

FLOAT PLANS

BUILDING INSTRUCTIONS

Assemble the float frames in accordance with the drawing, and the frame schedule. The frames should be assembled in a "U" shaped jig, which is made of three pieces of $3/4$ " square spruce strips. Nail the three pieces of spruce to a piece of plywood, or other flat sturdy surface in such a way as to form a "U" 9-1/2" deep and 15-3/4" wide inside. Cut the frame uprights and crosspieces of $3/4$ " square spruce and the gussets from 1/16" plywood. Assemble the frames by laying the frame members into the jig mentioned, gluing and nailing the gussets or bulkhead in place. Hold the gussets and the bulkheads back approximately 1/16" from the outside edge of the frame, (with the exception of the step which should be flush with the edge of the frame) to prevent the end grain of these gussets or bulkheads from fracturing the plywood skin. The nails are kept 1" from the corner of the frame to allow for the $3/4$ " cut-out to be made later for the longerons. When all four gussets of the bulkhead are in place on a frame, remove the frame from the jig, turn it over and apply the other two or four gussets. After the glue has thoroughly dried, cut out the four corners for the $3/4$ " square allowance for the longerons. This cutout must be accurate. If at all possible, make the cutout on a table saw.

To assemble the floats, you need a straight true nailing surface. On this surface the floats are built inverted. To prevent any glue which may spill from your work from adhering to the working surface, spread wax paper over the surface prior to assembly of the float. Tack-nail two 12' x $3/4$ " square clear spruce longerons to the working surface with their outer surfaces 15-3/4" apart. Starting at the bow, measure off all the frame locations on one longeron and square them across to the other. Place the frames in their proper positions, gluing and nailing each joint as you go. Install the $3/4$ " plywood mount pieces between the proper frames as they are installed. Be sure that each frame is square with the working surface and with the longerons. After all the frames are secure on the top longerons, install the aft bottom longerons. Start with frame ahead of the step, to which the longerons are butt fitted. Nail downward into the frame uprights after gluing all joints. Be sure to retain the squareness of the fit in all the frame to upper longeron joints. After the rear straight longeron is fitted, fit the forward longerons. These are a built-up structure; they are laminated in place to allow easy bending, but give a stiff structure upon completion. Be sure you understand the illustrated joint shown in the plan before you proceed with assembly. The laminated longerons must be trial assembled and fitted before actual assembling and gluing. After an initial fitting of the three laminations, glue and nail the first layer of the curved longeron to the frame. Begin at the step and work forward. Follow the construction detail at the bow for a sturdy joint. After the first lamination is in place, apply glue over its entire length and bend the second layer down upon it. Be careful to leave no voids or ripples in this structure.

Nail the second layer in place over the first, using a backing block and/or C clamps if needed. The third layer is much like the second. It is nailed on about 4" centers through the entire length. With the forward longerons in place, the basic framework is complete except for the nose pieces. Nail these into the structure as shown in the plan. Clean off excess glue and protuberances that may interfere with application of the plywood skin.

While the framework is still on the working surface, apply the 1/16" plywood skin to the sides. All the surfaces of the skin which contact the framework must be secured with glue and 1/2" brass nails spaced 2" center to center in slight zig-zag pattern. Two pieces of plywood are required for each side; fit, glue and nail the joint very carefully at Station D. After the side skins are in place, apply the 1/8" bottom plywood the same way as the 1/16" side panels. Every point of contact between the plywood skin and the framework must be glued. Apply the 1/8" bottom material with 3/4" brass nails on 3" centers. In applying the 1/8" plywood to the forward portion of the float, begin at the step and work forward. This necessitates that you have made a previous trial fit for length on the plywood skin so that you can insure a tight joint when you reach the bow. Plank the aft section in the same manner, starting at the step. Be sure the step is a tight joint. Complete this assembly, allow the glue joints sufficient time to dry thoroughly and then carefully pry the nearly completed float from the work surface.

The deck of the right hand float is 1/16" plywood. Before you put the deck in place, roughly fit it and mark frame stations on the deck, glue hand rings shown in the prints to the deck and cut the 5" holes through. After this is done treat the deck and the interior of the hull with wood preservative or bilge paint, carefully keeping the preservative off the yet unmade glue joints. After the wood has been treated, glue and nail the plywood deck down in the same manner that the 1/16" plywood sides were applied. In the case of the left-hand float between station C and H, the deck is 1/8" instead of 1/16" plywood sides were applied. This provides a walkway for cranking the engine.

Lightly sand all corners to a slight radius, round off the nose slightly, and prime the entire exterior. A good quality marine primer is suggested here, and for a finish, a good marine enamel or other finish which will be both durable and water tight. After the painting has been completed, nail 3/8" square spruce rails down each side of the float in the center of the lower longerons from nose to step and from step to stern. These are nailed down but not glued to allow for easy replacement in the event they become damaged in handling. The rails provide a raised surface to keep from scuffing the bottom in handling, and improve directional stability on the water. These members should be either oil treated or painted before attachment to the hull.

2. OPERATION

You are now ready to run preliminary tests of the machine in the water. The preliminary runs should be done very slowly to get the proper feel of handling the machine on the water, gradually accelerating to flying speed. You may find the floats have a tendency to stick slightly on smooth water. This can be overcome by slightly excessive speed with a rather sharp pullup off the water. The floats will come off quite easily under these conditions, but you must immediately drop the nose back down to level to retain flying speed. Preliminary flight should be done at a minimum altitude and at minimum air speed until the gyro is thoroughly checked for adequate control both fore-and-aft and laterally. Have at least one-half mile of clear water available for the initial testing. You will find that while the machine will get off the water relatively fast, it will take slightly longer runs than it did on land because of the greater gross weight. On water the rotor is brought up to speed exactly as it is on land. The machine flies almost exactly as it did on wheels, with one minor exception. In the event of a steep descent, it will have a slight lag before it will stop descending, again, because of heavier weight. Outside of this, the floats themselves will have no effect on the flying of the machine. It should be noted in the first test by an observer, whether in a normal flying attitude, the floats on the machine trim out level in flight, or if they are nose-down or nose-high. An ideal condition is to have the float nose slightly high in normal flight so that when power-on landings are made, the machine strikes first on the tail, with the step an inch or two above the water. In the event of a power failure over water, the same procedure as is followed on land applies. Bring the gyro down at a rate of descent to maintain good flying speed and flare out just above the water. If your craft feels sluggish due to heavier gross weight, increase the rotor hub length to 34" instead of normal 10". This will improve the performance measurably. Bensen factory will supply you with 34" raw stock. Specify the width needed: 3" for spindle head, or 2-1/2" for Gimbal head. All-metal rotors have a 25" hub length, and being more efficient than wood blades (no noseweights and trim tabs), do not require the extension to 34".

From here on out, it's your baby. We wish you all the luck in the world. Drop us a line, send us some photos, and let us know how your machine is flying. On this end, we will keep you up to date on any recommended changes or new techniques and will be glad to answer your questions.

1. ATTACHMENT TO AIRFRAME

The floats are now ready to be attached to the airframe. Due to wide variations in homebuilt gyro airframes and methods and materials used in construction of home-built floats, only a suggested general layout is shown.

Start by locating the -102 (1" x 1-3/4 x 7") attachment brackets in position as shown on the sheet 2 of the drawing. Extreme care should be used in drilling through the longeron in order that the 3/16" hole passes exactly through its center width. See cross-section "A-A" for clarification. Two holes are drilled through the longeron and three through the 3/4" plywood plates to secure the attaching bracket. An 1/8" aluminum crush plate -104 should be installed on the underside to span the joint between the longeron and plywood plate to equally distribute the compression load.

The next step is to install the axles. These axles, as supplied in Bensen Kits, are 78-1/2" long and are centered on the airframe and drilled in accordance with Bensen drilling techniques specified in the Basic B8 gyro-glider prints. The 3/4 x 3/4 attaching angles are now installed. Clamp them in position on the axle in such a manner that they will be snug against the inside surfaces of the attaching brackets. Drill the angle and the tube in clamped position, once you have determined the location, and insert the 3/16" bolts. Do not drill the lower ends through the -102 brackets at this time. You are now ready for your water attitude test.

1. When the craft floats on water statically, with a 170 lb. pilot in the seat, the Mast and the Head Plate must be tilted 10 degrees rearwardly. If this angle is less than 10 degrees, the rotor would be slow to start; if more, rotor tips may strike water in the rear. Note that this condition is independent of the location of the teeter hinge. Make this test first and move the floats back or forth with respect to the airframe until the desired 10 degree angle is obtained. Then drill the holes and bolt the assembly together through -102 brackets.
2. Then check the correctness of your teeter bolt location. When the craft and the pilot are suspended by the teeter hinge in the "hang test", inclination of the Mast and the Head Plate should be 2° nose-down. If your inclination falls outside of this figure more than 2°, you must make new "cheek plates" and move the rotor head approximately 1-inch per degree until the desired figure is obtained. Alternately, you can add lead weights on front or back of floats until the desired balance is obtained. This is a must, so don't fail to check it before going out to fly.

3. FLOAT INSTALLATION ON B-8 GYRO-GLIDERS

Though designed for copter installation, these floats operate well on towed gliders also. Their size and stability provide safety and ease of handling, plus the capacity to carry two people.

Construct the floats, axles, brackets and attaching angles just as you would for a copter. Then, to balance your machine properly, temporarily clamp the two floats to the attaching angles. Do all this with the machine hanging from the teeter bolt. Climb into the seat and check for balance. If necessary, move the floats to attain the balance situation described in the text. When you have found the proper float location, note it, then proceed with drilling of attaching angle and float bracket -102. In all probability, you will move the floats approximately 5" rearward.

You can, of course, get much the same effect by moving the rotor head to achieve balance and making new head side plates to fit.

In any case, do not attempt to operate the machine in a tail-heavy condition. The balance described is the maximum rearward balance recommended. Err on the side of nose-heaviness, if you must. Make early tests with caution and be sure that you can maintain a slight nosedown attitude upon slackening of the tow line. Remember: avoid a tail-heavy condition.

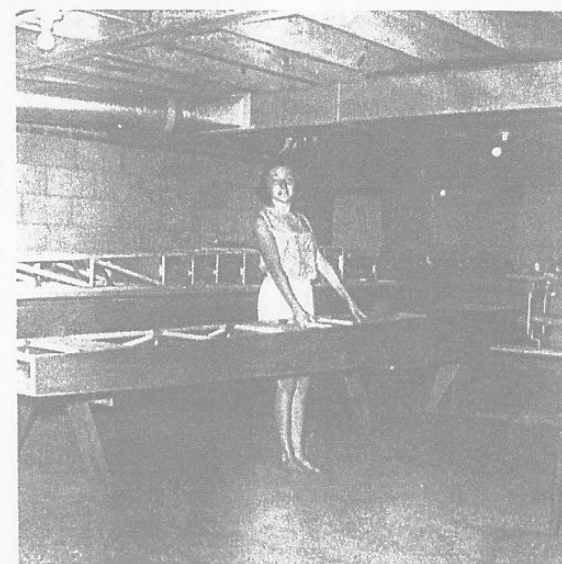
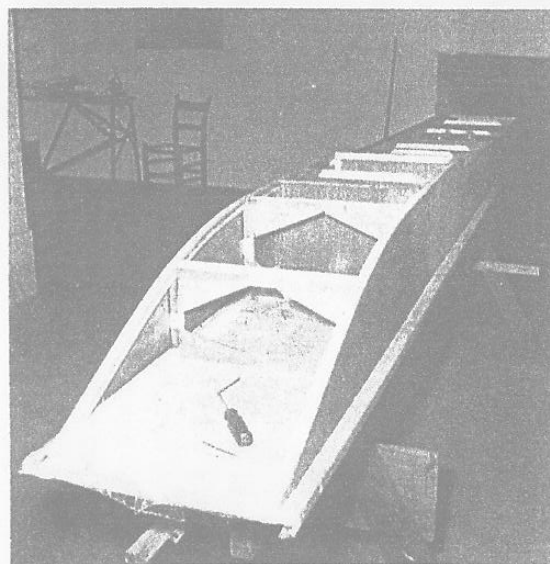
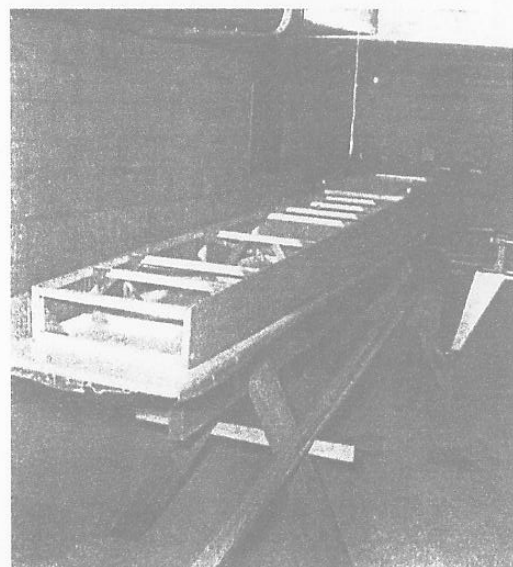
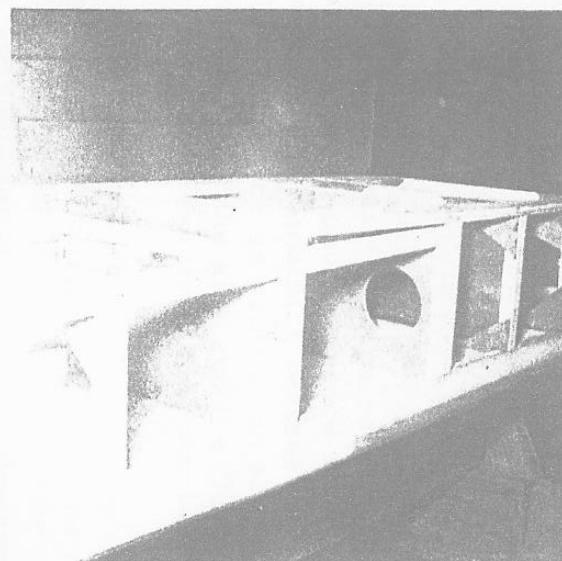
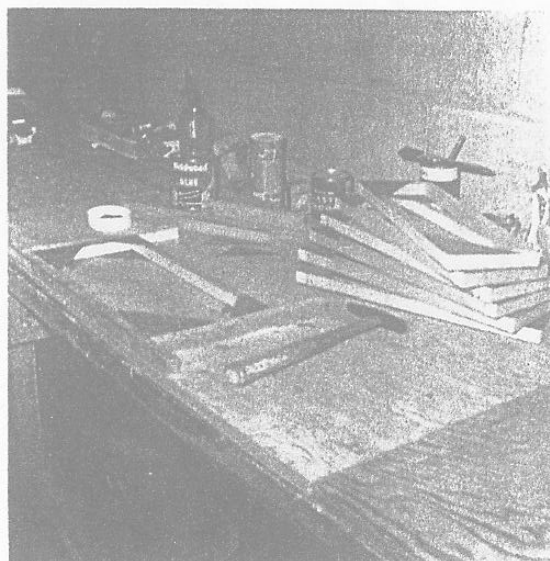
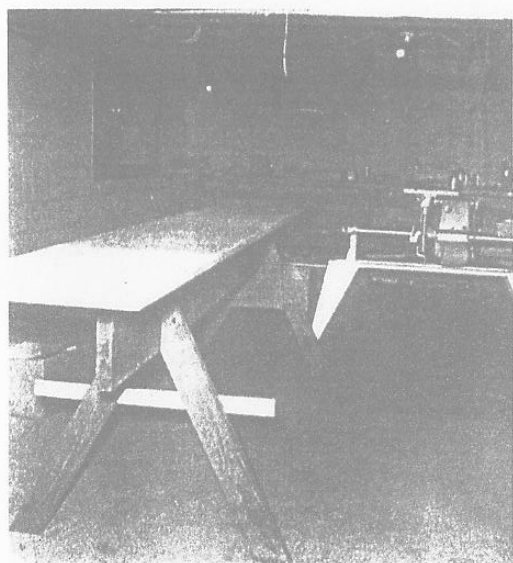
4. SOME AFTERTHOUGHTS

1. We eliminated the 1/4" x 1/4" spruce around the strut mounting pads in later models. Two of the clincher nails (plus the glue joint) to the adjacent frame members, and one to the longeron, did the job.
2. For extra emphasis: all faying surfaces must be glued.
3. We do not hold with the FAA regulations regarding varnish on wood surfaces. If outer face is sealed, as it must be, inner face should be able to "breathe". Soak it with Wood-Life, Celcursol, or other.
4. Most of the material dimensions are laid out to allow use of standard sizes.
5. "Paralketon" is on the material list. Use it especially around salt water to prevent rusting and pitting. (Waxy, gasoline-soluble rust preventative. Very handy.) Aircraft suppliers carry it.
6. After use in salt water, wash down with fresh water (a garden hose). Spray engine with rich gas-oil mixture in flit gun.

The float plans themselves were checked over for structural and marine design by Howard Abbey. You may remember his as the designer and builder of Abbeycraft Hurricanes--power boats that repeatedly won such races as Miami-Palm Beach, Miami-Nassau, around Miami Beach Nine Hours, etc. His designs are greatly refined, show an understanding of naval architecture far beyond most. Chris-craft and Owens have purchased hull lines from him. In any case, he said that he himself would build the floats slightly differently, but that for amateur construction, he thought the design was adequate, the structure sound. He showed us some tricks, which we adopted successfully in our latest set of floats. They are:

Fastening: We used 1-1/2" bronze serrated nails to make the structural joints in the 3/4" members. They are sold under various trade names at about \$1.85 per pound, retail. You must drill before driving these. They hold like grim death.

We attached the gussets with the 1/2" escutcheon pins, brass. Built the frames, as described, in a jig, then cut out the corners on a very accurate cabinet makers' bench saw. We also cut all the frame members on the same saw, thereby achieved much greater accuracy than could possibly be obtained by other means. Used "Resorcinol" glue throughout, though the plastic resin will do.



PROGRESS OF CONSTRUCTION. From left to right and from top to bottom: 1. Working table; 2. Frames (bulkheads) assembled separately on the bench; 3. Detail of the step; 4. Sides covered, note wax paper under the float; 5. Ready to cover the bottom; 6. Second float under way while the first one is removed from the table.

On the attachment of the plywood skin: We did it as you would a plywood-covered aircraft structure. Fitted the skin sections, marked the frame and longeron outlines, prepared 3/4" x 1/4" nailer strips (handily using scrap spruce stock) with light lathing nails on about 2" centers. Then applied glue to both frame and skin, and working together, fastened down for glue cure using nailer strips. We also had lightly marked the center lines of the nailer strips required. The result was a very tight job, lighter by several pounds, since no nails remained, and free of many troubles attendant to remaining fasteners. Oh yes, we avoided driving the nails flush. 1/8" or so protrusion allows easy removal of the nails after complete cure of the glue and the friction of the nail in the strip provides adequate glue pressure. This works OK for the 1/8" bottom, too.

You have to watch the natural tendency to add weight to the structure and to the mounting. People think things get stronger by being bigger. As a matter of fact, we are pretty well convinced that the 1/16" plywood is adequate for the bottom. However, the 1/16" aircraft material is much more than half as heavy as 1/8" fir, and the 1/8" does give good stiffness. You can't stand a lot of ripples in the bottom if you are to get any performance. To use such a structure would require a stringer type of construction. Such an arrangement is superior in that it can be made lighter, in total, and in that it allows the structure to work without damage. It is more difficult, however, and makes watertight bulkheads a real problem. (Aircraft of this weight do not require compartmentation, per FAA regs, as we recall. It's still a good idea, though.)

One last thing. The side covering requires a joint, and in the plans we call out a joint on a frame. This is tough business, in that the area is small and any working will open it. However, Abbey convinced us that a scarf joint was the thing, and we were flabbergasted to find it quite easy to make, even in 1/16" plywood! We marked a line one inch from the edge, then used a razor sharp block plane to take the material down to a smooth 16 to 1 taper. Requires support by a couple of pieces of wood clamped so as to hold the plywood and to support the feather edge. Finish off with a sander or sanding block, but mighty carefully to avoid convex surfaces. Align carefully, clamp and glue. These joints were so strong and smooth that we put them between frames, in the middle of a bay. Didn't even take a backing strip, though may be a good idea, in general. A cloth strip might make good reinforcement.

That's it! Good luck, and keep them whirling!

It's fun!

MATERIAL LIST FOR TWO FLOATS

Plywood: Aircraft, marine, or exterior A-A or A-B:

1/16" thick: approx. 2-1/3 sheets 48" x 96"

1/8" thick: approx. 1-2/3 sheets 48" x 96"

3/4" thick: 1 piece 16" x 96"

Supplier: Acorn Development, Box 504, Gloucester, Mass. 01930

Aircraft Spruce Co., Box 424, Fullerton, Calif. 92632

We purchased it as "Aircraft Macoba" 4 x 8 x 1/16 AB, polished one side, finished (sanded smooth) other side. Macoba: African wood of cherry family, fabricated in West Germany.

Spruce: Clear or selected #1

1" x 10" x 12'0": 2 pcs.) or equivalent widths: actual finish

1" x 10" x 8'0": 1 pc.) thickness: 3/4". Rip to size.

Nails: Brass escutcheon pins, or brass, bronze, or copper nails:

1/2": approx. 2500, 3/4": approx. 600, 1-1/2": approx. 200

Nuts, Bolts, & Washers: Brass, bronze, cad. plated, or stainless:

#10-24 x 1": 16, #10-24 x 2": 8.

Glue: 2 lb Weldwood Resorcinol or Weldwood Plastic Resin.

Gaskets: Truck inner tube and weatherstrip adhesive.

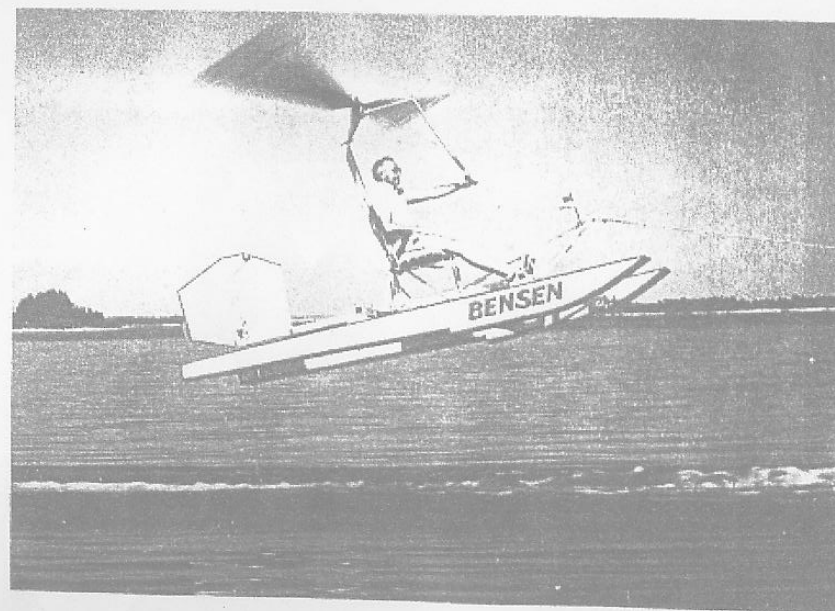
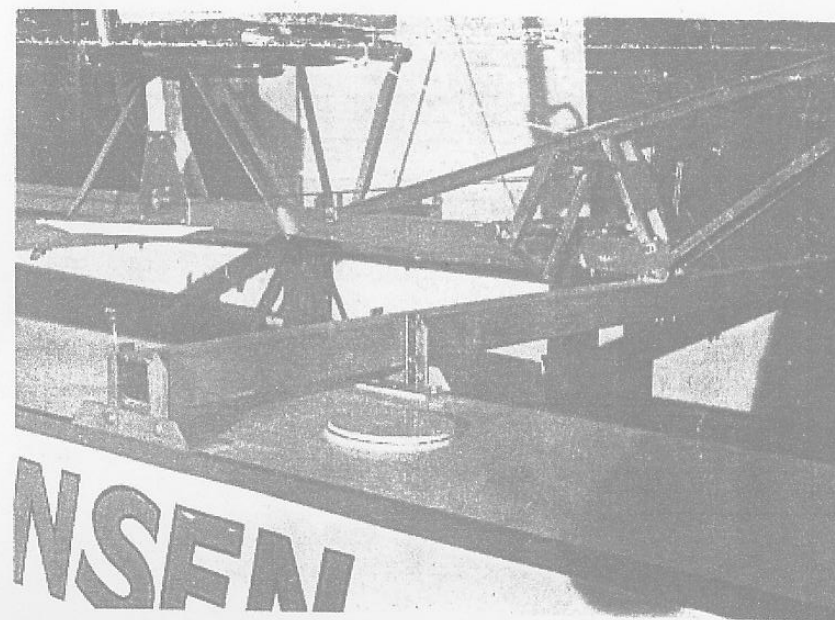
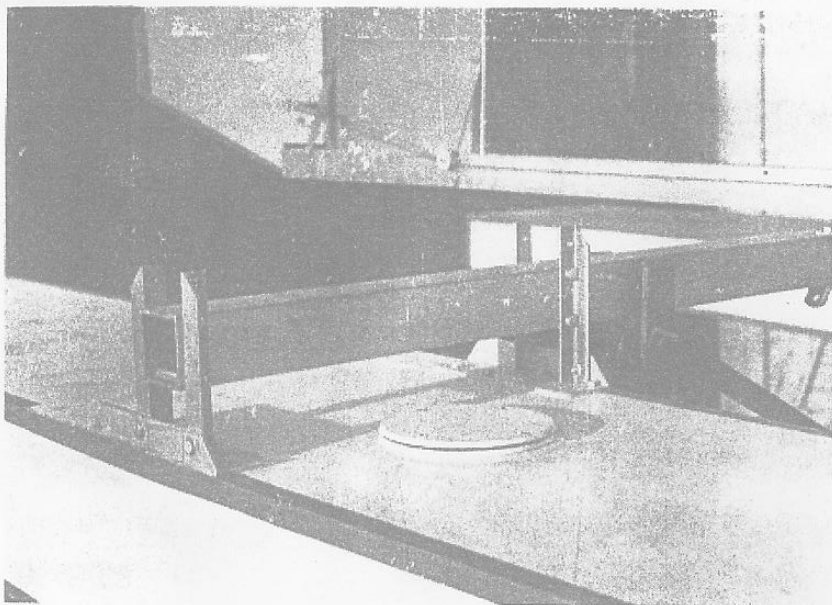
Wood Preservative: Wood-Life or equivalent, or bilge paint.

Finish: Sealer, enamel primer, synthetic enamel or an epoxy marine finish.

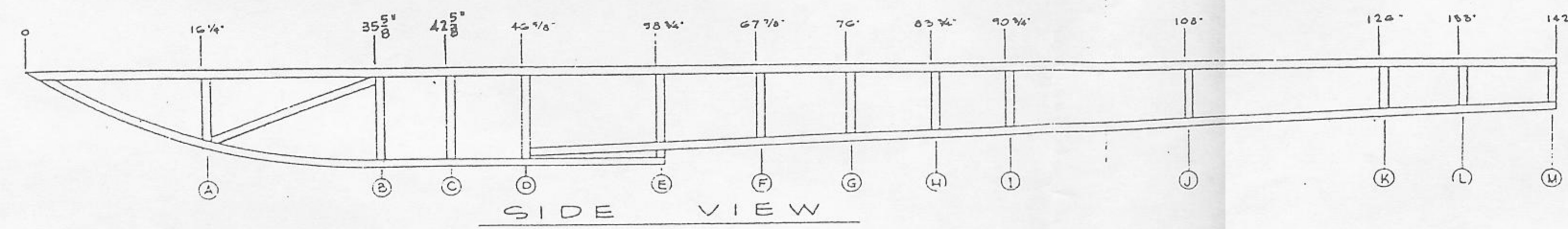
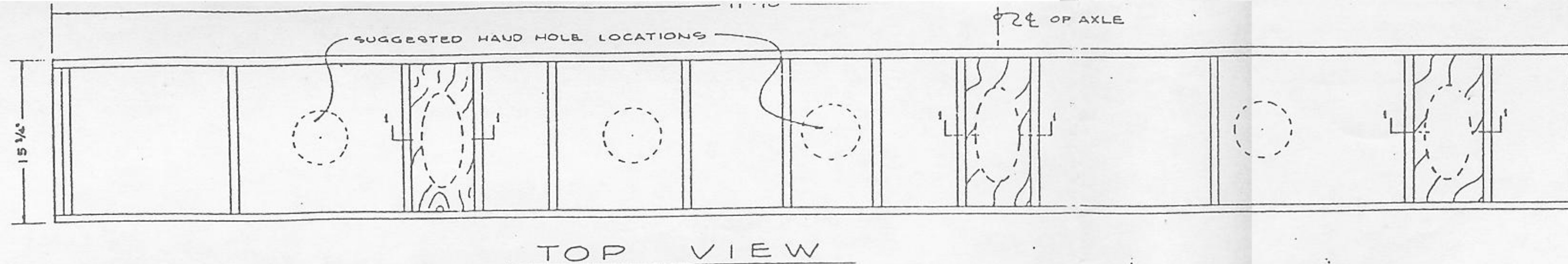
Protective Coating: "PARALKETON", waxy, gasoline soluble rust preventative a must on all metal joints in salt water operation.

Note: Inasmuch as most gyrocopters built by amateurs display considerable detail variation from the original, precise mounting details and a detailed material list for the mounting are not provided here. The structure is simple and adaptation to individual requirements is not difficult. Materials used depend upon the type of fabrication used and the details of the copter. Suggested materials are shown in the print. Serious departures from the structure shown should be avoided.

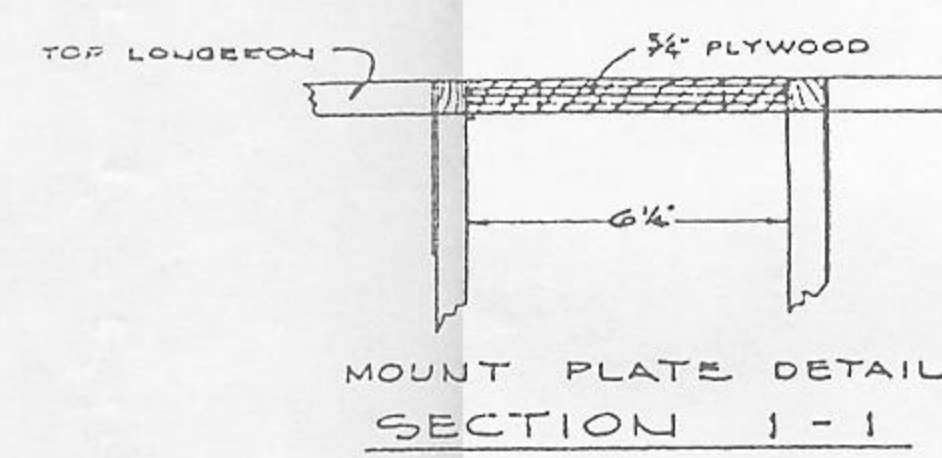
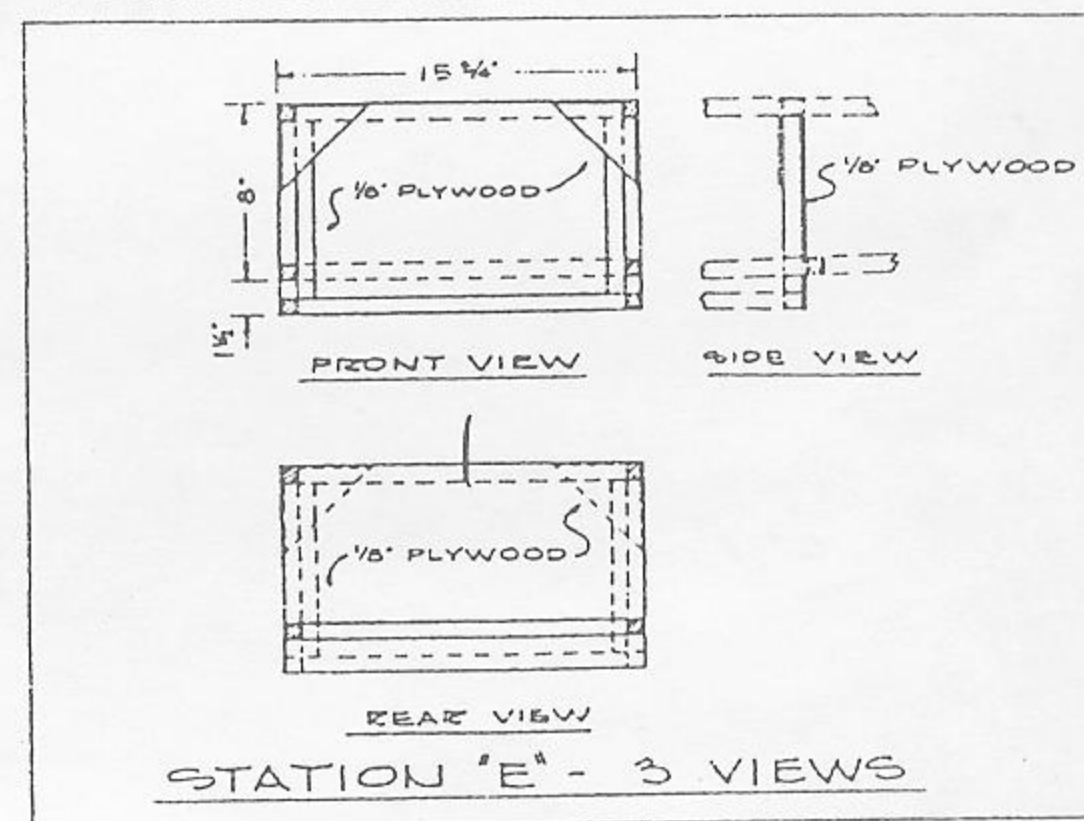
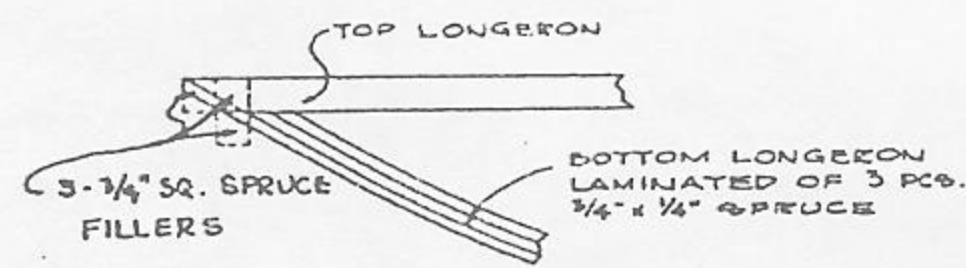
If 1/16" plywood is unobtainable or absolute minimum weight must be held, cover the bottom of both floats and the tops between C and H with 1/8" plywood and cover the remainder with heavy muslin or aircraft fabric and dope. With this covering add diagonal bracing in bay A-B. Handle with care!



FLOAT INSTALLATION. From left to right and from top to bottom: 1. Rear Axle attachment; 2. Front Axle attachment, note inspection hole covers; 3. Gyro on floats ready for flight test, transported on a small boat trailer; 4. First test hop close to the water, in towed flight.



NOTE!
FRAME LOCATIONS ARE GIVEN IN
INCHES FROM ZERO POINT AT BOW.

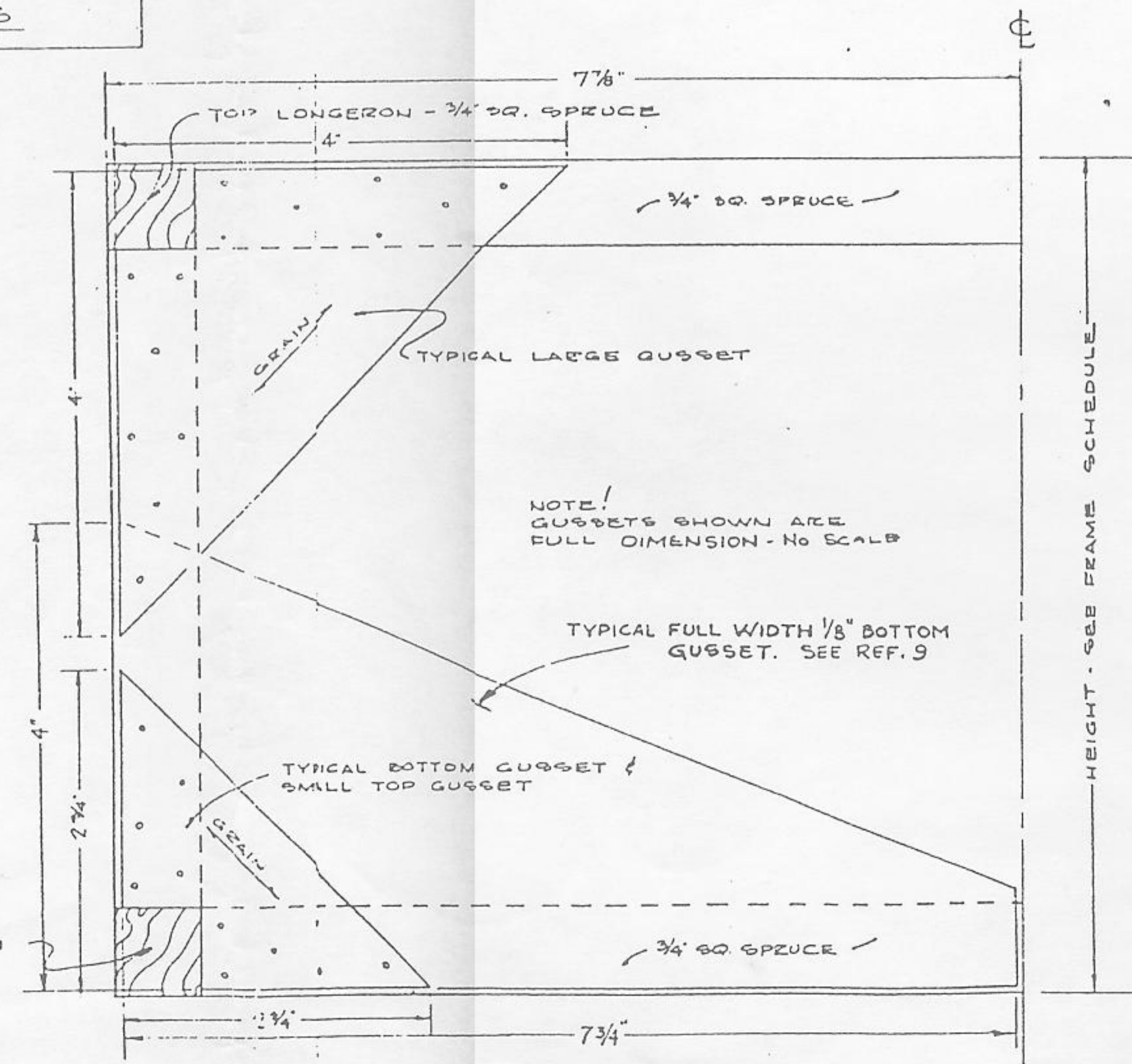
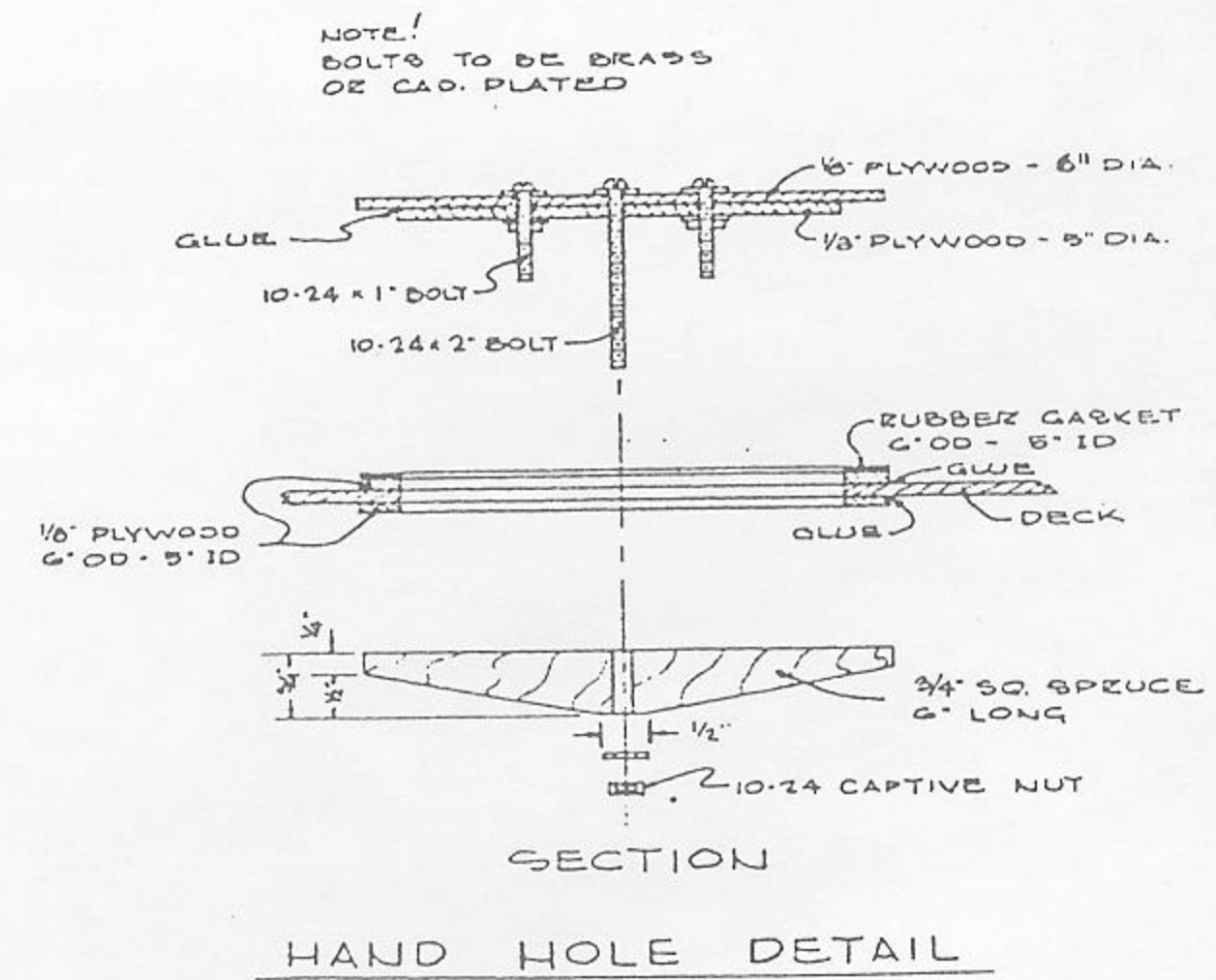


FRAME SCHEDULE		
FRAME	HEIGHT	REFERENCE
A	7 1/8"	1, 9, 10
B	9 1/2"	6, 9, 10
C	9 1/2"	5, 7
D	9 1/2"	5, 7
E	9 1/2"	3, 6
F	7 1/4"	4, 5
G	7 1/4"	4, 5
H	7 1/8"	4, 8
I	6 7/8"	3, 7
J	6 1/4"	1
K	5 3/8"	4, 6
L	5 1/4"	4, 6
M	5"	2

- REFERENCES -

1. SMALL GUSSETS BOTH SIDES, TOP & BOTTOM
2. SMALL GUSSETS ONE SIDE, TOP & BOTTOM
3. SOLID BULKHEAD ONE SIDE
4. SMALL GUSSETS BOTH SIDES, BOTTOM
5. LARGE GUSSETS BOTH SIDES, TOP
6. SMALL GUSSETS ONE SIDE, TOP
7. SMALL GUSSETS ONE SIDE, BOTTOM
8. LARGE GUSSETS ONE SIDE, TOP
9. 1/8" FULL WIDTH, BOTTOM REAR GUSSETS
10. SMALL GUSSET FRONT, BOTTOM

- GENERAL CONSTRUCTION NOTES:
1. NAIL AND GLUE ALL WOOD AND PLYWOOD SURFACES IN CONTACT WITH EACH OTHER.
 2. BOTH FLOATS TO HAVE 4 HAND HOLES IN TOP DECK AS SHOWN IN "TOP VIEW."
 3. COVERING: ENTIRE BOTTOM OF BOTH FLOATS AND TOP DECK OF LEFT FLOAT BETWEEN (C) AND (H) TO BE 1/8" PLYWOOD. REMAINDER OF BOTH FLOATS TO BE 1/16" PLYWOOD.
 4. MATERIALS: CLEAR OR SELECT NO. 1 SPRUCE; AVIATION, MARINE, OR EXTERIOR A-B PLYWOOD.
 5. USE ONLY WATERPROOF GLUE.
 6. ALL NAILS TO BE BRASS OR COPPER.
 7. ALL GUSSETS AND BULKHEADS WITH THE EXCEPTION AS NOTED & STATION 'E' - 1/16" PLYWOOD.
 8. GRAIN OF PLYWOOD IN BULKHEADS TO BE VERTICAL.



- GENERAL NOTES:
1. THESE FLOATS ARE INTENDED FOR INSTALLATION ON BENSON MODEL B-8 GYROSLIDER & BENSON GBM GYROCOPTERS.
 2. SCALE AS REQUIRED FOR OTHER ROTOCRAFT

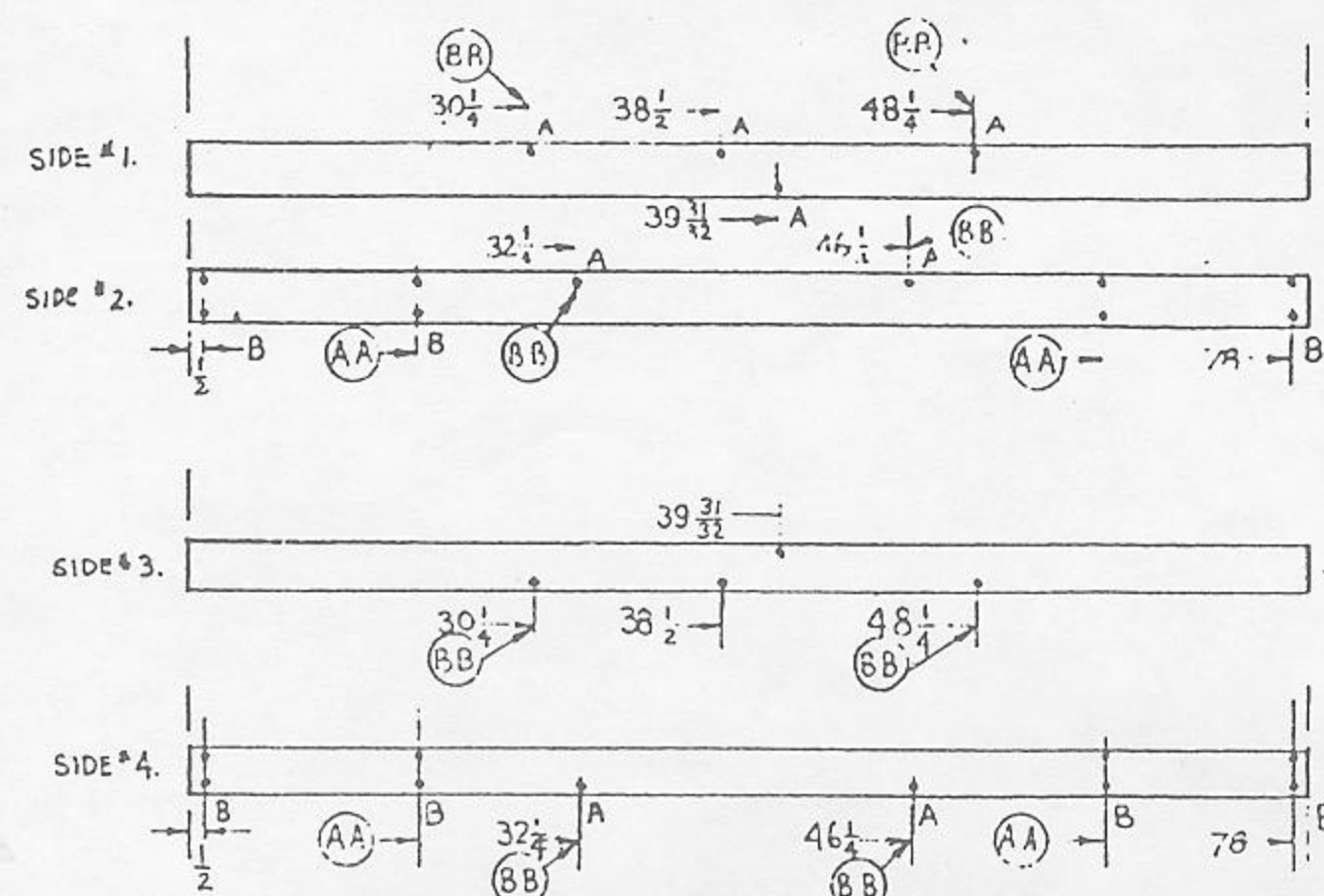
GYROCOPTER FLOAT
CONSTRUCTION

SHEET
1

BENSEN AIRCRAFT CORP.
P.O. BOX 2746
RALEIGH, NORTH CAROLINA

REV. 10 OCT. 67 GW

JULY 13 1963

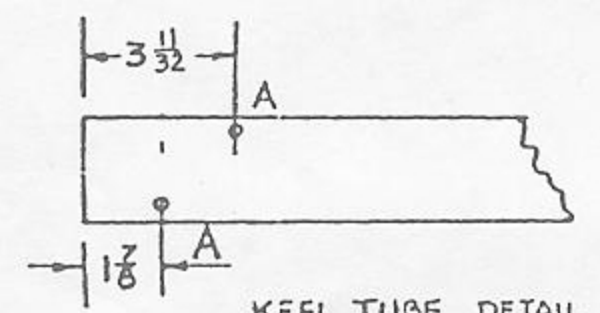


AXLE TUBES - FRONT & REAR

NOTE! (AA) THIS DIMENSION IS DETERMINED BY INSIDE DIMENSION BETWEEN FLOAT ATTACHING BRACKETS.

(BB) OMIT THESE HOLES ON FRONT AXLE.

USE PROVIDED FIXTURE IN BENSON KITS TO LOCATE EDGE DISTANCE OF "A" & "B" HOLES



KEEL TUBE DETAIL

BASIC FRAME DETAILS OMITTED FOR CLARITY.

AXLE 8-106-101A

FRONT AXLE -101B

5- BA 3-14A BOLTS
5- BA 960-1032 WASHER
5- BA 364-428 LOCK NUT

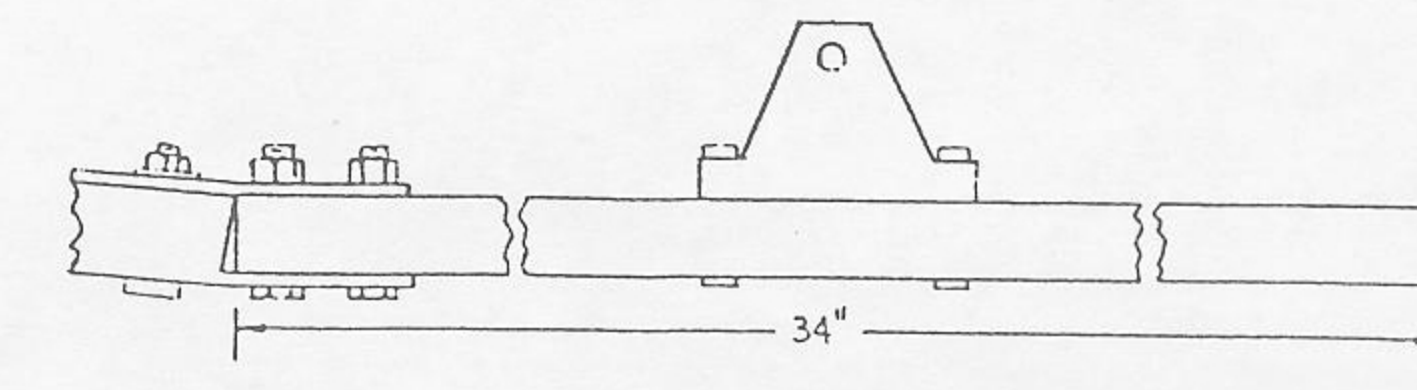
SECTION "A-A"
TYPICAL FRONT / REAR
BOTH SIDES

-102 BRACKET

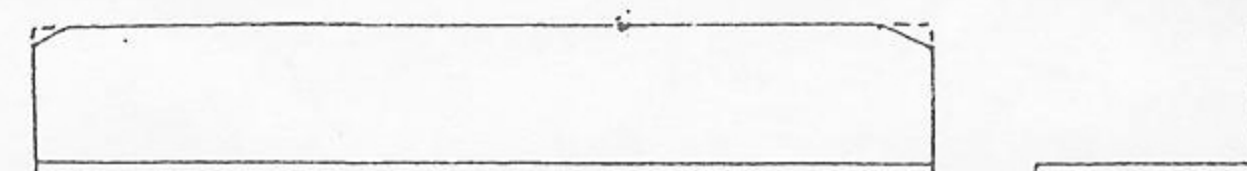
LONGERON

-104 CRUSH PLATE

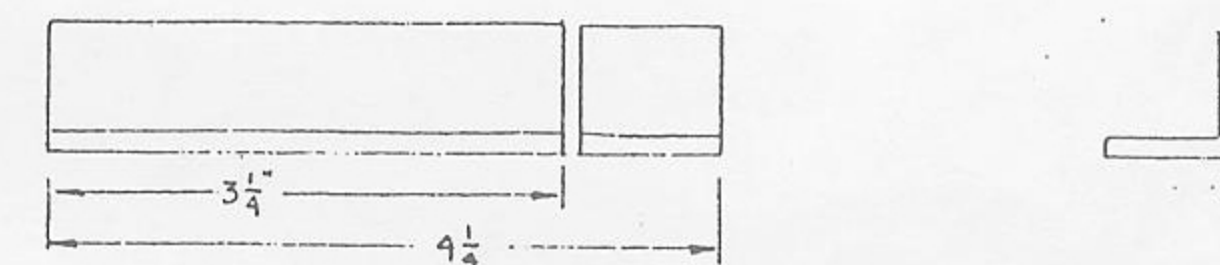
2- BA 3-5A BOLT
2- BA 960-1032 WASHER
2- BA 364-428 LOC NUT



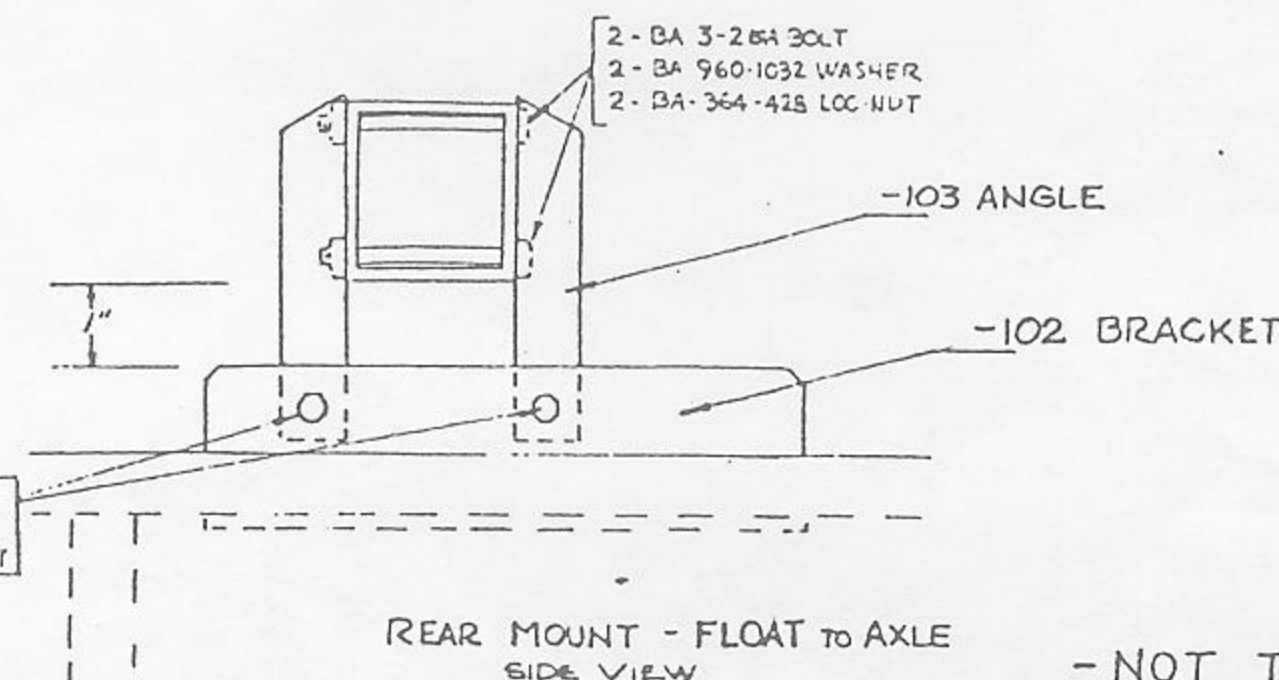
NOTE! FOR BEST HYDROCOPTER PERFORMANCE IT IS DEFINITELY RECOMMENDED TO INCREASE THE STANDARD 10" ROTOR HUB TO 34" AS SHOWN.



BRACKET -102 1/8 x 1 1/4 x 7 ALUM. 8 REQUIRED



ANGLE -103 FRONT 3 1/4, REAR 4 1/4 8 EA. REQ. 3/4 x 1/4 ALUM.



REAR MOUNT - FLOAT TO AXLE
SIDE VIEW

- NOT TO SCALE -

TYPICAL INSTALLATION
GYROCOPTER FLOATS

BENSEN AIRCRAFT CORP.
P.O. BOX 2746
RALEIGH, NORTH CAROLINA

SHEET
2

ETB
AUG 31, 1963