Repeat using next two bellville washers.

   Insert AN960-816 washers on bolts, follow with AN310-8 nuts. Torque to approximately 25 ft. lbs. Check to see that cross drilled hole in bolt is not above top of nut. If hole is above top of nut, remove and add washers to reach correct height. For proper cotter pinning, see cotter pinning details in back of manual.

   Use a small file and emery paper to remove any nicks or scratches from the crankshaft taper. Polish them out very good. Apply some fine grade valve grinding compound (available at most local auto parts or hardware stores) to the taper and lap prop and hub assembly onto the crankshaft, rotating by hand until they mate. You may have to repeat this operation a couple of times. Remove all traces of the lapping compound with solvent and dry. Apply a
good coat of white grease on both surfaces before installing hub onto the crankshaft.

Place prop hub key in keyway on crankshaft. Slide prop and hub assembly over taper on crankshaft. Place washer in end of hub followed by prop hub retainer bolt. Torque to 200 ft. lbs. and safety wire per safety wire instructions in back of manual.

... and have your picture taken with your finished gyroplane.
AN AIRCRAFT BOLTS

Hex head aircraft bolts are made of high-strength type 4037 or 8740 alloy steel. They are heated to a minimum tensile strength of 125,000 P.S.I., and plated per specification QQ-F-416A.

The length of AN aircraft bolts is measured from under the head to the end of the shank. The "grip" is the unthreaded portion of the shank.

See table for conversion of length and/or grip to proper AN callout.

Example: AN 4-26A

AN = AIRCRAFT QUALITY HARDWARE
4 = 1/4 DIAMETER
26 = 2-5/32 GRIP OR 2-25/32 LENGTH
A = SHANK IS NOT DRILLED—Without the A, the shank would be drilled in threaded area.

AN AIRCRAFT BOLTS DIMENSION CHART

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SIXTEEN
TORQUE LIMITS FOR (AN) BOLTS
Using AN363 or 310 Nuts

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<tr>
<th>AN3 Bolt</th>
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<td>50/70 inch-lbs.</td>
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<td>AN5 Bolt</td>
<td>100/140 inch-lbs.</td>
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<td>AN6 Bolt</td>
<td>160/190 inch-lbs.</td>
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<td>AN7 Bolt</td>
<td>450/500 inch-lbs.</td>
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<td>AN8 Bolt</td>
<td>480/690 inch-lbs.</td>
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SAFETY WIRING METHODS

NUTS, BOLTS, and SCREWS

Nuts, bolts, and screws are safety wired by the single-wire or double-twist method. The double-twist method is the most common method of safety wiring. The single-wire method may be used on small screws in a closely spaced closed geometrical pattern on parts in electrical systems, and in places that are extremely difficult to reach.

The figure above is an illustration of various methods which are commonly used in safety wiring nuts, bolts, and screws. Careful study of this figure shows that:

a. Examples 1, 2, and 5 illustrate the proper method of safety wiring bolts, screws, square-head plugs, and similar parts when wired in pairs.

b. Example 3 illustrates several components wired in series.

c. Example 4 illustrates the proper method of wiring castellated nuts and studs. [Note that there is no loop around the nut.]

d. Examples 6 and 7 illustrate a single-threaded component wired to a housing or lug.

e. Example 8 illustrates several components in a closely spaced closed geometrical pattern, using a single-wire method.

When drilled-head bolts, screws, or other parts are grouped together, they are more conveniently safety wired to each other in a series rather than individually. The number of nuts, bolts, or screws that may be safety wired together is dependent on the application. For instance, when safety-wiring widely spaced bolts by the double-twist method, a group of three should be the maximum number in a series.

When safety-wiring closely spaced bolts, the number that can be safety-wired by a 24-inch length of wire is the maximum in a series. The wire is arranged so that if the bolt or screw begins to loosen, the force applied to the wire is in the tightening direction.

Parts being safety-wired should be torqued to recommended values and the holes aligned before attempting the safetwiring operation. Never over torque or loosen a torqued nut to align safety wire holes.

GENERAL SAFETY WIRING RULES

When using the safety wire method of safety-tying, the following general rules should be followed:

1. A pigtail of 1/4 to 1/2 inch (three to six twists) should be made at the end of the wiring. This pigtail must be bent back or under to prevent it from becoming a snag.

2. The safety wire must be new upon each application.

3. When castellated nuts are to be secured with safety wire, tighten the nut to the low side of the selected torque range unless otherwise specified, and if necessary, continue tightening until a slot aligns with the hole.

4. All safety wires must be tight after installation, but not under such tension that normal handling or vibration will break the wire.

5. The wire must be applied so that all pull exerted by the wire tends to tighten the nut.

6. Twists should be tight and even, and the wire between the nuts as taut as possible without overtwisting.

7. The safety wire should always be installed and twisted so that the loop around the head stays down and does not tend to come up over the bolt head, causing a slack loop.
Cotter pin safetying

Cotter pin installation is shown above. Castellated nuts are used with bolts that have been drilled for cotter pins. The cotter pin should fit neatly into the hole, with very little sideplay. The following general rules apply to cotter pin safetying:

1. The prong bent over the bolt end should not extend beyond the bolt diameter. (Cut if off if necessary.)

2. The prong bent down should not rest against the surface of the washer. (Again, cut if off if necessary.)

3. If the optional wraparound method is used, the prongs should not extend outward from the sides of the nut.

4. All prongs should be bent over a reasonable radius. Sharp-angled bends invite breakage. Tapping lightly with a mallet is the best method of bending the prongs.
20608 FUEL FITTING KIT

20606—2 SPECIAL FITTING (5/8" Hex)
20608—3 ELBOW
20608—4 VALVE
20608—5 STREET ELBOW
20608—6 NIPPLE
20608—7 PLUG

PART OF 20605 SEAT TANK ASSEMBLY

20605—24 MODIFIED ADAPTER
20605—3 DRAIN VALVE

FUEL LINES & FITTINGS

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P/N 20607—21 HOSE

P/N 20607—22

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