builder's instruction manual

BUILDER'S INSTRUCTION MANUAL

FOR

SAILCRAFTER YACHT KITS

SAILCRAFTER YACHT KITS

TABLE OF CONTENTS

INTRODUCTION

This Builders Instruction Manual has been prepared by experts with a great deal of knowledge and experience in the field of fiber glass boat building. This knowledge and experience is represented in the pages you are about to read.

The manual has been broken down into six separate sections:

1. General
2. Techniques
3. Bill of Material - Defined & Explained
4. Blueprints and Drawings
5. Installation of Component Kits
6. Fiberglass Repair

Section 5 covers the installation and assembly of your Sailcrafter Yacht. You will be referring to this section continuously. Sections 2 and 3 deal with the jargon, processes, and procedures used in the fiber glass sailboat construction. These sections should be read first, as they will help you to understand what is being said in the Installation Section.

Section 4 deals with blueprints, drawings, and data concerning the assembling of your Sailcrafter Yacht. This section will be used in conjunction with Section 5.

The language used in the Manual has been simplified for your understanding. Many terms have been defined and explained as they are used every day in fiber glass sailboat fabricating plants. It is recommended that you read through the entire manual to become completely familiar with all the terms, processes, and techniques before starting assembly of your yacht.

If, during the construction of your yacht, you need advice or information you may contact the Engineering Department by writing Sailcrafter Yacht Kits, 275 McCormick Avenue, Costa Mesa, California 92626, attention Chief Engineer. You will receive a prompt reply.

BILL OF MATERIAL - Defined and Explained

2.1 Fiberglass

There are three different types of fiberglass reinforcements:

a) Mat
b) Cloth
c) Woven Roving

Depending on the "Lamination Schedule" or area of construction, these three types of fiberglass are combined.

a) The fiber glass MAT is a very strong material and is designated by the approximate weight per square foot: 3.0 oz. mat, for example. However, "squeegeeing and brushing" of the wet fitted material may cause it to tear or ball up.

b) The CLOTH, always used in conjunction with mat, is most satisfactory for a finished surface. The designation for cloth refers to the approximate weight per square yard: 7-1/2 oz. cloth, for example.

c) WOVEN ROVING is used for structural purposes in conjunction with mat. This is the material that provides maximum strength and rigidness to a fiberglass laminate. Without woven roving a laminate of fiber glass cloth and mat would bend and flex. Woven roving, like mat, is designated in approximate weight per square yard: 24 oz. woven roving, for example.

NOTE: A detailed explanation concerning the nature of fiber glass is covered in Section 6 on fiber glass repair.

2.2 Resins and Catalysts

The resin used to solidify the fiber glass in all Sailcrafter Yachts is a polyester resin. Use only polyester resins when applying fiber glass to your Sailcrafter Yacht - other types of resin will not be compatible.

2.2 (continued)

Before the resin can be applied to fiber glass for a "bond" or lay-up", it has to be catalyzed. The catalyst is an "agent" which works chemically to cure the resin into a solid state.

Once a batch of resin has been "catalyzed", the "pot life", or time remaining in which the resin can be worked effectively before it turns into a solid mass, is very limited! Catalyzation of resin should be at the rate of 1/2 to 4% per volume - increasing with decreasing temperature. For example, on a hot day (75-80°) you will want to catalyze your resin with only about 1/2% per volume. On colder days (50-60°), you will want to add more catalyst.

NOTE: It is best to read the section on Resins in Section 6 before experimenting with resins.

2.3 Gel Coat

The glossy, finished exterior color you see on a fiber glass hull or deck is the gel coat. Gel coat is pure resin, catalyzed, and with the appropriate color pigment added. The gel coat finish on your Sailcrafter Yacht is very hard and needs no maintenance except for light waxing now and then to retain the luster of the color.

Unlike the construction resins mentioned earlier, gel coat does not harden in the presence of air. It is necessary to cover the gel coat with a soluble "mold release coat" or a thin layer of flexible plastic such as Saran Wrap. Once covered, curing takes place in about 30 to 45 minutes.

Gel coat colors, like other pigmented materials, are difficult to match. It is recommended that Ram gel coats be used whenever possible. A quart of gel coat for the hull and deck have been included in your component kit.

2.4 Marine Wood Products

The lumber used for the interior should be marine plywood, exterior plywood, or teak. A/D grade may be used for most construction. Hardwood finished plywood may be used if a natural finish is desired. The edges of plywood panels and bulkheads will generally be finished with a strip of solid

2.4 (continued)

hardwood. Grab rails, toe rails, winch pads, and other pieces of woodwork located on the deck should be made out of oiled teak. Fiberglass bonds to teak wood are not reliable because of the high oil content of this wood. To bond on teak plywood, which has a fir core, the teak outer surface must be removed to the core.

All the interior and exterior wood products needed for the completion of your Sailcrafter Yacht can be acquired from Sailcrafter Yachts. These marine wood products are all oiled teak and have been cut, shaped, rounded, and sanded for immediate installation in your yacht.

2.5 Fasteners

The fasteners for all Sailcrafter Yacht fiber glass boats are passivated stainless steel. Bolts for securing the chainplates to bulkheads, headstay, and backstay fittings to the hull, are stainless steel bolts fitted to the holes in the chainplates.

Deck hardware such as winches, genoa tracks, and mainsheet travelers should be thru bolted with round or oval head bolts as appropriate. Use the largest size bolt that will fit through the holes in the hardware.

Toe rails, cabin trim, and other decorative wood can be fastened with self-tapping stainless steel screws. These should be long enough to protrude through the fiber glass to the beginning of the full sized threads and then snapped off flush. They should be countersunk and hardwood plugs glued in place over the heads. All hand rails, grab rails, ladder fastenings, and other wood parts that take a load should be thru bolted with stainless steel bolts. It is good yacht building practice to have all screw slots lined up fore and aft.

While stainless steel screws are not thoroughly compatible with aluminum, they are the best material available for fastening to the mast or boom. They should be lubricated with a heavy silicon grease before installation in order to shut out the water which is necessary for electrolytic action.

Fasteners for all component kits can be acquired from Sailcrafter Yachts at any time. These fasteners are factory approved and are all individually sealed in plastic containers for your convenience.

2.6 Supplier/Vendors List

INTRODUCTION:

The following Suppliers/Vendors "Bill of Material" list is given as a suggestion to help you complete your Sailcrafter Kit boat. Although not all the "pieces and parts" have been listed, the major components for completion are included.

BEDDING COMPOUND - DOLPHINITE	DOLPHIN PAINT & CHEMICAL 922 Locust Street Toledo, Ohio Local marine hardware
BEDDING COMPOUND - PRC	BOAT LIFE 65 Bloomingdale Rd. Hicksville, N.Y. Local marine hardware
BILGE PUMPS	PETERS & RUSSEL Springfield, Ohio Balboa Marine Hardware Newport Beach, Ca.
BODY PUTTY - POLYESTER	Automotive & paint stores Body shop
BOTTOM PAINT	INTERNATIONAL PAINT CO. 21 West Street New York, N.Y. WOOLSEY BRAND PAINT STORE BALBOA MARINE Newport Beach, Calif.
CUSHIONS	JOHANSEN & CHRISTENSEN 398 W. 16th Costa Mesa, Calif. MARSHALL & SONS 14903 Lakewood Paramount, Ca. Columbia Yachts, Portsmouth f/excess stock SC-23, SC-25, SC28, SC-36

2.6 (continued)

FIBERGLASS MAT, CLOTH, NOVEN ROVING	RICHMOND SUPPLY CO. Chula Vista, Ca. MARCO CHEMICAL COMPANY 1020 W. 44th Street Norfolk, Va. Local marine hardware
GATE VALVES	BRAHAM INDUSTRIES 1249 W. Katella Orange, Calif. EMPIRE MACHINERY Virginia Beach Blvd. Norfolk, Va.
GEL COATS	RAM CHEMICAL 210 E. Alondra Gardena, Ca. LENOIR COATINGS & RESIN Lenoir, North Carolina
HEADS	WILCOX CRITTENDEN Middleton, Conn.
HEADS - SELF CONTAINED	MONOGRAM INDUSTRIES 6357 Arizona Circle Los Angeles, Ca 90045
HEADLINERS	JOHANSEN & CHRISTENSEN 898 W. 16th Street Costa Mesa, Ca. COLUMBIA YACHT CORP., Portsmouth, Virginia
HOSE - DUCTALL	INDUSTRIAL HOSE & RUBBER 2816 E 11th Street Los Angeles, Calif. KENYON MARINE Guilford, Conn. Local marine hardware

2.6 (continued)

LIFELINES & GATES	R. C. MARINE 17422 Armstrong Santa Ana, Calif.
LIFELINE WIRE	LODS & CO. Pomfrett, Conn.
PELICAN HOOKS & FITTINGS	WILCOX CRITTEN Guilford, Conn. HOOD INDUSTRIES Bakersfield, Calif.
LIGHTS - INTERIOR FIXTURES	Local marine hardware LO VOLT 2364 S. 128 th Compton, Calif.
LIGHTS - RUNNING	SWING AWAY Wesley Street Portsmouth, Va. Local marine hardware
LIGHTS - NAVIGATING	Perkins Marine Miami, Florida
LUMBER - TEAK	Brush Lumber 7653 Telegraph Montebello, Calif. HOUSE OF HARDWOOD W. Los Angeles, Calif. SPAR LUMBER 1325 Harbor Long Beach, Calif. DEAN HARDWOODS 3701 Elm Portsmouth, Va.

LUMBER - MAHOGANY	THOMPSON MAHOGANY 7400 Edmund Philadelphia, Pa. BRUSH LUMBER 7653 Telegraph Montebello, Calif. SPAR LUMBER CO. 1325 Harbor Long Beach, Calif.
- PLYWOOD	U. S. PLYWOOD 2662 E. Del Amo Blvd. Compton, Calif. 90224 STENART PLYWOOD 14051 So. Marquardt Santa Fe Springs, Ca. U. S. PLYWOOD Ingleside Rd. Norfolk, Virginia
MEK - CATALYST HARDENER	LENOIR COATINGS & RESIN Lenoir, North Carolina ERSKINE JOHNS 4677 Worth Los Angeles, Calif. Local marine hardware
MICRO BALLOONS	Crystalliner 1626 Placentia Costa Mesa, Calif. LENOIR COATINGS & RESIN Lenoir, North Carolina
MUFFLER	SALISBURY RUBBER 401 No. Morgan Chicago, Illinois
PAINT - VARNISH	INTERNATIONAL PAINT CO. 508 N. Beacon San Pedro, Ca. Local paint store Local marine hardware

POLYESTER RESIN	LENOIR COATINGS & RESIN Lenoir, North Carolina RAM CHEMICAL 210 E. Alondra Gardena, Calif. Local marine hardware
PROPELLER (Bronze)	COLUMBIAN BRONZE Freeport, Long Island, New York AAA Propeller Service 127 Industrial Way Costa Mesa, Calif.
PULPITS (Bow & Stern)	RULE INDUSTRIES Cape Anne Industrial Park Glouscester, Mass. HARRIS MARINE 1308 Logan Costa Mesa, Calif. BALBOA MARINE HARDWARE Newport Beach, Calif.
RELEASE, P.V.C.	CRYSTALINER 1626 Placentia Costa Mesa, Ca. LENOIR COATINGS & RESIN Lenoir, N.C.
RINKLE, BELLEY (Exhaust Flex Coupling)	ALLIED METAL HOSE CO. 3746 Ninth Street Long Island City, N.Y.
SABER SAW BLADES	PLETZ BROS Industrial Park Norfolk, Va. Local Sears & Roebuck Local builders supply

SCREWS, STAINLESS STEEL	ITT HARPER 7307 Pulaski Hwy Baltimore, Md. LAVENDAR FASTENERS 894 W. 18th St. Costa Mesa, Ca. Local marine hardware
SINKS, STAINLESS STEEL	VOLRATH Sheybogan, Wisc. Ziegler Harris 11341 San Fernando Rd. San Fernando, Ca. Local marine hardware
STOVES, ALCOHOL & BUTANE	GALLEY MAID P.O.B. 10417 Riviera Beach, Fla KENYON MARINE GUILFORD, CONN. Local marine hardware
TANKS, FUEL	TECSTAR INC. 16550 N.W. 10th Miami, Fla. Vic Berry 2527 W. Coast Hwy Newport Beach, Ca.
THRU HULL FITTINGS - BRASS	R. C. MARINE 17422 Armstrong Santa Ana, Calif. GEM MARINE Lake City, South Carolina WILCOX CRITTENDEN Middletown, Mass

RUB RAIL - RUBBER	VIP RUBBER 945 So. East Street Anaheim, Calif. Wefco Rubber Products 1655 Euclid Santa Monica, Ca.
WATER HEATERS	AMERICAN APPLIANCE 2425 Michigan Santa Monica, Ca. GALLEY MAID Riviera Beach, Fla. Local marine hardware
WATER PRESSURE PUMP	PETERS & RUSSELL Springfield, Ohio Local marine hardware
WINDOW GASKET (vinyl foam tape black 3/16" thick x 5/8" wide in 30' rolls). 3M & Bear #576	PELTZ BROS Norfolk, Va. Industrial supply house
WIRE - PRIMARY	DEL CITY WIRE CO. P.O.B. 82457 Oklahoma City, Oklahoma STANDARD WIRE & CABLE 3440 Overland Los Angeles, Calif. Local automotive supply Local electrical supply

TECHNIQUES

3.1 Gel Coat Touch-up and Repair

Minor abrasions and scratches can be removed from gel coat with an abrasive automobile polish followed by a wax polish such as Johnsons "J Wax Kit". More serious damage and flashing areas should be ground until smooth and fair with a disk or belt sander using 60 grit cutting surface. Any depressions should be filled with polyester body putty. Ample putty should be applied to allow for some shrinkage. When the putty has hardened it should be sanded in turn with 220 and 400 wet or dry sandpaper.

The gel coat should be applied next by using a spray gun. The Tyson propellant type guns are satisfactory. Thin the gel coat approximately 40 percent with acetone for spraying. Add one to two percent by volume of catalyst. More catalyst causes the resin to set faster. Curing is slower at temperatures below 70° and does not proceed satisfactorily below about 57°. Temperatures between 70° and 57° may be partially compensated for by slightly more catalyst. High humidity also interferes with curing.

After the gel coat is sprayed on, a thin layer of mold release (500G mold release liquid from Thalco Corp.) should be applied with the spray gun to shut out the air and permit the gelcoat to cure.

Curing should be complete in about two hours. The release is water soluble and can be easily washed off. Sand with 400, then 600, wet or dry sandpaper and finish with a buffer.

For additional information concerning gel coat touch-up and repair, consult Section 6.

NOTE: Ground fiber glass is an irritant to the respiratory system and a mask should be worn when machine sanding. Use separate cups for gel coat and release. Mix small quantities only of gelcoat. Clean out cup and gun with acetone at least once an hour. Mask off surfaces outside the work area to prevent accidental overspray.

3.2 Micro Balloon Filled Resin

Micro Balloons mixed with a polyester resin will yield micro balloon filled resin, which is used in yacht construction for casting, fairing, and sealing. Its "pot life" is longer and, therefore, cures more slowly than pure resin. The slower curing time allows more "working pot life time" and generates less heat without distortion.

Mixing Procedure

1. To prepare the micro balloon filled resin use no less than 1/2% and no more than 1% of catalyst by volume. For example: 1/2 ounce of catalyst with each gallon of clear resin.

2. Add micro balloons to the catalyzed resin slowly, stirring thoroughly.

3. The mixture may be thick or thin and cure slowly or quickly, depending on its application. For example, in large areas such as the keel, rudder, hull, and deck, fast curing is not required and slow curing will avoid distortion.

4. The mixture should appear, and be, about the consistency of a thin pancake batter.

5. Other areas where micro balloon filled resin is employed should contain more catalyst and more asbestos to form a thicker compound.

3.3 Bonding

All of the interior liners, head liners, and rubber tubes are fastened and secured to the hull and deck by bonding. The bonding process is similar to bonding any type of structure (rudder, bulkhead, etc.). However, some items require thicker bonds for greater strength.

The procedures for making a bond are listed below:

a) Bonding surfaces should be sanded clean of all paint, loose glass fibers, and any foreign matter which will interfere with a glass-to-glass bond.

3.3 (Continued)

b) All gel coat should be sanded off.

c) Sanding should be done with coarse paper (min. 40 grit).

d) Bonding strips should extend a minimum of 4" on either side of the bond. This means that if there is a space or a filler between the two surfaces, glass strips wider than 10" will be required.

e) Bond laminates should consist of the following on all boats:

1. 4 ozs mat under 24 oz woven roving 10" wide, covered by 7-1/2 oz. cloth 12" wide on all bulkheads, around the forward water tank, at the aft end of the hull liner where bunks and shelves contact the hull.

2. All other bonds should consist of 3 oz. mat plus one layer of 7-1/2 oz. cloth.

F) No more than 2% catalyst by volume should be used in the resin mixture.

Excellent material used in boat construction that will bond well are marine plywood, exterior plywood, most hardwoods, and hardened plywoods. Solid teak is an exception as it is a very oily wood which is incompatible with the resin. To bond teak plywood the teak outer surface must be removed to the fir core for 4" from the edge.

Should you decide to lay out your own interior and not use the hull liner (or modify the hull liner) you will have to bond all bulkheads, cabinets, and floor boards to the hull.

3.4 Cutting, Drilling, and Grinding

Polyester resin fiberglass is a quite hard and very durable material for the construction of sailboats. When grinding,

3.4 (continued)

cutting, and drilling, work is done on the hull or deck, take care to watch your tools for dulling. Drills and taps, for example, dull quickly and should be sharpened or replaced when inspection shows wear. National Coarse Threads are generally preferred to National Fine Threads, i.e. 10/24 NOT 10/32.

Saw cuts can be made with special sabre saw bladee (see Suppliers and Vendors List) or with an abrasive wheel on a high-speed drill motor.

Any rough or uneven surfaces may be ground or sanded with a disk, belt, or orbital sander. Avoid breathing the dust as it is an irritant to the respiratory system. It is suggested that a mask be worn over the mouth and nose so as not to inhale powdered fiberglass.

Likewise, power tools should be blown free of fiberglass dust, since it is an abrasive in bearings, motors, and gears.

NOTE: Caution should be used at all times when working with power tools on fiberglass. The fiberglass is a very hard material and tools have a habit of slipping, sliding, and jumping out of place.

3.5 Winterization

For all boats with inboard engines and heads that are shipped to areas that have below-freezing temperatures, it is strongly recommended that the engine cooling system be winterized by utilizing an approved anti-freeze. The approved anti-freezes for the Perkins, Westerbeke, Palmer, and Atomic 4 engines are as follows:

DONGUARD	PYRO-PERMANENT
HUBBARD - HALL	SMITH BLUE CO.
PEAK	TELAR
PERMA-STA	ZEREX
PERMAGUARD	

It is also strongly recommended that the water tanks and the head be completely drained of water, including all the lines.

3.6 Anti-Fouling Protective Coating System

This specification covers sandblasting and the application of an International Intergard coating No. 4424/4423 and TRI-LUX T.B.T.O. anti-fouling paint containing Biomet coating to the keel and underwater hull areas. It should be used on all Kit Boats that have outside ballast and is optional on boats with inside ballast.

1. Cast Iron Keel

   a) Grind entire surface of keel to white metal. "White metal" is defined as a surface with a gray-white uniform metallic color, slightly roughened to form a suitable anchor pattern for coating. The surface should be free of visible mill scale, corrosion products, paints, or other foreign material. It is the intent of this specification to have a surface conforming to Steel Structures Painting Council Surface Preparation Specification #5.

   b) All sand and dust residue is to be removed from the surface before coating is applied.

   c) The ground surface must be primed before re-rusting occurs. For outdoor locations, this normally means that the steel should be primed within a period not exceeding six hours after cleaning. For indoors, low humidity locations, longer periods may be used. The steel should be re-ground if rain or condensed water wets the surface prior to priming. (Priming should not be done before the epoxy filler is applied.)

2. Epoxy Filler

   Apply epoxy filler, where needed, to the dry, white metal surface and trowel smooth.

3. Priming

   a) Apply one coat of Intergard 4424/4423 to the dry, white metal and the epoxy filled surfaces. The primer should be thinned 5% and applied to about a thickness of 1-1/2 mil.

   b) For additional information on application procedures, cleaning of equipment and handling precautions, reference is made to a booklet supplied by International Paint Company.

3.6 (continued)

4. Transport and Assembly

a) During transportation of the keels from the foundry to the boat yard, damage to the epoxy filler and the Intergard coating will occur. Additional damage may also occur during the fitting of the keel to the hull.

b) After the keel has been attached to the hull, repair the damage with epoxy filler and smooth to desired contour.

c) Apply a second coat of Intergard 4424/4423 as specified in Section 3 (Priming) to all surfaces of the keel.

d) Allow four (4) hours drying time before top coating.

5. Anti-Fouling Coating

a) Apply one (1) coat of Tri-Lux T.B.T.O. anti-fouling to all of the keel and hull.

b) Before applying the Tri-Lux anti-fouling to the hull, the polyester gel coat should be thoroughly sanded to provide an anchor pattern or tooth for good adhesion.

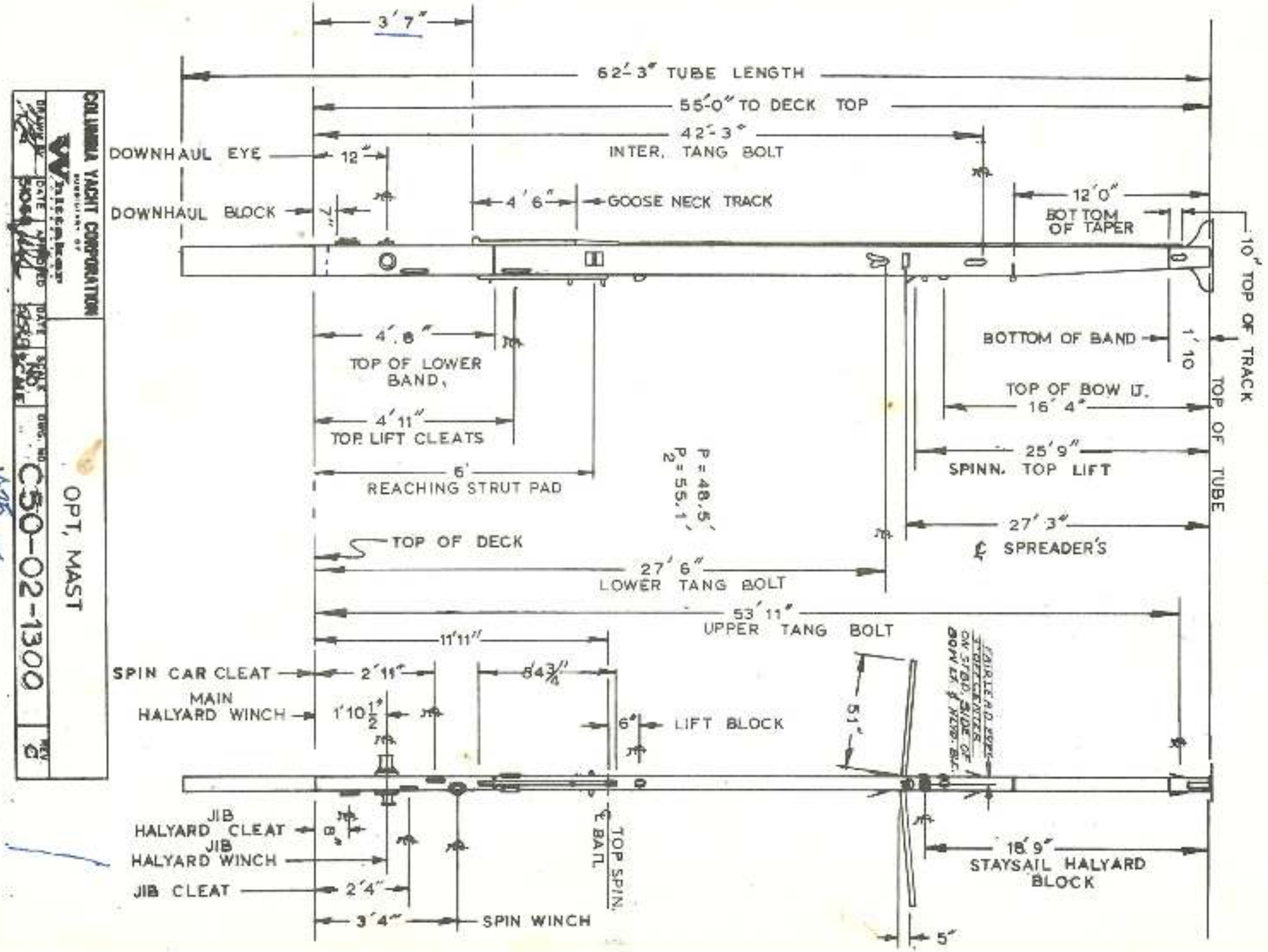
c) Allow four (4) hours drying time.

d) Apply second coat of Tri-Lux anti-fouling as specified in Section 5. a.

e) Allow 24 hours drying time before immersing boat in water.

f) International Tri-Lux is a vinyl anti-fouling formulated for ship bottom use. It contains Tri-Butyl tin oxide (T.B.T.O.) as the toxic agent. Unlike cupreous anti-foulants it may be applied directly to a primed steel surface without the need for an additional anti-corrosive coat.

THE FOLLOWING BLUEPRINTS AND DRAWINGS SHOULD BE STUDIED CAREFULLY PRIOR TO STARTING ASSEMBLY.



COLUMBIA YACHT CORPORATION

DRAWN BY	DATE	CHECKED	DATE	SCALE	DWG. NO.	REV.
					C50-02-1300	C

OPT, MAST

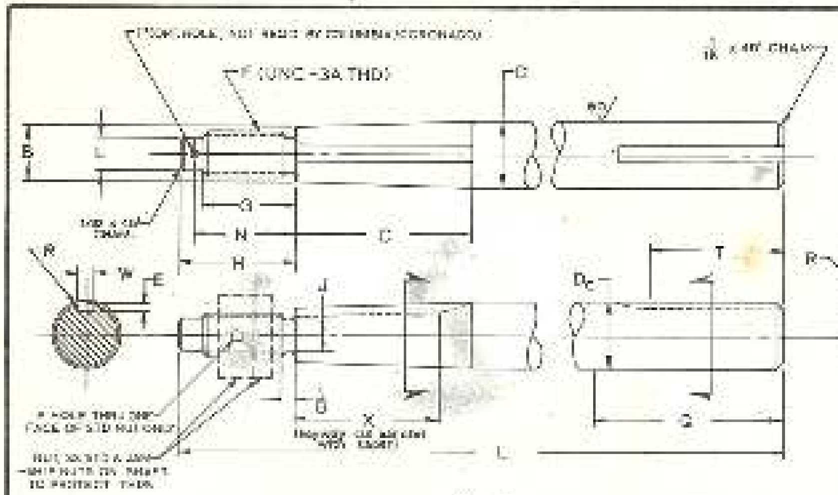


fig 1
taper=3/4 in on dia. per ft = 1/16 in per in = 3° 34' 47" total included angle

NOM DIA D	B MIN	B MAX	C REF	W NOM	W MIN	W MAX	E NOM	E MIN	E MAX	R	F DIA	F PITCH	G	H
3/4	.624	.626	2	3/16	.1865	.1875	3/32	.094	.097	1/32	1/2	13	1-1/16	1-5/16
1	.827	.829	2-3/4	1/4	.249	.250	1/8	.126	.127	1/32	3/4	10	1-7/16	1-3/4
1-1/4	1.030	1.032	3-1/2	5/16	.3115	.3125	5/32	.157	.160	1/32	7/8	9	1-5/8	2

NOM DIA D	J DIA	L	N	P	X_{min}	D_c MIN	D_c MAX	O	T	COTTER PIN SIZE	NUT THICKNESS JAM	NUT THICKNESS PLAIN
3/4	25/64	3/8	1-3/64	9/64	1.500	.748	.750	1	1.750	1/8 x 3/4	1/2	5/16
1	19/32	1/2	1-33/64	9/64	2.125	.997	1.000	4	2.00	1/8 x 1	3/4	7/16
1-1/4	23/32	5/8	1-29/32	7/64	2.812	1.247	1.250	5	4.00	5/32 x 1-1/4	7/8	1/2

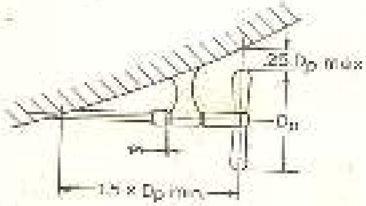


fig 2

14"

ENGINE ASSY, SHAFT, & PROPELLER TABULATION

BOAT, ENGINE ASSY	DRIVE TRAIN	ENGINE ASSY PN	SHAFT DIA	FIXED BLADE PROP L	FIXED BLADE PROP STD PN	FIXED BLADE PROP PROP	MARTEC FOLDING PROP L	MARTEC FOLDING PROP STD PN	MARTEC FOLDING PROP PROP	REMARKS
C26 VR Gas 1/1	—	16643	3/4	40.00	16624	11 x 10 RH	33.80	17269	12 x 6 RH	
A27, VR Gas 1/1		16643	3/4	40.00	16624	11 x 10 RH	33.80	17269	12 x 6 RH	
C26 AT 4, 1/1	1	13964	3/4	31.06	17268	11 x 10 RH	31.06	17268	12 x 6 RH	
C26 PM P60, 1/1	2	13975	3/4	28.56	13614	11 x 10 RH	28.56	13614	12 x 6 RH	
A30 AL AD-21, 1/1	3	13875	1	39.00	33600	11 x 10 RH	30.54	17320	12 x 6 RH	
A30 PM P60, 1/1	2	13975	1	35.00	33600	12 x 8 RH	30.04	17320	12 x 8 RH	
A30 AT4, 1/1	1	13964	1	35.00	33600	12 x 9 RH	30.43	17320	12 x 8 RH	
C30 AT4 V2 2/1	4	17441	1	50.00	17478	16 x 10 RH	45.55	17471	16 x 10 RH	
C34 PM P60 V2 2/1	4	13877	1	52.50	16801	14 x 10 RH	48.05	16803	16 x 10 RH	
C34 AL AD 21, VD 2/1	5	16865	1	52.50	16801	15 x 11 RH	48.05	16803	16 x 10 RH	
C34 PK 4107 VD 140/1	6	17500	1	52.50	16801	16 x 10 LH	48.05	16803	16 x 10 LH	
A35 PM P60, 2/1	7	13976	1	50.50	16801	15 x 11 RH	38.05	16803	15 x 10 RH	
A35 AL AD-21, 2/1	8	16865	1	50.50	16801	15 x 11 RH	45.05	16803	15 x 10 RH	
A35 AT 4, 2/1 1/1	17	17565	1			13 x 9 LH				
C36 AT 4, 2/1	9	13965	1	46.75	17301	16 x 11 RH	46.75	17301	16 x 10 RH	
C36 PM P60, 2/1	7	13976	1	46.75	17301	16 x 11 RH	46.75	17301	16 x 10 RH	
C36 AL AD-21, 2/1	8	13960	1	42.62	16410	16 x 11 LH	42.62	16410	16 x 10 LH	
C39 PM P60, VD 2/1	4	13877	1	54.50	16801	16 x 12 RH	50.06	16803	16 x 12 RH	
C39 AL AD 21, VD 2/1	5	16865	1	50.32	13618	16 x 12 LH	50.67	13615	16 x 12 LH	
C39 PK 4107, VD 2.08/1	6	13964	1	55.12	13618	16 x 12 LH	50.67	13615	16 x 12 LH	
A41 AT 4, 2/1	9	17355	1	58.50	16801	16 x 13 RH	45.05	16803	16 x 12 RH	
A41 AL AD-21 2/1	8	17350	1	58.50	16801	16 x 12 LH	45.05	16803	16 x 12 LH	
A41 PK 4107, 1.91/1	14	17470	1	58.00	16801	16 x 12 RH	45.05	16803	16 x 12 RH	
C43 PM P60, V2 2/1	4	13877	1	55.12	13618	16 x 12 RH	50.67	13615	16 x 12 RH	
C43 PK 4107, V2 2.08/1	6	13962	1	56.12	13601	16 x 13 LH	45.87	17590	16 x 12 LH	
C45 PK 4107, 2.57/1	10	13965	1-1/4	73.00	17498	20 x 13 LH	65.17		20 x 13 LH	ALSO 20 x 12 PN 13457
C45 PK 4.236, 1.26/1	11	16970	1-1/4	73.00	17498	20 x 14 LH	65.17		20 x 13 LH	ALSO 20 x 13 PN 13475
C50 WS 4.107, 2.57/1 (OPT)	10	13967	1-1/4	25.00	17303	20 x 14 LH	41.00	17303	20 x 13 LH	W/V TORQ [illegible]
C52 PK 4107, V2 2.45/1	12	17360	1-1/4							
C57 PK 4.236M, 1.17/1	11	13570	1-1/4	70 FIT	17303	20 x 14 LH	70 FIT	17303	20 x 13 LH	L APPROX AT

GET PLAN # 13967 FROM ED GOLD → IF IT SHOWS 4.107
1¼" ⌀ SHAFT

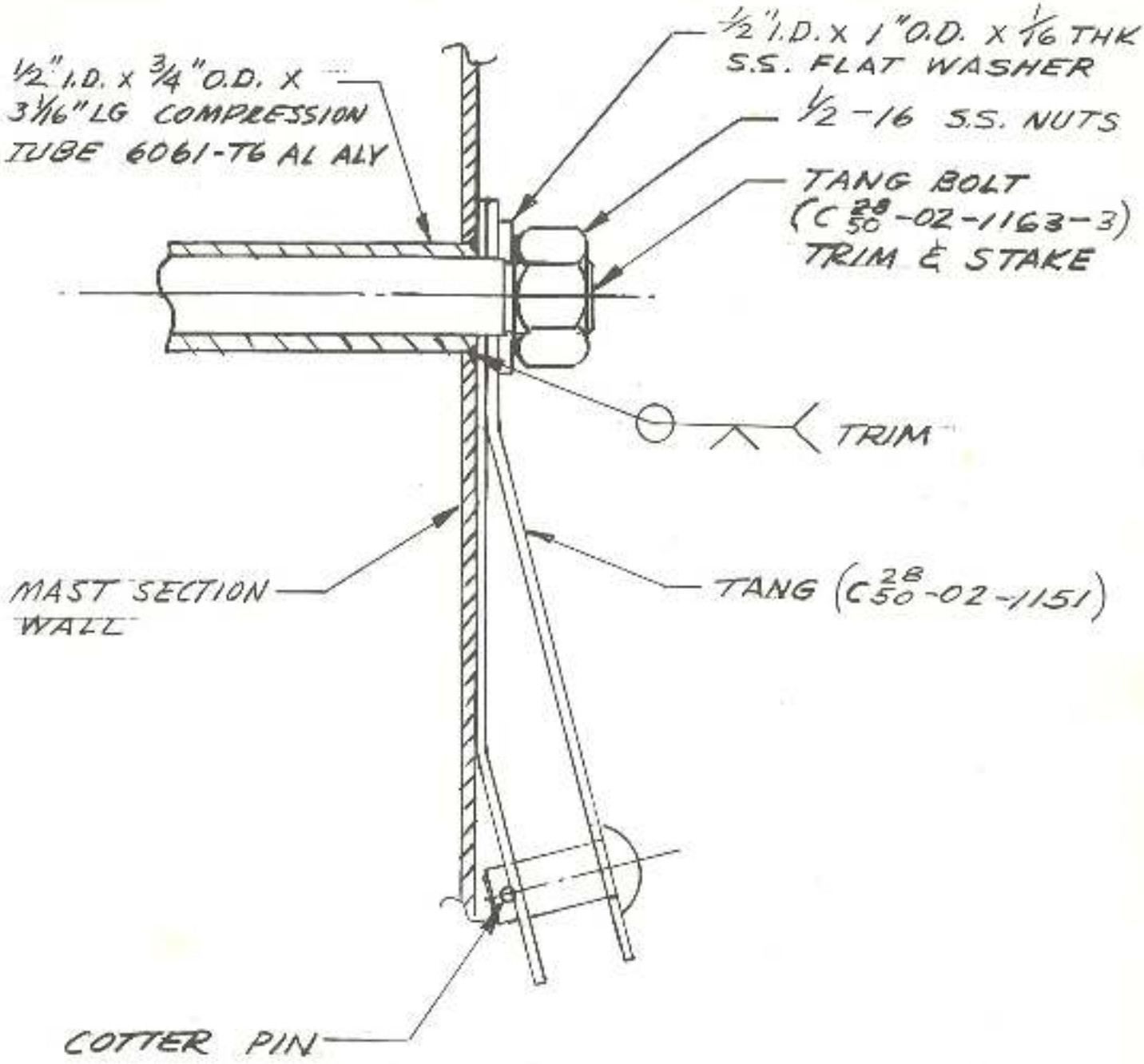
13. BARRETT MISSILE OR FLEX COUPLINGS 40AA & 50A MAY REPLACE PM PC 34 & 36 RESP.
9. PM P60 WAS CALLED M60. UNITS ARE DIMENSIONALLY SIMILAR — PM PC 34 IS DIMENSIONALLY SIMILAR TO AL AD 21.
8. ALL ENGINES HAVE STRAIGHT DRIVE.
7. ALL PROPS ARE TWO BLADE.
6. ALL BOATS ARE TO HAVE A ZINC COLLAR FWD OF THE STRUT, OR FWD OF THE PROP ON A BOAT W/O A STRUT.
5. ALL BOATS WITH STRUTS SHALL MEET THE REQUIREMENTS OF FIG 2, EXCEPT CRUISING BOATS.
4. SAE STANDARD J755 SHALL BE MET.
3. MAT'L—MONEL 400, COLD DRAWN, PRECISION STRAIGHT OR AQUALOY BOAT SHAFTING.
2. TOLERANCES: .XX ±.01, .XXX ±.005
1. DIMENSIONS ARE IN INCHES.
NOTE: UNLESS OTHERWISE SPECIFIED

14 – WN TRANS AS-4-PC, PM PC 34 ⑬
13 – PS 7B
12 – WN TRANS 10-04-000-08, PM PC 36 ⑬
11 – WN TRANS AS2-7100, PM PC 34 ⑬
10 – WN TRANS AS2-7100, PM PC 36 ⑬
9 – PC 1B, PM PC
8 – AL 7B, AL 7B, AL PC
7 – PM 1B, PM PM
6 – WN TRANSMISSION, W. VERN 200
5 – AL TR, AL VD RV-10T
4 – PM TR, AL VD RV-10T
3 – AL TR, AL PC
2 – PM TR
1 – PM TR
DRIVE TRAIN (TR, RG, VD, & PC)

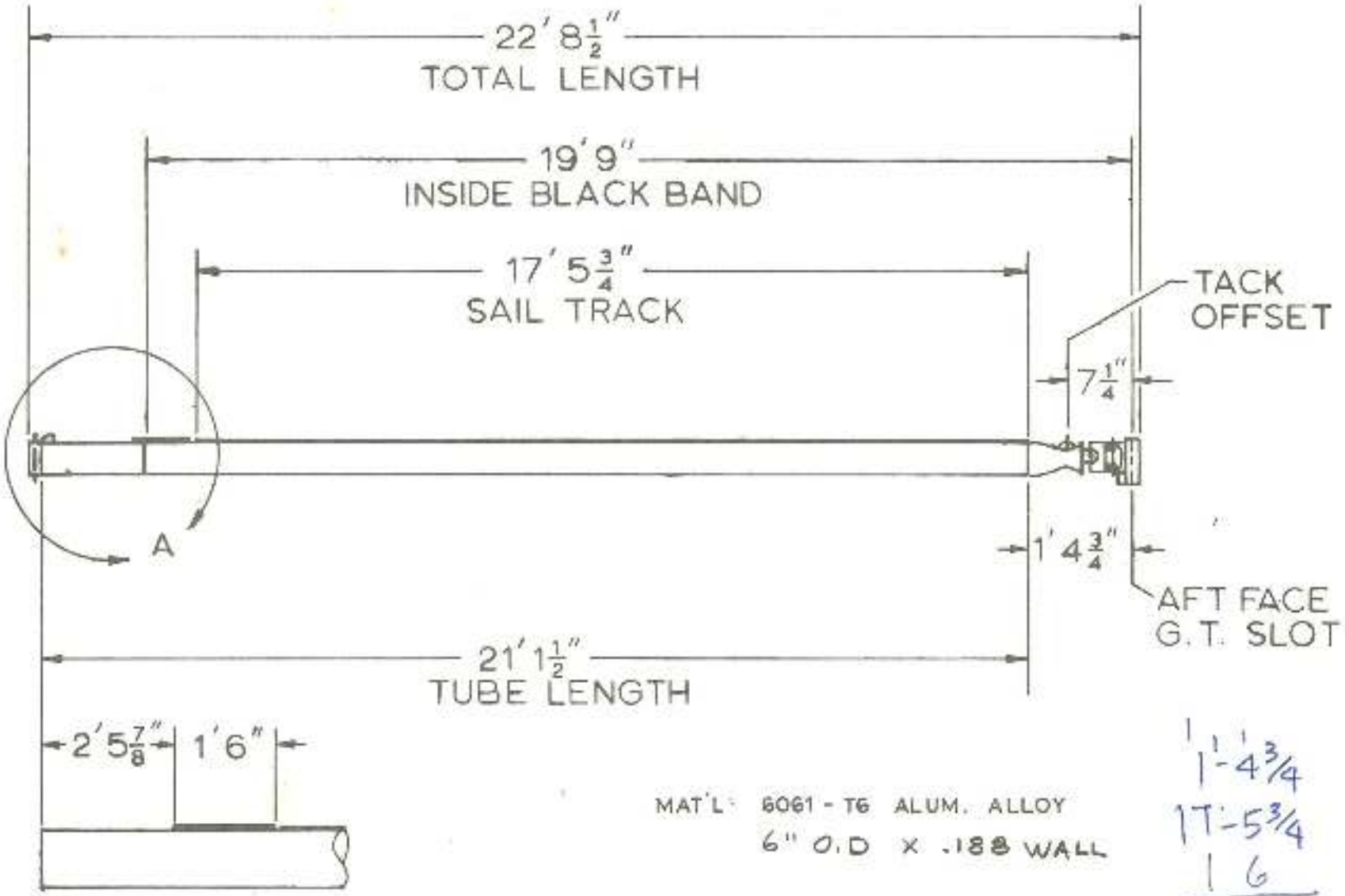
WE – WESTERBEKE
VD – V-DRIVE
WS – WESTERBEKE
WN – WARNER
WT – WALTERS
TR – TRANSMISSION
RG – REDUCTION GEAR
PK – PERKINS
PM – PALMER
PG – PARAGON
FM – FEDERAL MARINE
PC – FLEXIBLE COUPLING
AT – ATOMIC
AL – ATOMIC
ABBREVIATIONS

REV	DESCRIPTION	DR	DATE		ECO
J	CHG C39 AS & ADDITION & PROPS [illegible]	[illegible]	[illegible]		3625
H	REV C26 A36, ADD PD	[illegible]	[illegible]		3110
G	REVISED & REDRAWN	[illegible]	[illegible]		2570

COLUMBIA YACHT CORPORATION — Whittaker
PROPELLER SHAFT, PROP & ENGINE
STD-00 14210



COLUMBIA YACHT CORPORATION A SUBSIDIARY OF Whittaker					TANG ASSEMBLY	
DRAWN BY RICHEY	DATE 7/23/8	APPROVED [illegible]	DATE 8/12	SCALE FULL	DWG. NO. C 28/50 - 02 - 1150	REV.



MAT'L 6061 - T6 ALUM. ALLOY
6" O.D X .188 WALL

1
1'-4 3/4
1'-5 3/4
1 6
20-4 1/2
2-5 7/8
22-10 3/8

COLUMBIA YACHT CORPORATION SUBSIDIARY OF Whittaker CORPORATION					STD. BOOM	
DRAWN BY GORNLEY/WOLF	DATE	APPROVED	DATE	SCALE NONE	DWG. NO. C50-02-1200	REV.

NOTE: SWAGE AND SWAGE INSTALLATION MUST BE STRONGER THAN THE SPECIFIED WIRE UNDER ALL CONDITIONS, INCLUDING ALLOWANCE FOR FATIGUE, FOR LIFE OF WIRE.

	HEADSTAY	BACKSTAY	UPPERS	INTER	FWD. LOWERS	AFT. LOWERS
LENGTH	$54'-5\frac{3}{4}''$	$60'-5\frac{3}{4}''$	$52'-5\frac{1}{4}''$	$41'-6\frac{1}{2}''$	$25'-11\frac{1}{2}''$	$26'-5''$
WIRE SIZE 1x19x DIA	3/8	3/8	3/8	3/16	5/16	5/16
FITTING NO.	M-EYE	M-EYE	M-EYE	M-EYE	M-EYE	M-EYE

RUNNING RIGGING

HALYARDS

	MAIN	JIB	SPIN	SPIN STAY	SPIN POLE LIFT	BOOM LIFT
$7x19x\frac{7''}{32}$ WIRE	107'	$57'-6''$				$54'-0''$
LENGTH ROPE		$58'-\frac{1''}{2}$				$6'-0''$
7x19x DIA. WIRE						5/32"
SIZE ROPE						3/8"
FITTING NO.	MERRIMAN 390J - 7/16	MERRIMAN 390 - 4				*2 SE S/S

SHEETS

	MAIN	JIB	GENOA*	SPIN	SPIN AFTER GUY	SPIN FWD GUY	SPIN STAY
LENGTH	$125'-0''$		$70'-0''$	$75'-0''$	$75'-0''$	$75'-0''$	
SIZE (DIA)	7/16		5/8	1/2	1/2	7/16	
FITTING NO	w/eye spc. 1" chr eye			*3 SE S/S	*3 SE S/S	*2 SE S/S	

* TWO REQ'D.

SE SWIVIL EYE
S/S SNAP SHACKLE
M MARINE

MISC

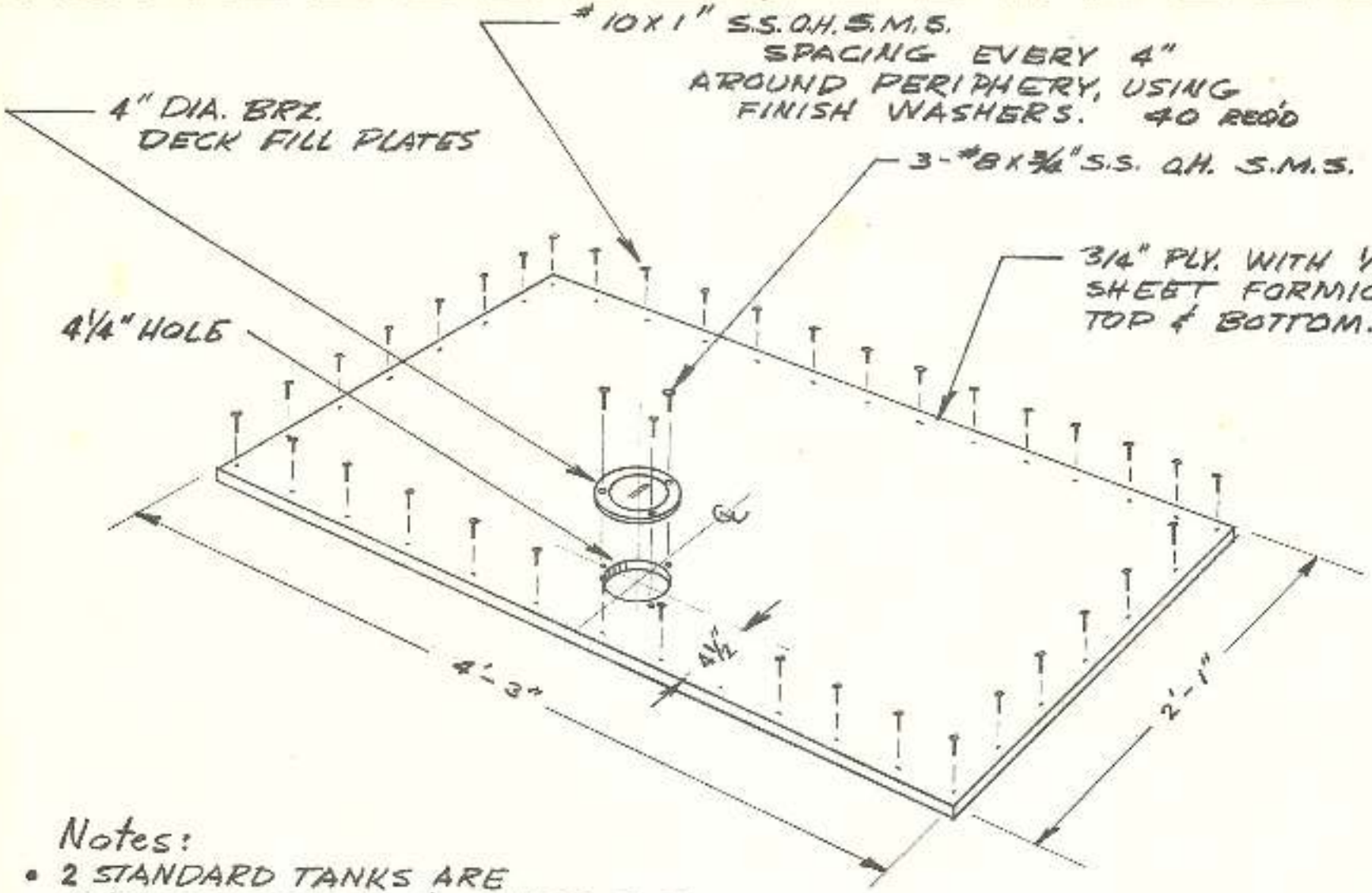
	OUTHAUL	DOWNHAUL	SPIN CAR LIFT	BOOM VANG		
LENGTH	w/winch w/o/winch	$18'-0''$ $12'-0''$		100'		
SIZE (DIA)		3/8		1/2		
FITTING NO.		*3 blk w/ becket		1-*3 snap shackle 2-5/16 anchor shackle 1-*3 snatch blk 1-rubber snubber		
MAT'L		DACRON				

C CHG 2236 B CHG 2189

COLUMBIA YACHT CORPORATION
SUBSIDIARY OF Whittaker

RIGGING SPECS

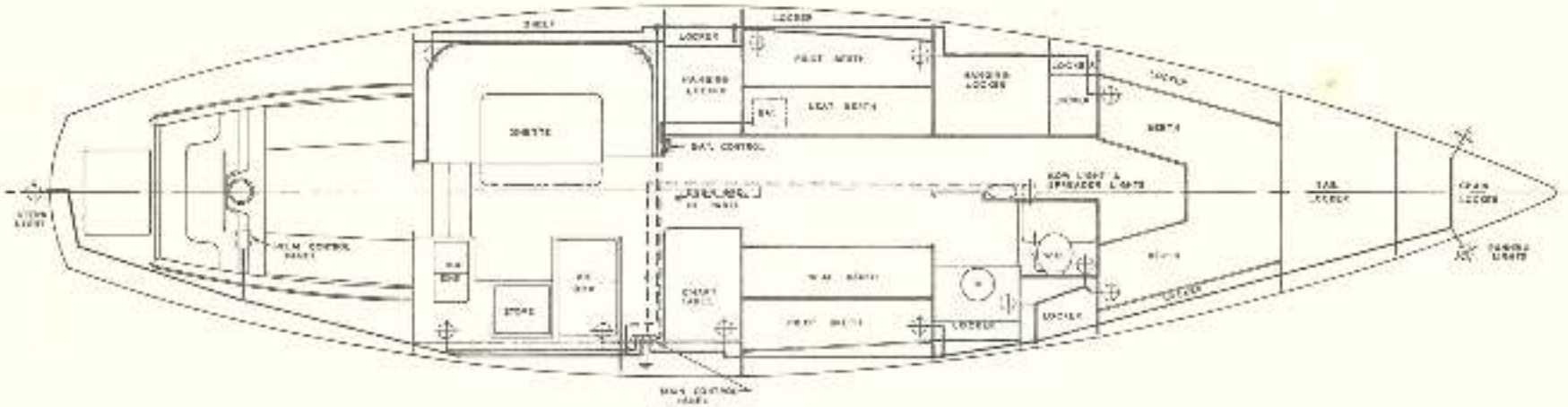
DRAWN BY	DATE	APPROVED	DATE	SCALE	DWG NO	REV.
			1/71	—	C80-03-1000	C



Notes:

- 2 STANDARD TANKS ARE AVAILABLE PORT & STARB. FOR LOCATION (SEE DRAWING C 50-00-200)
- SEAL IN G.E. #SE 1202 SEALING COMPOUND.

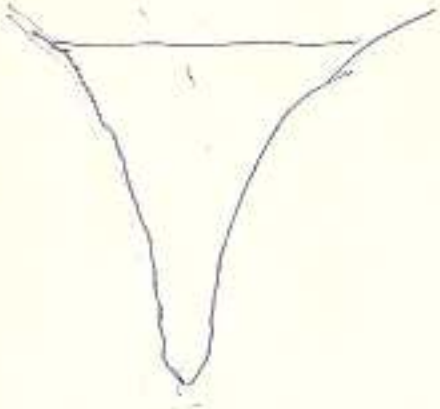
COLUMBIA YACHT CORPORATION					WATER TANK COVER	
	6/16	NO			C50-08-1520	



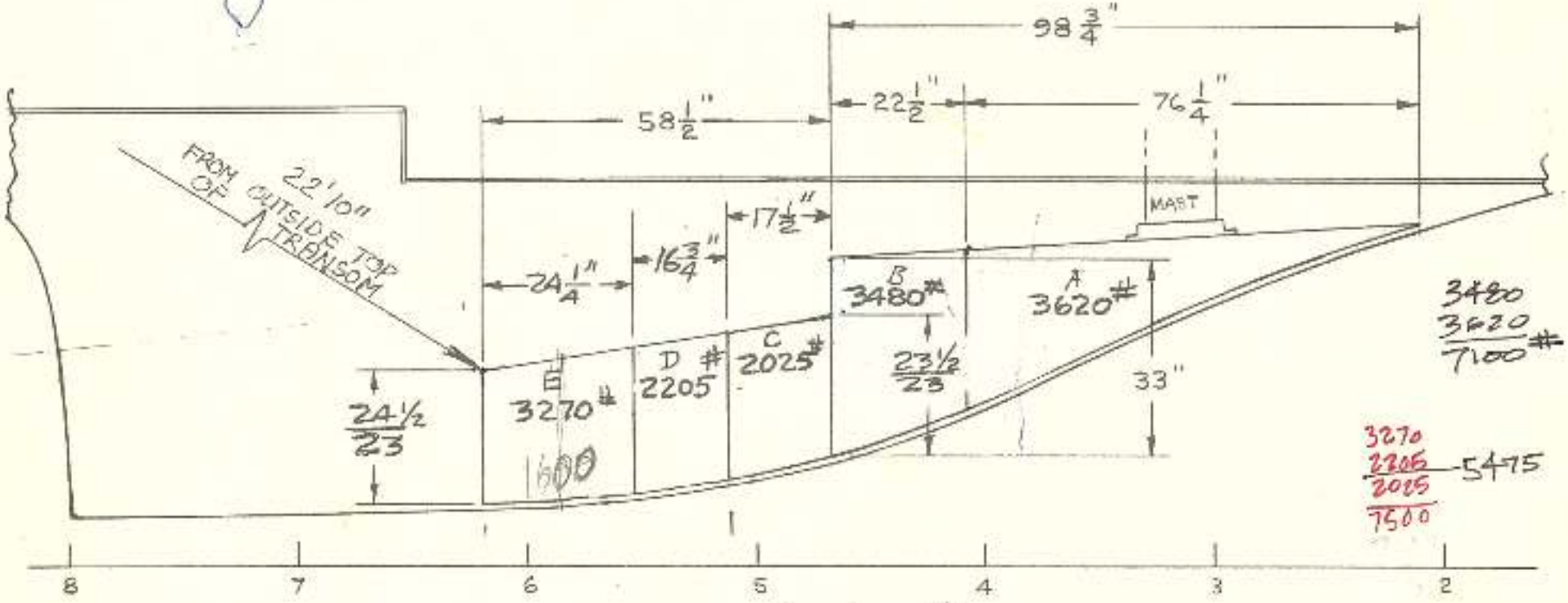
LIST OF SYMBOLS

COLUMBIA 50

STANDARD WIRING



WEIGHT TOLERANCE FOR EACH SECTION ± 2.5 LBS.



3480
3620
7100#

3270
2205
2025
7500

5475

TOTAL BALLAST 14,600# ±25#

COLUMBIA YACHT CORPORATION	BALLAST C50	
8/20/69 RCP 2/69 12-11	C50-17-1000	C

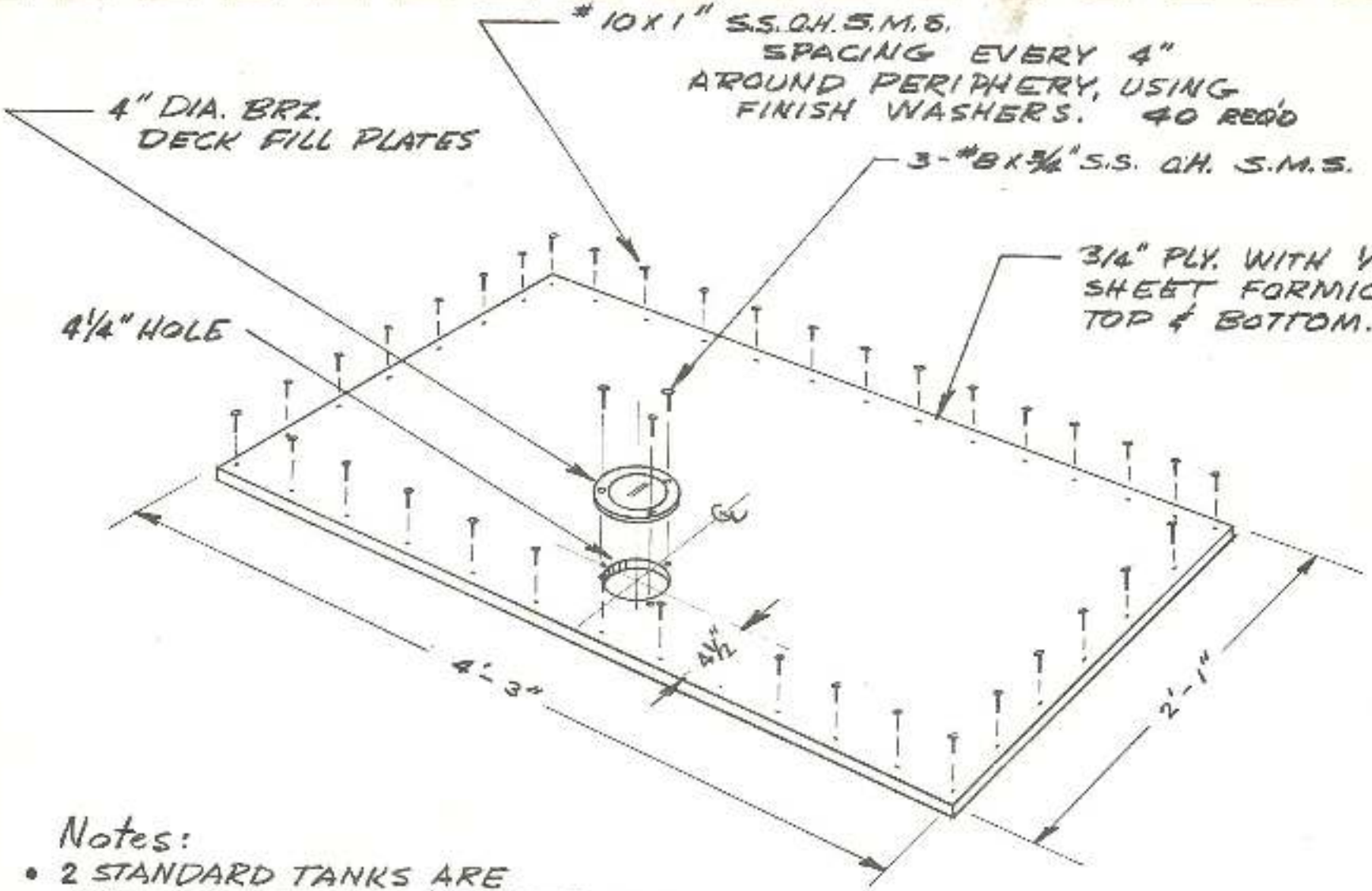
C	
1585	B
CHANGE ORDER	CHANGE LETTER

SAIL	AREA	LEACH	LUFF	FOOT	MAT.	WT.	REMARKS

SPECIFICATIONS	

COLUMBIA 33

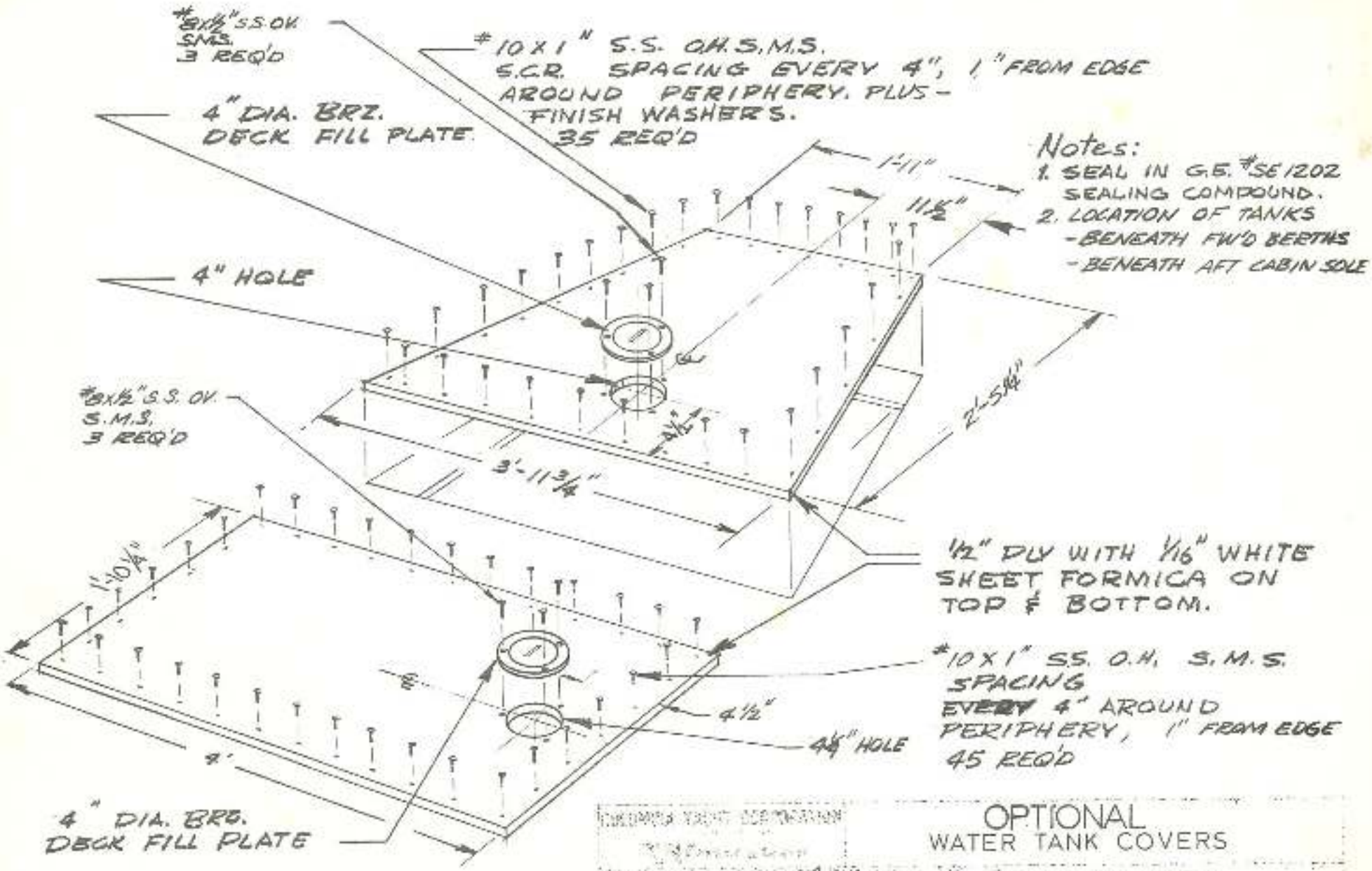
SAIL PLAN



Notes:

- 2 STANDARD TANKS ARE AVAILABLE PORT & STARB. FOR LOCATION (SEE DRAWING C 50-00-200)
- SEAL IN G.E. #SE 1202 SEALING COMPOUND.

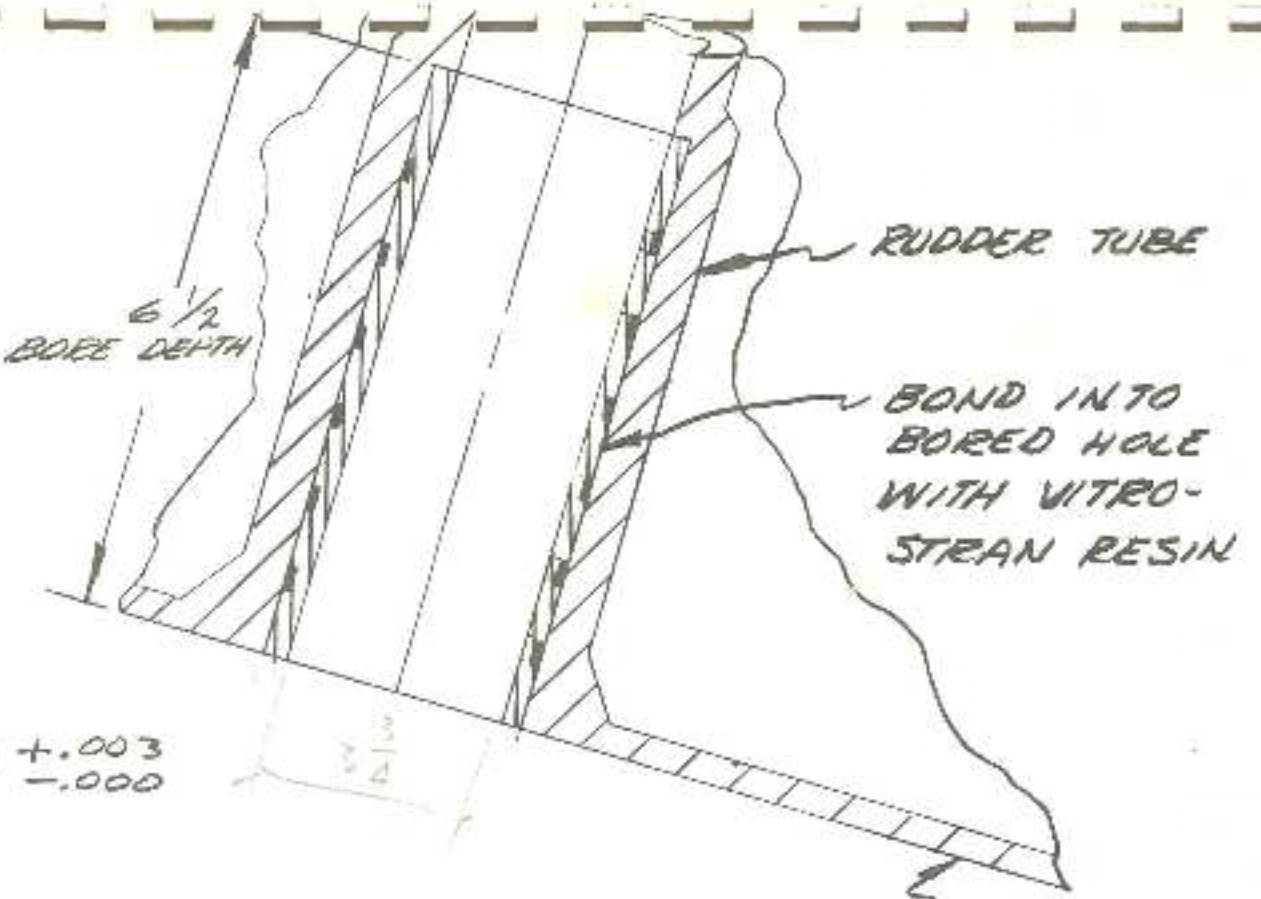
COLUMBIA YACHT CORPORATION				WATER TANK COVER	
	5/1968		6/16 NO	C50-08-1520	REV.

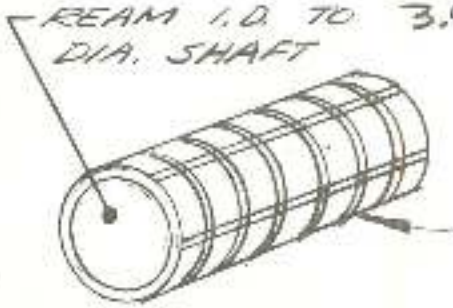


OPTIONAL
WATER TANK COVERS

C 50-08-1530

649-68 NO





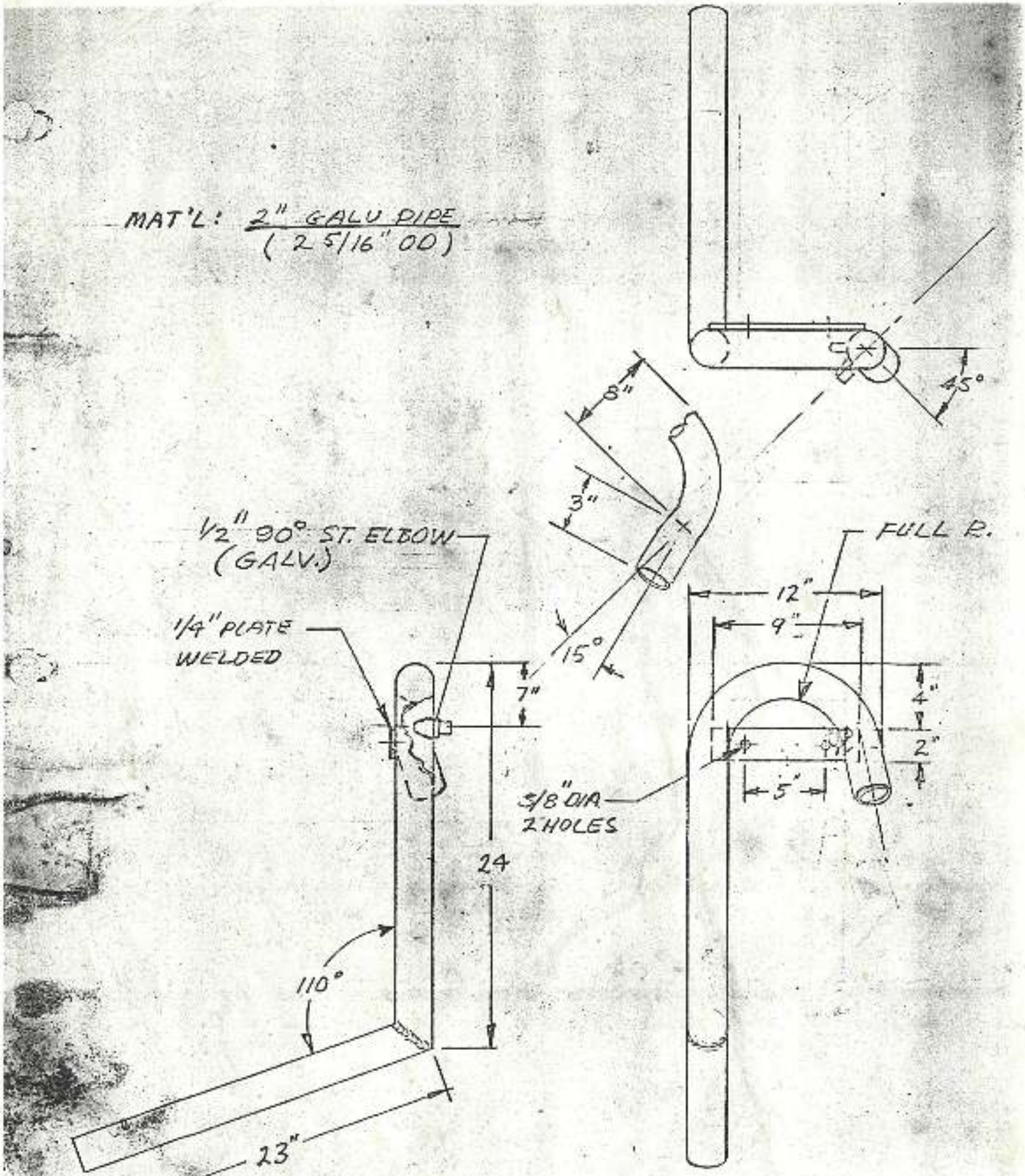
NO SCALE

MAT:
(1) 3-3/4" I.D. X 4-1/2" O.D. X 6-1/2" LONG BRONZE BUSHING (OILOMUN A.N. 7766P)
(2) VITRO-STRAN RESIN

C-50-10-10010-C

COLUMBIA YACHT CORPORATION SUBSID ARY OF Whittaker CORPORATION					RUDDER BUSHING INSTALLATION	
DRAWN BY Brown	DATE 9/6	APPROVED	DATE 9/6	SCALE 4":1"	DWG. NO. C50-10-1001	REV. C

MAT'L: 2" GALV PIPE
(2 5/16" OD)



EXHAUST LOOP

C50-05-1431

A

5.1 GENERAL ASSEMBLY INSTRUCTIONS

After studying Sections 1, 2, 3, and the drawings included in Section 4 in great detail, you are now ready to commence the work of building your Sailcrafter Yacht. We suggest certain preparations and tools prior to starting work (see 5.1.1 through 5.1.5). The rest of Section 5 covers the individual detailed instructions for your guidance.

If you are going to build your own wood interior instead of using the unitized fiberglass interior which is available it is important to plan the interior in as much detail as possible and to try to visualize the finished result before a single piece of plywood has been cut. Work inside the boat, marking the positions of all bulkheads on the fiberglass shell with masking tape, chalk, etc. Make mock-ups from small sticks and cheap plywood or cardboard just to help to visualize the finished result. Then sit down and look at it -- try to "sit" at the dinette or on the "bunks" -- try to work at the "galley" -- try to operate the "head". Then change things around and try the above all over again until you are sure the interior suits your needs.

When this is done plan all assembly methods necessary for assembling the interior. For example: the main structural bulkhead to the mast post or the formica galley top joint to the galley face should be designed to conceal unfinished edges. Be sure you have it all planned so that no unpleasant surprises will occur later.

The first step in constructing the wooden interior is to install the cabin sole and the floor timbers which support it. Install them in the location shown in the Hull Assembly drawing.

Make sure there is drainage through all of the floor timbers so that water can run from all compartments to the bilge sump. If necessary, cut limber holes at least 3/4" diameter to provide drainage.

The cabin sole can now be cut and mitered to fit the slope of the hull. When everything is ready a small amount of rather thick micro balloon filled resin should be prepared and spread on the hull in the area where the sole will rest. Smooth out the micro balloon filled resin with a trowel or squeegee, making a smooth transition from the sole to the hull, then, when it is cured, bond the sole to the hull with two layers of 3 oz. mat and one layer of 7-1/2 oz. cloth.

5.1 (continued)

With the sole in place proceed to cut and fit the bulkheads, V-berths, and your other cabinets. Some of the remaining interior woodwork can also be cut and fitted at this time. However, depending on the location of thru-hulls, bulkheads, etc., the finished pieces should probably be set aside and only bonded to the hull in the proper sequence, with the hull to deck joint, chainplate installation, and plumbing and electrical installations.

5.1.1 Tools Required

In order to do a workmanlike job on your boat you will need certain hand tools and power tools. They are as follows:

- ✓ BAND SAW
- ✓ TABLE SAW
- ✓ SABRE SAW
- ✓ ELECTRIC HAND DRILL
- ✓ RATCHET TYPE SCREW DRIVER
- ✓ SMALL MITRE BOX
- ✓ MITRE HAND SAW
- ✓ HACK SAW
- SET OF FILES
- SET OF HOLE SAWS
- COUNTERSINKING DRILL BITS
- NUMBER DRILL SET
- TAP SET, NATIONAL COARSE
- ✓ ACCURATE CARPENTER LEVEL
- CHALK LINE
- ✓ 12' ROLL UP TAPE
- ✓ CARPENTER'S HAMMER
- ✓ SET OF SCREW DRIVERS
- SET OF WOOD CHISELS
- SOCKET AND OPEN END WRENCH SET

5.1.2 Keeling and Leveling Hull

It is suggested that you purchase your kit with the keel installed. Since the keel represents approximately 50% of the weight of the hull it is very difficult to handle without heavy equipment that a boat builder has available and which is not normally available to the amateur builder. If you have not had the keel installed by Sailcrafter then it should be installed first. This is accomplished in accordance with Section 5.8.

5.1.2 (continued)

After the ballast has been installed it is recommended that the hull be very carefully replaced in the cradle so that all of the weight of the boat rests on the keel, with the saddles of the cradle used only to keep the boat from falling. Be sure you have adequate carpeting covering the cradle saddles so it does not mark the hull. The whole boat should then be leveled very carefully. This is done by fastening clear plastic hoses to the hull, one on the port side taped to the hull above the waterline and running under the boat to the starboard side -- again taped to the hull above the waterline. The second tube should be fastened at the bow above the waterline and run aft to the stern and taped to the hull above the waterline. These hoses should be filled with a vegetable dye colored water. Then level the boat so that the water level is exactly the same dimension fore and aft and port and starboard above the waterline.

After the hull is perfectly level you can proceed with your next step.

5.1.3 Temporary Cover Over Work Area

It is recommended that a temporary cover be built over the area in which you will be working. The roof should be strong enough to protect your work area from snow and rain and if you are working in a colder climate it is suggested that inexpensive plastic sheeting be used to construct a windbreak all the way around the structure. Be sure that the roof is high enough so you can stand up on deck.

Since you will be doing fiberglass work it is important that the average temperature be held reasonably constant so that your fiberglass work will turn out well. Extremes of humidity or temperature will produce poor fiberglass work which will have to be done over. Be sure you have good ventilation while you are doing fiberglass work to protect your health.

Having a temporary enclosure for your work station will make it more pleasant and enjoyable to build your Sailcrafter Yacht.

5.1.4 Importance of Leveling

The importance of checking all your work with an accurate carpenter's level cannot be over emphasized. Since your boat is level, checking each of the parts you install with a level will insure your final product is square and true with respect to the waterline of the boat. If you have purchased your

5.1.4 (continued)

Sailcrafter Kit with the interior installed you will note that there is draft in all of the vertical surfaces. This is necessary in order to remove the interior parts from its mold. Vertical surfaces cannot be used as a reference for locating wood parts, or else they will be tilted at the angle of draft rather than vertical with respect to the waterline of the boat. This is another reason why the constant use of a level is extremely important. When mounting bulkheads it will sometimes be necessary to shim them where they contact the fiberglass surfaces, to insure that they are vertical.

5.1.5 Order of Assembly

It is suggested that you start work on the interior first. Since the interior has a great deal of detail, fiberglass, wood, and mechanical work, getting this completed first makes a lot of sense. Completing the engine installation in accordance with the drawings and Section 5.4 of this manual should be the first order of business. Installing all thru-hulls at the same time is a good idea. It is extremely important for the safety of your yacht that all thru-hull glass work be done very carefully, in accordance with Section 5.5.

Once the interior is complete the next step should be to install all deck hardware and deck wood in accordance with the drawings. Be sure that all hardware and wood is carefully through bolted and very carefully sealed when installed, to eliminate any possibility of leaks. After your deck is complete it is suggested that you do whatever touch-up work is required on the hull, fair in the keel, using micro balloon filled resin, and install the rudder in accordance with the drawings and Section 5.7. After this work is complete the next step is to clean, buff, and polish all fiberglass surfaces and apply an anti-fouling coat to the bottom, in accordance with Section 3.6.

If you bought a spar kit the next step is to complete the mast and boom in accordance with Section 5.18.

After this is complete you are ready for the long awaited day of launching. Buy a couple of cases of champagne, (one bottle for your boat, the rest for you and your friends) and launch your boat in accordance with Section 5.19.

5.2 HULL TO DECK JOINTS

5.2.1 Hull to Deck Joint with "H" Metal

Sand outer and inner gel face off 1/2" from the edge the full length of the hull and deck and across the transom.

Prior to joining the hull and deck, a short piece of "H" metal shall be slid along the joint of both the deck and the hull to insure the "H" metal will fit. The bottom of the "H" metal shall be filled half way up with a poly-sulphide sealant such as Nauti-calk and placed on the hull within one half hour. Care must be taken to insure that the sealant does not fall out. When the "H" metal is pressed down on the hull edge the sealant should ooze out. The top of the "H" metal shall be filled half way up with Nauti-calk. Within one half hour the deck shall be placed on the hull and forced down into the "H" metal. When the deck is pressed into the "H" metal sealant should ooze out.

When riveting, place rivets 3" apart. When double lowers are used the rivet spacing shall be 1-1/2" from two feet forward of the forward lower to two feet aft of the aft lower.

Clean the "H" metal within two hours and seal rivet heads. The open corners at the transom and the bow between the "H" metal shall be bonded with 4 oz. of mat and one layer of 3 oz. cloth.

After installing corner and bow castings, a fillet of sealant shall be wiped between the "H" metal and the fiberglass above and below the "H" metal and the castings.

The headliner and deck shall be bonded in the deck mold. After trimming the outer and inner gel face should be sanded off 1/2" from the edge, the full length, on both sides and across the transom.

The hull liner will be placed accurately in the hull while the hull is still in the hull mold. The top edges of the hull and hull liner will be bonded the full length of the hull liner before being pulled from the mold.

After trimming, the outer and inner gel face should be sanded off 1/2" from the edge, the full length of the hull and across the transom.

5.2 HULL TO DECK JOINTS

5.2.1 (continued)

Before joining the hull and deck, a short piece of "H" metal (6"-8") should be slid along the joint on both the deck and hull to insure a proper fit. The bottom of the "H" metal should be filled 1/2 to 3/4 of the way up with caulking and placed on the hull. Use a rubber mallet to insure the metal is down. When the "H" metal is down, caulking should ooze out. Drill a hole in the "H" metal with a 13/64" bit and pop rivet. (See Riveting Instructions).

The top of the "H" metal should be filled with caulking 1/2 to 3/4 of the way up. The deck shall be placed on the hull and forced into the "H" metal. When down caulking will ooze out. Drill and rivet.

After riveting, clean caulking before it cures. Then seal rivet heads. The corners and bow should then be bonded, (4 oz. of mat and 3 oz. of cloth). Then install gunnel rubber. Insert bottom of rudder in bottom of "H" metal. Use a wedge to run along top. Rubber will fall into place. Install corner and bow casting with machine screw in kit. Then seal around castings and "H" metal, top and bottom, with marine sealer (G.E. White) to insure no leaks. Excess sealer should be cleaned before it cures.

RIVETING

The rivet spacing should be 3" apart. When double lowers are used the rivets should be 1" to 1-1/2" apart, 2' forward of forward lower to 2' aft of aft lower.

5.2.2 Hull/Deck Joint (without "H" Metal)

Trim the flange on the hull down to 1-1/2" overall, except at the bow where you should make a template of the underside of the deck flange from the bow to 3' aft, both port and starboard. Transfer these lines to the hull flanges and trim to the line. Grind off the seam at the bow and stern so the deck will set down evenly.

Trim the flange on the deck down to 1-1/2" overall in width and then route the flange to 1/4" thick. At the bow you will have to make a template of the outside of the hull and transfer this to the deck before trimming the forward most three feet, both port and starboard.

5.2 HULL TO DECK JOINTS

5.2.2 (continued)

Set deck on hull. First, set in engine, heat riser, and fuel tank.

Clamp the deck and the hull together in about six points on both sides.

Starting with the transom and working forward evenly on both sides, drill and countersink screw holes through the deck flange and hull flange, clamping the hull and deck together in a fair line as you go. Use a flathead #8 self-tapping screw to pull the deck and hull flange together. Space these 8-10 inches apart.

Clean the inside of the joint - using Acetone - leaving the surface free from grease and other contaminates.

Mix a fairly thick batch of micro balloons to a consistency that is easily workable with a putty knife and lay up into the recess of the joint about six feet at a time. Make this a cool mixture so you will have from 30-45 minutes to work with it. Next, take the mahogany strips that are provided (cut into 6' lengths) and force up into the micro balloons until the bottom of the strips are just above the bottom of the joint. In most areas you can cut some cleat stock (1" x 1" pine) and, using the shelf space or cabinet tops of the hull liner as an anchor base, force the mahogany strips in tight. Before the micro balloons go off, scrape all the excess from the joint with a putty knife. Continue this process completely around the hull. With micro balloons fill in all areas so you have a flush joint from the deck to the hull. When the micro balloons have cured apply a strip bond across the joint, extending 3" upward on the deck and down the side of the hull. The bonds should consist of one layer of 3 oz. mat and one layer of 7-1/2 oz. cloth. It is not necessary to make the bonds a continuous strip. Cut the pieces 3 or 4 feet long and overlap the ends 2-3 inches. The mat comes in 5" widths and the cloth in 6" widths. This allows the cloth to overlap the mat 1/2" and makes it a neat, professional looking bond. Use body putty to fill any small imperfections. The joint is now complete.

5.4 ENGINE AND FUEL TANKS

The engine should be set in prior to decking the boat, however it may be set in through the main hatch if installed later. The engine exhaust should also be set in place before the deck goes on.

The engine is installed on the engine bed that is molded into the hull liner in accordance with the hull drawing. The propeller shaft is fastened to the engine with a solid flange. For the S-28, S-36, and S-50 the shaft is enclosed in a bronze shaft log tube which has a Cutlass bearing in the aft end. A hole or slot is cut in the hull to allow this tube to go through the hull. The forward end of the prop shaft tube is coupled to a stuffing gland by a short piece of steam hose, using stainless steel hose clamps at each end.

The engine should be moved to its correct location, set on its mounts, and secured temporarily with stainless steel lag screws.

The prop shaft may now be put in place by pushing it through the prop tube from the outside and the shaft flanges coupled together. The shaft should be free from horizontal and vertical pressure so that the shaft turns freely. The stuffing gland should be at least 2" aft of the engine flange in order that the packing gland can be opened for the installation of packing. The prop shaft tube should then be bonded in accordance with CSP-00-9054. Then fair out the bonds by sanding. Fill the small voids with body putty, sand, gelcoat, wet sand and buff.

For other Sailcrafter Yachts using a strut type aft bearing the strut shall be mounted in accordance with CSP-00-9051.

The fuel tank is installed in its compartment by sanding the gelcoat from the sides and bottom of the compartment and filling the space between the tank and the compartment walls with Micro Balloon filled resin. Mix to about the consistency of pancake batter and catalyze with no more than 2% by volume of resin. Mix well before pouring. Fill up to from 2-3 inches from the top of the tank. This locks the tank in. The fuel fill line is run in accordance with the plumbing drawing.

Drill the proper size hole in the deck to receive the deck fill fitting. Bed the underside of the deck fill fitting with polysulphide and, holding the vertical flange on top of the deck, fill fitting facing forward, insert the fitting and screw it down. Connect the fill hose and fill

5.4 (continued)

fitting together with a hose clamp. The ground wire must be installed from the fill fitting to the tank to engine ground to prevent explosion from static discharge, in accordance with the wiring diagram.

The fuel tank vent line is led from the tank to the engine compartment in accordance with the plumbing diagram.

1. The hose must be led continuously up, so fuel is not trapped, to a screened thru-hull vent fitting on the transom and fastened there with a hose clamp.

2. Before the vent hose reaches the screened fitting in the transom a loop should be made in it, a size just large enough so it does not collapse the hose. This is to keep any sea water from backing up into the fuel. The hose must then be secured to the deck along its path with electrical ty-wraps every 14".

The exhaust system consists of a stainless steel flex hose, a water jacketed exhaust pipe, a length of exhaust hose, a pipe loop, muffler, which is a stock unit, and a thru-hull fitting. The exhaust system location is shown in the hull assembly drawing.

The engine compartment ventilators are located in accordance with the deck assembly drawing. The exhaust is a forced air system with the fan mounted on the underside of the deck on the port side aft, and the intake on the starboard side. Both are connected to 3" flex hose which leads to the engine compartment, creating a complete air flow throughout the compartment and around the engine and bilge. The output hose must lead to the lowest point in the engine compartment. The input hose should lead to the opposite end and be located high in the Engine Compartment.

Follow the wiring diagram to connect the engine.

5.5 THRU HULL INSTALLATIONS

1. Bore a hole of adequate diameter for the thru-hull device (Item 4) through the entire hull laminate (Items 6 and 7).

5.5 (continued)

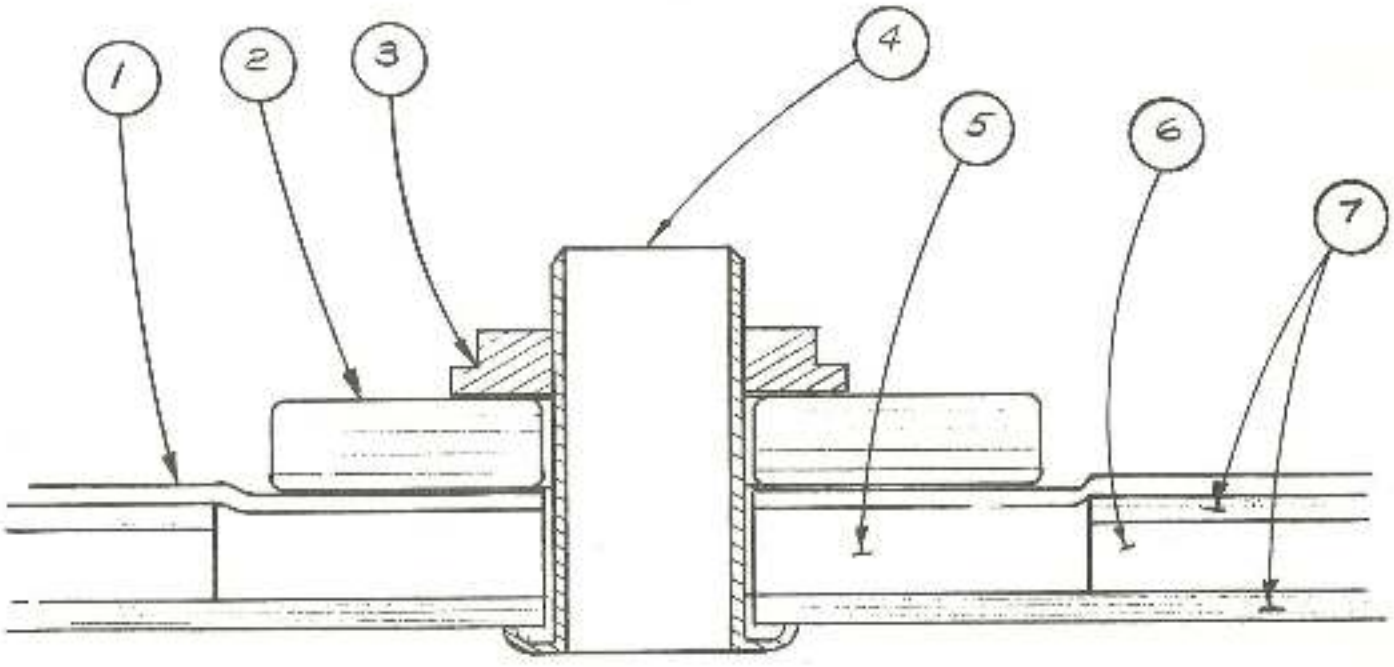
2. Remove the balsacore (Item 6) and inner hull laminate for an area around the thru-hull, large enough in diameter to allow the plywood donut to seat properly.

3. With the thru-hull temporarily located, fill the void around it with random matting and resin (Item 5) as shown.

4. Bond over this, filling with a cover bond (Item 1) according to Section 5A of CSP-00-9031. (1 lam 24 oz. roving and 3 oz. mat).

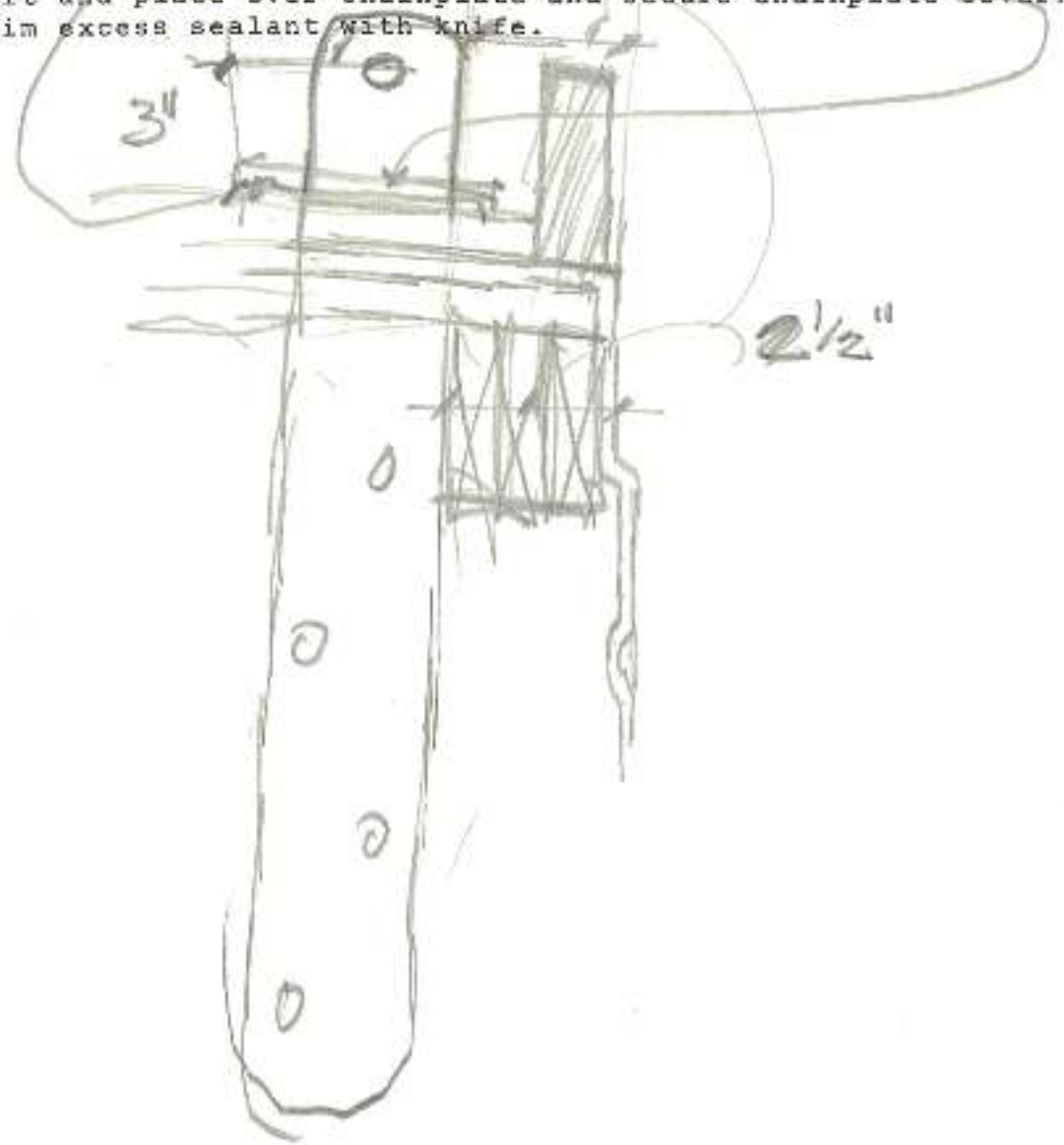
5. Finish the installation by sealing the thru-hull and tightening nut (Item 3).

6. If the thru-hull device is of a flush mounting type use a bond equal to the outer hull laminate to secure it in place prior to filling the void, as defined in Step 3.



5.6 Chainplate Installation

Drill hole in deck, elongating to fit chainplate. Place chainplate through deck and secure. Seal around chainplate below and above deck. Use Minnesota Manufacturing Company Weather Ban Sealant Tape, 3" wide and 1/8" thick. Slit and place over chainplate and secure chainplate cover. Trim excess sealant with knife.



5.7 Rudder Assembly

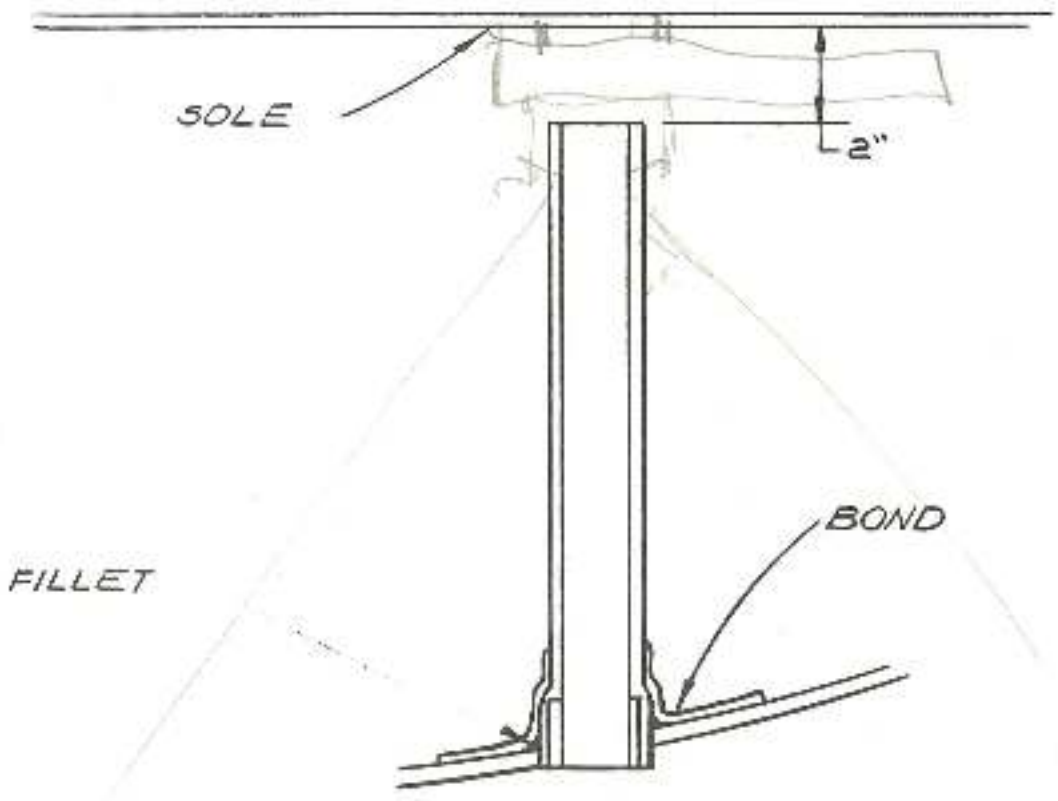
Drill hole in hull at rudder location (for size see drawing). Align the rudder tube, drill hole in deck. Bond rudder tube to hull as follows:

1. The rudder tube is extended through a clearance hole in the hull and aligned with a locating jig.

2. Tube is filleted to the inside of the hull with a small amount of asbestos filled resin as shown. Catalyst should not exceed 1/2 to 1% by weight.

3. The tube is bonded to the hull with three (3) layers of 3 oz. mat and three (3) layers of 24 oz. woven roving. Catalyst content of resin not to exceed 2% by weight. Apply in three applications of one layer of mat and one layer of woven roving. This laminate must extend at least 5" out from tube and 5" up onto tube.

4. The top of the tube should terminate approximately 2" from the underside of the cockpit sole or deck, except when wheel steering is used. In this instance, there should be approximately 3" between the top of the quadrant and the underside of the cockpit sole.



5.7 (continued)

Lubricate rudder shaft and place Nylatron washer between hull and rudder. Push rudder up. Secure deck flange and place Nylatron washer under tiller head. Install hex head set screw, lining up rudder and tiller. Drill through tiller head and rudder shaft and install hex head bolt and secure.

5.8 Keeling Procedure

5.8.1

The entire keel must be painted with International Intergard No. 4424/4423 Primer, except the top and sides of the flange, which must be sanded to white metal and cleaned with acetone.

5.8.2

The keel must be dry fitted with keel pocket to assure proper fit. If the keel fits, move to Step 3. If not:

a. Mark areas that do not fit.

b. Remove keel and grind metal off. Never grind fiberglass pocket.

c. Refit keel to pocket to assure fit.

5.8.3

To determine that the keel is vertical with respect to the hull, measure from the aft tip of the keel to the bottom of the boot top on either side. These two dimensions should be equal within 1/2". If these two dimensions are more than 1/2" shims shall be used made of stainless steel strip running the full length of the keel. This shim must be completely encased in the Epibond 150AB when the keel is fitted to the hull.

5.8.4

Remove keel from keel pocket and sand keel pocket and sides to roughen surface and remove gelcoat.

5.8.5

Apply to the top of the flange to the keel 1/2" coating of Furane Epibond 150 A/B which has been mixed in a 1 to 1 ratio in accordance with the manufacturer's recommendations.

5.8.6

Fit keel to keel pocket by resting the entire weight of the boat on the keel.

5.8 Keeling Procedure

5.8.7

Wrap keel bolts with caulking cotton and apply PRC-5000 (Nauti-calk may be substituted for PRC-5000) to the bolts on the inside of the boat.

5.8.8

Place keel bolt back-up channel over bolts and tighten keel by using a flat washer, lock washer, and nut on each bolt. Nuts should be tightened with a 16" lever arm.

5.8.9

The Furane Epibond 150 A/B has a three hour working life. Be sure to fill the gap between the hull pocket and the keel and clean all excess Epibond 150 A/B within three hours. The boat should not be put in the water before the 72 hour cure has been completed.

5.8.10

The Epibond 150 A/B should be sanded smooth and fair to blend the hull and the keel and repainted with Intergard 4424/4423 Primer over any spots where the sanding has cut through to the bare metal.

5.8.11

The only anti-fouling bottom paint that can be used on boats whose keels have been finished in accordance with this procedure is International Tri-Lux T.B.T.O. anti-fouling bottom paint.

5.9 Plumbing and Water Tanks

WATER TANK INSTALLATION:

1. Formica sheet shall be adhered to both sides of 3/8 plywood (inside only where the tank lid is to serve as the cabin sole) by application of a suitable contact cement, either contact cement #2210 from 3M Company or spray contact cement No. 5E-410 from Morton Company.

2. The tank drain thru-hull fitting shall be installed after the installer has inspected the tank wall around the bored hole for the thru-hull fitting against voids and weakness of the wall. The thru-hull is to be sealed with silicone sealant. A plywood donut is to be used on the exterior. The tank vent line thru-hull, if required by the plumbing drawing, shall be installed in the same manner.

3. The installer is to further inspect the inside of the tank against voids between the gelcoat and the laminate, particularly in the corners, which will lead to leaks.

4. The lid, prior to installation, shall be fitted with the required fill fitting. The fill shall be thru bolted to the lid and sealed both sides with silicone sealant.

   NOTE: If a vent line or over-flow line is not required by the plumbing drawing a 1/8" diameter hole will be drilled in the fill cap.

   The fill shall be so located in the tank lid that it will be most easily accessible for filling when a cushion or carpet is in place over the tank.

5. The lid shall be "dry" fitted to the tank top and drilled for mounting screws. There shall be a mounting screw in each corner. The spacing between screw centers shall be 4" maximum.

6. The inside of the tank shall be thoroughly cleaned prior to installing the top. Bed the top in a liberal bead of silicone sealant. The screws shall be oval head self-tapping and finish washers shall be used for all berth-top installations. Cabin sole installations shall use pan head self-tapping screws covered with plugs. The screws must be sealed.

5.9 (continued)

7. Excessive sealant should be displaced as the lid is secured. This sealant shall be wiped to form a neatly appearing bead. The screw heads shall be wiped clean.

See the drawing provided for the correct hot water connections to your engine from the hot water heater.

The head plumbing consists of the head discharge loop hose and thru-hulls, connected in accordance with the plumbing diagram.

All marine heads are shipped with the fittings loose. Tighten all fittings on head. Following the plumbing diagram place the pick-up hose to intake on head and secure with stainless steel hose clamps. Be sure to apply Pemetex to fitting before clamping. Place exhaust hose to flash on head. Run hoses to thru-hull fittings. Place head on base and bolt secure. Fill head with water. Close gate valve and pump head. Open thru-hull. Drain water. Find and stop leaks.

For stainless steel sinks, seal under edge of sink. Install sink (and weight it down until sealant has cured). Use sink bolts to secure sink to underside of glass. Clean off excess sealer.

5.10 Stove and Tank Installation

5.10.1 INSTALLATION OF LPG STOVES

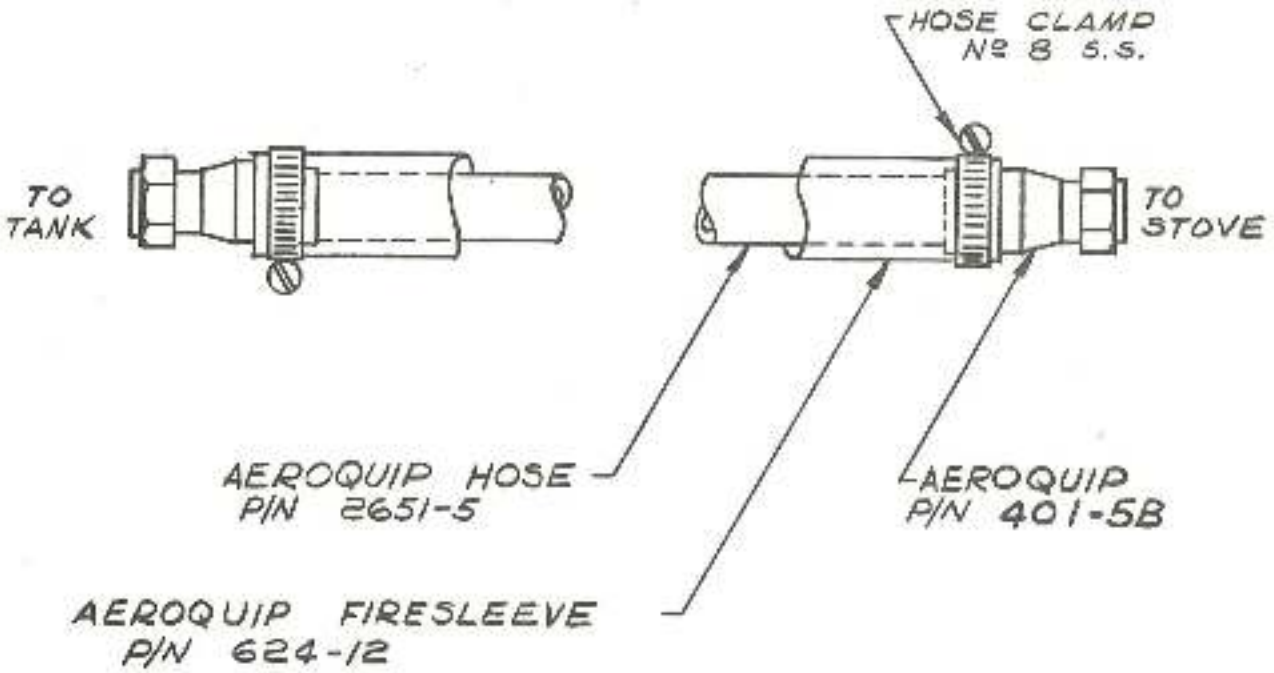
LPG stoves and their remote supply tanks shall be installed and connected in the following manner. No changes in materials or methods should be made before checking with Sailcrafter Engineering.

1. LPG means liquified petroleum gas - properly known as propane, butane, or some combination of the two. LPG under moderate pressure will liquify. Upon relief of the pressure it is readily converted into a gas. Due to this unique condition it is extremely important that the LPG tank and stove installation be carefully done and tested.

2. The stove must be securely mounted on its gimbals in such a manner that it can swing freely ± 30° from vertical. Stainless steel cotter pins must be installed to retain the stove in the gimbals.

3. Remote supply tank or tanks must be installed in the fiberglass self draining sealed box in accordance with drawing STD-08-20110.

4. The remote tank and the stove shall be connected by a continuous length, with no splices or joints, of Aeroquip Hose No. 2651-5, protected with Aeroquip Fire Sleeve No. 624-12. The hose assembly shall be assembled in accordance with the following diagram, using the fittings indicated.



5.10.1 (continued)

No substitutions whatsoever shall be made without checking with Sailcrafter Engineering.

5. After the assembly of the stove and tank are completed the following tests should be preformed.

   a. Fasten a quick disconnect fitting to the LPG fitting so that a hand air pump can be connected to apply pressure to the system.

   b. Close all valves on the stove and pump air pressure up to 10 psi and observe the pressure gauge for possible tank leaks.

   c. If no tank leaks are observed in test "a" above, the tank stove system shall be left with this pressure applied for a minimum period of five hours.

6. For final inspection the following test should be made.

   a. Air pressure shall be applied to 10 psi with the tank valve open and all stove valves closed.

   b. If there is no measurable drop in pressure in a one hour period the system shall be considered acceptable.

7. If at any time during any of the tests described in this procedure a leak is detected, the source of the leak shall be found and corrected, and the test shall be started over again.

5.10.2 INSTALLATION OF ALCOHOL STOVES

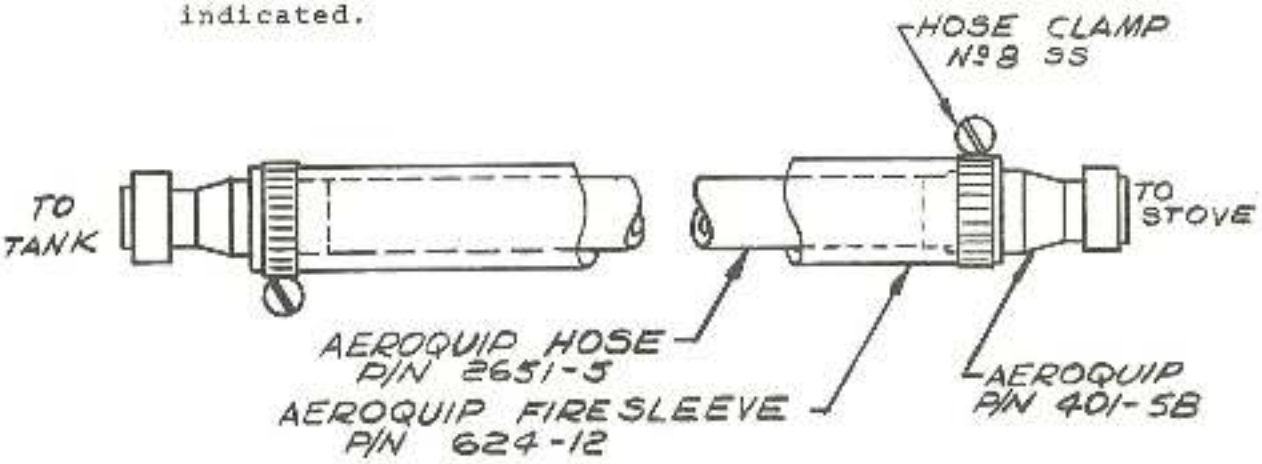
Alcohol stoves and their remote supply tanks shall be installed and connected in the following manner.

1. The stove must be securely mounted on its gimbals in such a manner that it can swing freely ± 30° from vertical. Stainless steel cotter pins must be installed to retain the stove in the gimbals.

5.10.2 (continued)

2. The remote supply tank must be bolted with stainless steel bolts and washers to the appropriate support. It must be equipped with a cut-off valve.

3. The remote tank and stove shall be connected by a continuous length, with no splices or joints, of Aeroquip Hose No. 2651-5, protected with Aeroquip Fire Sleeve No. 624-12. The hose assembly shall be assembled in accordance with the following diagram, using fittings indicated.



4. No substitutions whatsoever should be made.

5. After the assembly of the stove and tank are completed perform the following tests.

   a. Close the valve on the tank. Pump air pressure to 10 psi and observe the pressure gauge for possible tank leaks.

   b. If no leaks are observed in test "a" above, then with all valves on the stove closed the valve on the tank shall be opened and the pressure drop noted after five (5) minutes. This small (approximately one lb.) pressure drop is caused by air filling the system and is expected. The tank/stove system shall be left with this pressure applied for a minimum period of five (5) hours.

   c. During the final inspection the following tests shall be made of the stove/tank system.

5.10.2 (continued)

1. Air pressure shall be applied to 10 psi with the tank valve open and all stove valves closed.

2. If there is no measurable drop in pressure in a one hour period the system shall be considered acceptable.

6. If at any time during any of the tests described a leak is detected, the source of the leak shall be found and corrected and the test shall be started over again.

5.11 Installation of Windows

1. Cut out along scribe line for proper fit of windows, or make a template. It is best to make a 1/4" plywood template of the inside of the window frame (with the securing ring removed). Tape these in place to the cabin with masking tape and the alignment checked for symmetry and the overall aesthetic effect. When all the templates are taped in place, scribe around them. Remove the templates and make the cut outs along the scribe lines.

2. Place bond between liner and deck to insure solid fit - using 3 oz. of mat and clamp until resin cures.

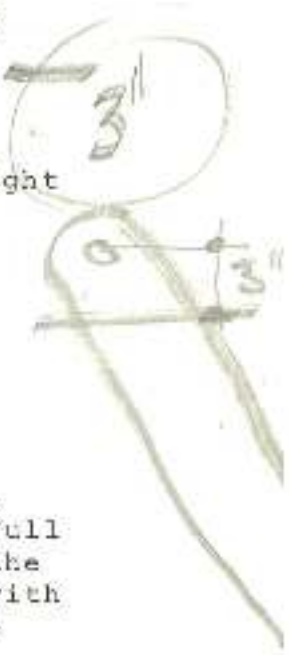
3. Sand gelcoat off inside and outside for 1/2", all the way around the hole.

4. Use a polyurethane sealant liberally under the frame and to the inside of the window frame. Install window. Tighten screws until a small amount of the sealant squeezes out around the frame. Window is complete.

5.12 Deck Hardware

The stem fitting is bolted through the deck and the outside of the hull using stainless steel flat head bolts of the proper size with flat and lock washers and nuts on the inside of the hull and deck. Use a liberal amount of sealant around the bolts and under the stem fitting plate on deck. The bow block on deck must be notched out the width of the stem fitting strap so that the stem fitting is flush against the bow.

The backstay chainplate is mounted either through the deck at the transom or on the transom, depending upon the Sailcrafter model you are building. Use round head stainless steel bolts of the proper size and length with nuts, lockwashers, and flat washers. The Deck Assembly drawing will give you the proper location. A gusset is bonded to the inside of the transom with the same bond as was used on the chainplate bulkheads when the chainplate goes through the deck. The plywood gusset is offset from the centerline to port 7/16" to allow for the 1/4" bond over the plywood gusset, and this will put the center of the backstay chainplate on the centerline of the deck. The centerline of the upper hole in the backstay must be 3" above the deck and on the proper angle in line with the backstay to the top of the mast so that there is a straight pull on the plate.



Mount all other hardware in accordance with the deck assembly drawing. Be sure to use either back-up plates or a large flat washer under all hardware.

The genoa track is bolted through the track, toe rail, deck, and hull. A filler strip of 1/4" x 3/4" teak is furnished with some boats to install under the track on top of the toe rail. In some boats this filler strip is molded. Scribe a line on top of the teak toe rail the full length of the genoa track. Place the outboard edge of the filler strip along this line and fasten the strip down with 3/4" brass escutcheon pins. Use only enough to keep the strip fastened in a fair line to the top of the rail. Starting from the stern, locate the genoa track bolt holes on the center of the filler strip. Then drill and bolt the track on, working forward. Install the track stops on the forward end of the track only. Use ample sealant around each machine bolt. Use the back-up strip provided under the deck.

The main sheet track is bolted through the deck in the same manner as the genoa track, using a filler strip. Locate the

5.12 (continued)

track according to the Deck Assembly drawing. Make sure the cars will slide the full length of all tracks.

To mount dead lites drill a 1/4" hole from the bottom of the deck up through in the proper location. From the top of the deck place the dead light so that the drilled hole is in the center of it. Scribe a line around the body of the dead light on deck and cut around the scribe line with a saber saw or a hole saw. Put a bead of sealant around the dead light underneath at the junction of the flange, the body and the deck, and bolt through the deck.

For boats with the mast going through the deck, the mast step must be installed with the boat level. Lay out the "J" measurement on the centerline on deck. Measure half the fore and aft outside measurement of the mast and add this to the "J". Drill a 1/4" hole at this point on deck and drop a plumb bob down to the bilge. Mark the point in the bilge at the point of contact with the plumb bob. This will be the center of the mast step. Center the mast step on this point and rotate it to either port or starboard to align it with the centerline. Then fasten down with the rest of the lag screws. Measure the distance from the center of the mast step to the center of the panting rod hole in the mast step, then transfer this measurement on deck and drill the hole on deck for the panting rod. Make a template of the mast section from plywood and add 1/4" all around. Lay this out on deck with the center of the template centered with the 1/8" plumb hole on deck. Scribe around the template. Then, with a saber saw make the cut out. The 1/4" oversize will allow for wedges when you step the mast.

5.13 Exterior Wood

If your boat has toe rail caps they are teak and are cut to the proper shape to fit the deck, however there is some fitting and trimming left to be done.

Start at the transom and fit the transom cap down over the toe rail (the rail caps are dadoed out on the bottom side). Fit and fasten down temporarily by countersinking and drilling the screw holes. The transom cap will extend slightly beyond both sides of the transom. Cut these ends off on approximately a 45° angle with the side rails. Place the side rail caps on the side rail and butt them up against the transom cap. Make a line on the side rail cap, parallel with the 45° cut on the transom cap, then cut the side cap to fit. Once you have made the preliminary fit butt the two pieces together and if they don't fit exactly flush a single saw cut at the joint will, with both pieces butted together, give you the desired joint. Continue up both sides of the rail, screwing the rail down as you go. The side caps have a scarf joint at each end (except the aft pieces against the transom). These are easily fitted together and keep the rail caps from splitting lengthwise.

When you get to the bow cap, it is fitted in the same way as the side rail caps. Some trimming out at the underside maybe needed so it will set down flush. This can be accomplished by laying the bow cap (it is in two pieces) in line with the rail cap and scribing the underside. Use a sharp chisel to remove the wood to the scribe line. When the complete rail cap has been temporarily fastened down, lay a thin batten along the outboard edge of the rail cap so that the edge of the batten just touches the outboard edge of the cap. Keep the batten in a fair line and scribe a pencil line on the top of the teak cap all the way around the deck. Then, with a belt sander, sand down to the pencil line. This will give you an even, fair line on the outboard side of the rail cap. Radius the top outboard edge with a hand router (1/4" radius) to finish it off. Leave the inboard edge of the cap unfinished for the present. Remove all the rail cap and then use Dolphinite sealant along the edge of the fiberglass joint where the deck and hull flanges join. Use another application in the dadoed out cavity of the rail cap. Then fasten all rail cap to rail permanently, using stainless steel self tapping screws and finishing off with teak plugs. When it is all fastened permanently install nibbs (inset knees) at the inside bow cap joint and the port and starboard joints where the side caps join the transom cap. Lay the nibb on top of the cap so the center point of the nibb is on the center joint cut.

5.13 (continued)

Scribe a pencil line around the nibb and chisel this out of the rail cap. Insert the nibb and screw a countersink horizontally from the inside of the nibb to the rail cap. Measure the cap from the outside edge until you find the narrowest point. Use this as the overall width dimension. Lay out a line on the inboard side of the rail cap, with a batten parallel to the outboard edge. Sand down the inside edge to the line, as you did on the outside, and finish the top edge off with the 1/4" bullnosed radius.

The main hatch consists of Cribboard Guides, main hatch, main hatch guides, clips, main hatch beam sill, one set of louvered doors, and drop-down cribboards on some boats. On others drop-in cribboards are used in place of louvered doors. Locate them in accordance with the Deck Assembly drawing.

The cockpit coaming blocks and coamings come pre-fit and it is merely a matter of fastening them on with screws countersunk and plugged. Start with the coaming blocks. Then the coamings, and then the helmsman's seat backrest. This last mounts with the bottom flush with the bottom of the side coamings and will keep the water from running into the cockpit. The helmsman's seat is also pre-fit. It mounts up under the side coamings and the backrest in the back. Screw from under the seat into the coamings and backrest.

There are four knees provided to give the helmsman seat added support (in the S-50 only). Two are spaced evenly off the centerline aft and one each port and starboard. These are screwed onto the fiberglass side by first marking their location and then drilling holes from the cockpit into the lazarette area, and screwing them from inside the lazarette out. They are also screwed and glued at the top down through the helmsman seat and then plugged.

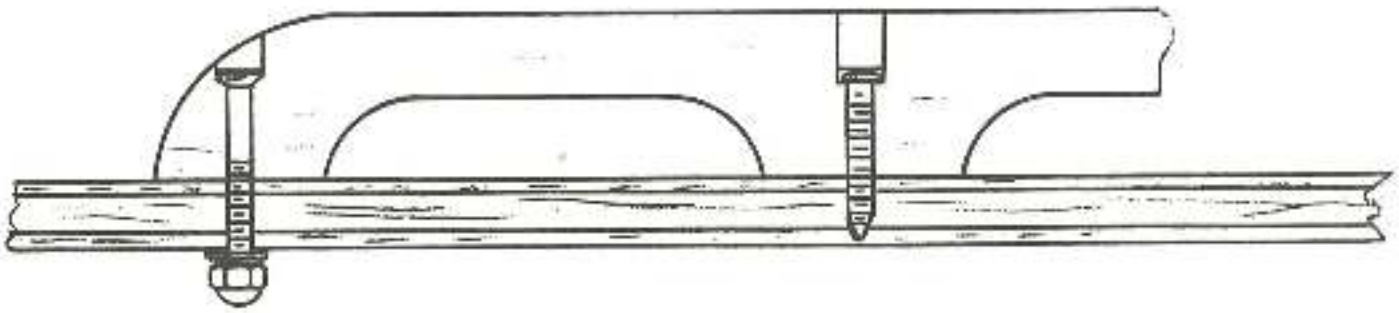
Winch handle boxes are located in accordance with the Deck Assembly drawing. Take the measurement from the outside of the box at the radius of the flange and the box and lay this out, centered on the forward side of the island between the cockpit seats. Keep the bottom line of the cut out 6" above the deck. The boxes are furnished with a teak trim. Trim the trim to fit the box. Install the box using dolphinite sealant and flat head self-tapping screws, countersunk. You are now ready to install the teak trim.

5.13 (continued)

Looking at the back of the frame, there are slots cut from the inside of the frame across the wood to the outside. These are drain holes and should be at the bottom of the box. Fasten the frame by screwing, countersinking, and plugging the holes.

Grab rails are mounted on the cabin top, as shown on the Deck Assembly drawing. They are fastened as follows:

All cabin top teak hand rails used shall have at least one stainless steel thru-bolt at each end fastening them to the deck. Hand rails with more than two grips shall be fastened with thru-bolts as illustrated below. The intermediate grips shall be fastened with stainless steel self-tapping screws.

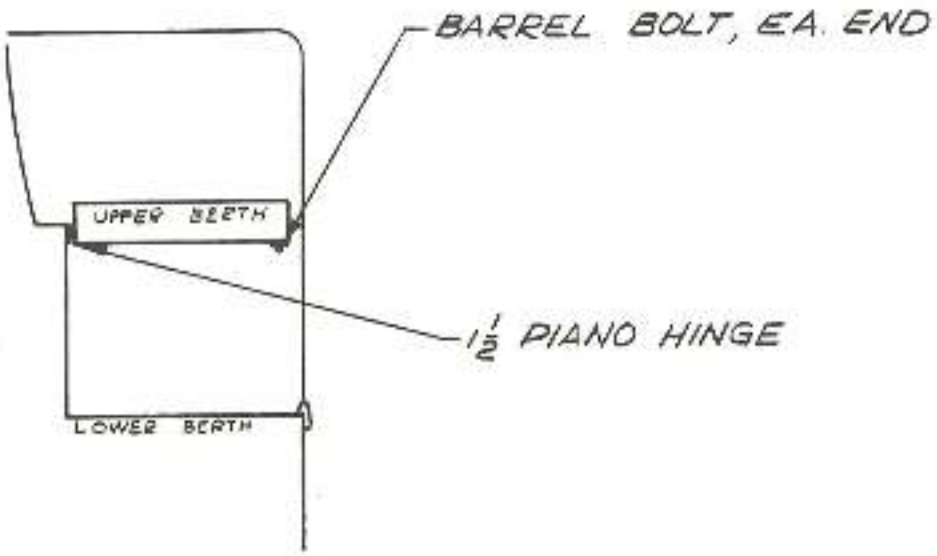


The eyebrow trim is pre-cut and shaped to fit the cabin top. Follow the scribe line on the cabin to install this. After installing them some shaping and sanding may be needed to make them fair. Be careful you do not drill through the cabin when drilling your screw holes. Mount with countersunk stainless steel self-tapping screws. Finish with teak plugs over dolphinite sealant.

5.15 Cabinetry, Interior Wood

The interior cabinetry and wood parts should be located in accordance with the Interior Construction drawing.

The main bulkheads around the head should go in first. These are all pre-cut and should follow from forward to aft. Set the bulkheads in the recesses provided. Plumb them with a level and then fasten them into the hull liner by countersinking, screwing, and plugging. A good waterproof glue should be used at all wood to wood joints and a sealant behind the wood in any area where there may be water (galley sink, shower base, etc.). After installing the bulkheads the lockers may be installed, screwing the locker shelf down to the ledge of the hull liner provided. On all bulkheads and lockers that join the headliner, toe in your screws through the top of the wood to the deck. These need not be plugged as you will be installing the teak trim over them and against the headliner. The dish locker front and other lockers may be installed by first laying out the fore and aft line that the locker front will follow, then screw a cleat to the fiberglass, flush with this line. Set the locker front against the cleats, countersink, and screw the front to the cleats. Use ample glue between joints. Plug. Chisel off and sand the plugs flush with the front. The drop bunks midships should be installed as shown in the drawing.



5.14 Electrical System - 12 Volt DC

The lighting wiring harness is molded in the deck liner in most boats. All connections should be with Stak-on type connectors and terminal wiring eyes. All wiring harnesses should be bundled and wrapped with plastic ties every 14". Care should be taken to route all cable bundles up out of the bilge so bilge water cannot get to them. For connections to bilge pumps and other bilge mounted electrical devices the connection should be well up out of the bilge.

The mast wires come through the mast step and are secured to a female plug. A male plug is wired in the same manner to the mast wiring so the mast can be disconnected easily when unstepped.

Secure wires to the Master Control Panel in accordance with the wiring diagram, using ring type stax-on terminals.

5.15 (continued)

All shelves that are installed directly to the hull should be bonded the full length with 3 oz. of mat and 7-1/2 oz. cloth. The bond should be on both top and bottom of the shelves and run from 3" on the hull to 3" onto the shelves. They can be set in place for bonding by screwing a cleat on the fore and aft bulkheads, then setting the shelf on these and screwing it down from the top.

Leave all sea rail and pin rail to be installed last, to keep from scratching or gouging them. All bunks should have sea rail installed on the inboard edges to keep the cushions from sliding off. The same applies to the dinette seats.

The sets or drawers and doors are set into the cutouts and are drilled, countersunk, screwed, and plugged.

5.16 Spars and Rigging

If you have purchased the Sailcrafter spar and rigging kits you should, following the drawings carefully, assemble the mast as the final step in the construction of your yacht. Be sure that all stainless steel parts such as sail track are separated from the aluminum spars, using a vinyl electrical tape. This helps reduce the possibility of electrolysis in the future. Dip each screw as you screw it into the mast in a quality grease, which also assists in reducing electrolysis. All winches should be mounted on appropriately shaped teak blocks to both give proper support and separate them from the aluminum mast. If winches are mounted on a flat surface of a mast it should also be separated by a non-metallic material to reduce the possibility of corrosion. Be sure that cotter pins are placed in all pins in the mast head and in all rigging pins. Tape should be applied over these areas after the mast is rigged to avoid sail damage. Prior to leaving for launching all running rigging should be installed on the mast.

5.17 Launching & Commissioning

Now that your boat is complete and ready to go into the water it is extremely important that you carefully check out your rigging and mast prior to having the boat moved to the launching facility. Check the dimensions of all your shrouds, standing rigging, and the dimensions of the location of the tangs, in accordance with the drawings provided, to insure that when the mast is stepped that everything fits properly. Enclosed in this manual is a Launching & Commissioning Record. If you follow the Launching & Commissioning Record step-by-step you should have an easy time getting your boat ready for sea.

When tuning your rigging the following steps are recommended.

5.17.1 Mast Tune

Under no circumstances should any of the rigging be set up "bar tight". For all sailing conditions we recommend that the mast be vertical and in column, with the rigging "firm". It is very important that a knowledgeable person who understands this concept oversees the initial tuning of the mast and rigging.

You should be able to stand facing the mast, reach out and pull on any stay and see the mast move in that direction. With a light pull or push by hand at chest height, this dockside starting point will have both stays of equal tension with about 1" to 2" of play in the uppers and 2" to 3" of play in the lowers. The backstay and jib stay should be of equal tension and have about 1" of play. If the mast is stepped on deck the rigging will be tighter than a mast stepped on the keel. With double lowers the after lowers will be looser than the forward lowers by about 1" of play. Some of the newer tall rigs have intermediate shrouds, the tension of which should be between that of the uppers and lowers.

On a large mast you may notice a line of rivet heads running up one side of the mast. These hold a 3/4" PVC tube to the inside of the mast for the running of optional instrument wires.

The final tuning of the mast should take place while sailing to windward in a medium breeze of 8 to 10 knots. Sighting along the backside of the mast from deck level will indicate what further turnbuckle adjustment needs to be made to the WINDWARD side of the mast. The top of the mast SHOULD NOT "hook" to windward. In a medium breeze the mast should be straight and this is normally accomplished by taking up on the lower shrouds. ALWAYS TACK, and then make the turnbuckle adjustments on the now LEE or slack side of the mast and then sight the mast on the new,

5.17.1 (continued)

windward side, for further corrections. After a few tacks, the mast should be straight! Secure the rigging by inserting cotter keys into the turnbuckles, spread them open and cover with tape to prevent any snags!

Special attention should be given to the initial stretch of the rigging, especially after the first sail in a strong breeze. In windy conditions it is actually desirable to have the mast head "fall-off" slightly to leeward, giving the mast a smooth, even curve from head to deck. In a tall rig the intermediates play an important part in controlling the upper mast section and this will be especially noticeable in stronger wind conditions. After a few more sails in strong breezes, the rigging should be checked again for tune, as additional stretch will occur.

5.17.2 Backstays

When racing, the backstay may be tightened to compensate for extra forward loading applied by the Genoa. At the conculsion of the race it is very important to "slack-off" the amount you "took-up" on the backstay turnbuckle, as this avoids setting up unnecessary strains on the hull and rig. Since you want to keep the mast straight while racing, you will probably tighten up on the jib stay first so when the backstay is slacked off the mast head will hook slightly forward. When the backstay is tightened up, this "hook" will disappear and the mast will be straight.

Too much tension on the backstay is probably the prime reason for mast and rigging failure. It has been found that tension in the backstay can increase 150% to 200% due to the wind load on the headsail and dynamic loading due to heavy seas. With the optional hydraulic type adjusters tension can easily be applied far beyond that which is necessary or safe. The tension on a shroud or stay should not exceed 25% to 30% of the cable's breaking strength at the outside limit. Below are the breaking strengths, in pounds, for 1 x 19 stainless steel wire cable as supplied by the factory.

3/32" = 1,200	3/16" = 4,700	9/32" = 10,300
1/8" = 2,100	7/32" = 6,300	5/16" = 12,500
5/32" = 3,300	1/4" = 8,200	3/8" = 17,500

5.17.2 Backstays (continued)

On insulated backstays, unless otherwise specified, the upper insulator is located 18" down from the top swage eye, while the lower insulator is 7'6" up from the bottom swage eye.

5.17.3 Genoa Gear

The trend in modern yacht design has been to smaller main sails and larger jibs or "Genoas". Usually any sail that overlaps the mast is considered a Genoa and is identified by the amount of this overlap. Thus, if the distance from the face of the mast to the bow ("J" on the sail plan) is 10 feet and a line 15 feet distant (LP) was drawn parallel to the headstay, then any Genoa with a CLEW on that line would be a "150% Genoa". What is extremely important to realize is that these large sails can concentrate very high loads over a very small area, hence the gear must have a high safe working load. For example: in 25 knots of wind, a Genoa is subjected to a pressure of about 4 pounds per square foot, or ONE TON for a 500 square foot Genoa.

Since the above load could easily be transmitted to one spot at any given time, ALL of the Genoa Gear has been designed and prepared to accept those extreme loads. The track is thru bolted and all blocks are oversize. All other fittings are of the best possible design and strength FOR THE JOB INTENDED. Most fitting failures occur from improper usage, usually by trying to use a light or cheap fitting instead of the proper factory recommended one. If loads are expected to come close to the SAFE WORKING LOAD of the block, then the next size larger MUST BE USED. Please remember that if a line turns back on itself, like all halyards, spinnaker sheets, guys, and jib top sheets, then the load on that block is almost DOUBLED.

5.17.4 Spinnaker Gear

With the trend to larger Genoas, the spinnakers also get larger and need larger and stronger gear to handle them. As with the Genoa Gear, our Spinnaker Gear has been designed and fabricated to meet the extreme loads that this beautiful, but sometimes frustrating, sail can produce. While not included in the Spinnaker Gear, the optional Reaching Strut is a necessity on boats over 30', and could

5.17.4 Spinnaker Gear (continued)

well be used on smaller ones. In beam reaching conditions, when the pole is up against the headstay, an unnatural load is put on the mast, stay, and pole. The reaching strut allows for a better angle of pull for the after guy, pulling the pole off the headstay and thus reducing the loads to a safer point. This also eliminates chafe of the after guy on the upper shroud. To save wear and tear, read up on spinnakers and then have a couple of experienced friends join you for the first couple of spinnaker drills.

5.17.5 Reefing Gear

Two methods of mainsail reefing, roller and cringle (jiffy reefing), are in common use and their pros and cons could be discussed forever. On boats that have their mainsheet on the end of the boom, there may be a roller reefing mechanism contained in the gooseneck fitting. An optional GEARED ROLLER REEFING GOOSENECK may be installed in which a handle cranks the boom around and the sail is rolled down around the boom.

With mid-boom sheeting, most people will use the optional "Cringle Reef System", which is well illustrated and explained by drawing STD-00-0030. This system is quite fast, provides better "sail shape control" than does roller reefing and is definitely recommended for the racing skipper. It is really up to you to figure out if you want to go to roller reefing or cringle reef. After having consulted your own local experts you will know enough so anything we can add would be superflucus!

5.17.6 Folding Mast and Hinged Mast Step

If you have equipped your boat with this optional item it is completely explained and illustrated by drawing STD-02-18201.

6.1 INTRODUCTION TO FIBERGLASS

6.1.1 Composition and Properties of Glass Fibers

Glass is a combination of several common raw materials such as silica (sand), line, and alumina, plus small percentages of other elements. Among known solid materials, glass is unique in that it has no detectable crystalline structure. It is essentially a supercooled liquid of immeasurably high viscosity and surface tension.

Glass potentially has very high strength. This is one reason it is produced in fibers that are then combined to form the tough, high-impact-strength material known as fiber glass and used as a reinforcement for plastics. On a pound-for-pound basis, glass fibers are actually stronger and stiffer than steel.

E-glass fibers are the most common in use today because of their low cost and good fiber forming characteristics, strength, and electrical properties.

Glass fibers normally have a sizing (coating) applied during their manufacture. There are various types of sizings, but all have some common purposes: (1) to bind monofilaments together into a more easily handled fiber called a strand, (2) to lubricate monofilaments so that they do not abrade and break each other and thus cause reduced strand strength, and (3) to promote surface contact between the fiber and the laminating resin -- that is, to increase fiber wettability. Special purpose sizings are sometimes applied to alter the properties of the glass fibers.

6.1.2 Forms of Commercial Glass Fiber

Glass fiber materials are supplied commercially in the form of roving, woven roving, and cloth. Another form is milled fibers, which are mixed with resin to serve as a filler and stiffener in patching putty.

6.1.3 Resins

Glass fiber materials are laminated with plastic resins to form fiber-glass-reinforced plastic products, such as boats and automobiles. Commercially available laminating resins are synthetic polymers of a class called polyesters. Most

6.1.3 (continued)

are soluble in styrene monomers and are, in fact, sold as solid resins dissolved in styrene monomer. Special-purpose resins can be made fire-retardant, flexible, thixotropic (slow to drain off a vertical surface) or corrosion-resistant, to name just a few.

Polyester resins vary considerably in their physical properties after cure. That is why it is important to select the proper resin for each of the many fiber glass products now being manufactured.

6.1.4 Catalysts, Promoters, and Polymerization

Polyester resins have to be cured before they can be useful to a manufacturer of fiber glass products. The curing process is a chemical reaction called polymerization. Chemically, this word implies the buildup of large groups of molecules held together by chemical bonds. If many molecules group together in this fashion, the resulting product is a hard, rigid solid that assumes the shape of its container.

For all practical purposes, the container is called a mold, and the polymerization is called gellation, or, simply, a cure.

Two ingredients are essential to the successful polymerization of a polyester resin: a catalyst and a promoter. A catalyst is a material that, by its presence, aids a chemical reaction without actually taking part in the reaction itself. In the classic case, a catalyst could be removed from the products of a chemical reaction and used again and again. Polyester resin development, however, has lead to the use of peroxide compounds as catalysts for the curing reaction. Being somewhat unstable, though, these compounds tend to break down and thus yield other products that actually do the catalyzation. The peroxide compounds also cannot be recovered afterward because the product of a polyester cure is a solid resin mass. Nevertheless, as the peroxides do not chemically enter the polyester reaction, they are true catalysts.

A promoter is a material that enhances the action of a catalyst without actually having any catalytic value itself. Most resin manufacturers supply resin either with or without a promoter mixed in ("Promoted" or "Unpromoted"). All the promoted forms have a reasonable long shelf life when stored as directed.

6.1.4 (continued)

Ideally, resin should be so catalyzed that it begins to solidify as soon as it has been combined with the desired reinforcement and formed into the desired shape. Since the time required for these operations varies, refer to the resin manufacturer's data sheet to determine the correct amount of catalyst (and promoter, if required) for good results. The time required for solidification to begin is commonly known as the gel time.

Even mildly over catalyzed resin cures in a hard solid rather sooner than desired, so that the time available for the production of a finished part is reduced and quality may be lowered. On the other hand undercatalyzed resin may cure very slowly, if at all, and attempts to use it will result in a prolonged waste of time and labor.

To lengthen the "pot life" of catalyzed polyester resin, fiber glass workers recommend the following practices.

1. Mix only small quantities of resin and catalyst at a time.

2. Avoid high ambient (surrounding air) temperatures.

3. Keep containers cool, such as by placing them in ice water.

Here are some suggested safety precautions:

1. Allow ample ventilation.

2. Keep away from open flames and sparks.

3. If promoter is required, add carefully controlled amounts to the resin first, and then add the catalyst.

4. Never mix just promoter and catalyst together - a violent explosion will result.

6.1.5 Gel Coats

The glossy, opaque, and (usually) colored surface of a fiber glass product is called the gel coat. Its purpose is to protect the product as well as make it attractive to the eye. For example, the gel coat covers up protruding surface

6.1.5 (continued)

fibers of the reinforcing material, acts as a barrier to liquids, and limits degradation that may result from ultraviolet radiation. It also eliminates the need for painting the product after it has been built.

Although the gel coat is on the "top",or surface, of the fiber glass product, it is applied first during its construction, usually by spraying it on the walls of the mold. The remaining fiber glass reinforcements are then laminated onto the gel coat, permanently bonding it to the molded product.

Gelcoats consist of a complex mixture of several materials, including a curable polyester resin, a colorant, and a catalyst, which are formulated according to specific requirements.

6.1.6 Fiber Glass Laminates

Glass fibers reinforce polyester resins much like steel rods or mesh reinforces concrete. In both instances, the more reinforcement you add, the higher the breaking force of the end product - but only up to a point. After that point has been reached, the breaking force remains about the same, but the strength (pounds per square inch) actually decreases.

For glass-fiber/polyester-resin laminates, however, the percentage of glass fibers is usually limited by other factors, such as economics and workability. For instance, manufacturers of fiber glass boats make their laminates just slightly stronger than what is required for normal safety considerations. The current practice is to add from 25 to 40 percent glass by weight to the laminate.

The choice of a particular form of glass fiber is dictated both by the properties desired in the finished laminate and by the method of layup (discussed in Chapter 2). Generally, the continuous fiber forms (woven roving and cloth) offer the most strength for a given thickness of laminate. Their advantage lies partly in their continuous fiber form and partly in their capacity to be well saturated and wetted with relatively small amounts of resin. Thus, higher glass contents with higher strength can be achieved.

6.1.6 (continued)

Chopped fiber materials include mat and other chopped rovings. Although roving is sold as continuous strand material, it is usually chopped during use. These materials offer non-directional strengths and are applied behind gel coated surfaces to prevent the weave pattern of the cloth or woven roving from being transferred to the exterior surface. Still, chopped fibers do not provide as high a level of strength and stiffness as do the continuous fiber products.

6.1.7 Manufacture of Fiber Glass Products

Fiber glass products are manufactured by combining the basic materials described in a suitable mold. Several techniques are used, two of which are hand layup and sprayup.

In hand layup fiber glass materials (mat, woven roving and/or cloth) and resin are placed manually in the mold. But, first, the mold has to be prepared. It is cleaned thoroughly, cracks and flaws are repaired, and a release agent (such as a wax) is applied. The proper gel coat is then brushed or sprayed onto those mold surfaces corresponding to the external surfaces of the finished part.

After the gel coat has cured, enough glass fiber laminates for the desired thickness of the product are cut to fit the mold, and the resin is prepared with catalysts and/or promoters. Glass and resin are then added alternately until the laminate is complete. Each layer of glass and resin is worked with serrated or grooved rollers or squeegees to facilitate the resin's wetting of the glass, to remove air bubbles, and to obtain the desired thickness.

The finished laminate is allowed to gel undisturbed: and then, as soon as practicable, it is extracted from the mold and set aside to complete its cure before subsequent finishing operations begin.

In Sprayup, a mechanized improvement on hand layup, resin and chopped fiber glass roving are sprayed simultaneously onto the mold surface. The resulting mass is then rolled and cured.

6.2 BASIC PROCEDURES FOR REPAIRING SURFACE DAMAGE

6.2.1 Introduction

The purpose of this chapter is to give you the basic procedures for making surface repairs to gel-coated fiber glass products or parts.

IMPORTANT: To determine how to repair a particular type of surface damage refer first to the appropriate section.

Surface repairs to fiber glass products or parts consist of restoring the gloss, removing scratches, and repairing air bubbles, nicks and small holes, gelcoat crazing, and gel coat wrinkling. The basic procedures described in this section generally apply to all of the above repairs, except restoring the gloss.

A. Tools and Materials Needed

Tools and materials needed for repairing all six types of surface damage covered in this manual are given below.

TOOLS

Heavy duty polisher	Harsh grit buffing compound
Buffing pad (for polisher)	Acetone
White cloth	Water
Sanding block	Gelcoat
Putty knife	Cab-o-sil collodial silica
Cellophane	Catalyst
Single edge razor blade	Milled fibers
Rubber squeegee	Sandpaper - 100, 220, 400, 600 grit

B. Preparing the Surface

For restoring gloss or removing scratches, the surface is first cleaned with acetone. For repairing other types of damage, the damaged material is first removed with sandpaper or a putty knife, and then the void is cleaned with acetone. BE SURE TO READ THE APPROPRIATE CHAPTER FIRST.

C. Patching the Surface

1. Make a smooth, thick, manageable putty with the ingredients given in the appropriate section (6-9) for the type of surface damage you are repairing. (No patch is required for restoring gloss or removing scratches.)

6.2.1 (continued)

2. Apply the putty firmly in the void with a putty knife to force out all the trapped air. Build up the damaged area about 1/4" above the surface.

3. Immediately after you have applied the putty, place a piece of cellophane over the patch to start the cure. The cellophane should overlap the patched area about 1 inch on all sides.

4. With a single-edge razor blade, squeegee over the cellophane to remove excess putty and air bubbles. Hold the razor blade at as low an angle as possible, that is, almost flat in relation to the surface. This technique leaves enough excess gel coat in the patch to allow for shrinkage and removes most of the remaining excess gel coat from the area. If you do not allow shrinkage, the gel coat will be below the surface when it cures, and you will have to apply additional putty.

5. With the razor blade, and before the gel coat cures, scrape off the excess gel coat that you removed from the patched area in Step 4 above.

6. Allow the putty to become firm and hard to the touch. Then remove the cellophane.

D. Sanding the Patch

1. Block-sand the patch with 220 grit sandpaper to remove the excess putty and to restore the area to its original shape.

2. If tiny pin holes appear in the patched area after you have removed the excess putty, apply additional putty as instructed in Steps A through C below. If there are no pin holes, go on to Step 3.

IMPORTANT

Confine the sanding operation as close as possible to the patch. Pay very close attention to the area at all times. In that way you can remove the excess putty and contour the area properly without sanding through the gel coat to the fiber glass. As a result, you won't have to spray the area in order to restore the surface to its proper condition.

a. Apply just enough putty to fill the pin holes. In that way the area will require very little sanding.

6.2.1 (continued)

b. Cover the patch with cellophane to start the cure. Remove the excess putty with a single edge razor blade (see Procedure D, Steps 4 and 5 above).

c. When the putty has cured, remove the cellophane and block-sand the patch with 220-grit sandpaper as instructed in Step 1 above.

3. Remove all dust with a white cloth saturated with water.

4. Wet sand the area with 400 grit sandpaper and water to remove the scratches resulting from the 220 grit sandpaper.

5. Wet sand the area with 600 grit sandpaper and water to remove the scratches resulting from the 400 grit sandpaper.

E. Buffing the Patch

1. Attach buffing pad to a heavy duty polisher and apply harsh grit buffing compound to the pad.

2. Holding the polishes at a 45 degree angle, buff the patched area with just enough pressure to remove remaining scratches, sandpaper, grit, etc.

3. Restore the gloss to the area by holding the polisher flat and applying only light pressure.

F. Spraying the Patch

1. If you have sanded through the gel coat or other surface finish (that is, fiber glass is visible) while patching a damaged area, you must spray the patched area with the appropriate finishing coat. For the proper finishing procedures see Section 6.4.

2. Some types of surface repairs always require a finishing coat. When these repairs have been made be sure to finish them in accordance with the procedures given in Section 6.4.

6.2.2 Restoring Gloss

NOTE: Restoring the gloss to a fiber glass product takes very little time but enhances its appearance con-

6.2.2 (continued)

siderably, giving it an almost like new shine. For maximum satisfaction after you have repaired a hole or fracture, buff the entire unit, not just the repaired area.

TOOLS	MATERIALS
Heavy duty polisher	Harsh grit buffing compound
Buffing pad	Acetone
White cloth	Water

B. Cleaning the Surface

1. Saturate a cloth with acetone.

2. Wipe the surface of the fiber glass unit with the saturated cloth to remove all loose debris. If not removed, debris can scratch the finish during buffing.

3. Repeat Step 1 as necessary to remove all debris.

C. Buffing the Surface

1. Attach buffing pad to a heavy duty polisher and apply harsh grit buffing compound to the pad.

2. Holding the polisher at a 45 degree angle, buff the unit with just enough pressure to remove grease, grit, and grime.

CAUTION: APPLY MINIMUM PRESSURE TO CORNERS AND EDGES SO AS NOT TO REMOVE THE GEL COATING.

3. Holding the polisher flat on the surface and applying very light pressure, buff the unit to restore the gloss and remove slight scratches.

4. To remove heavier scratches, see Section 6.2.3.

6.2.3 Removing Scratches

TOOLS	MATERIALS
Heavy duty polisher	Harsh grit buffing compound
Buffing pad	Acetone
White cloth (2)	Water
Sanding block	Sandpaper, 200,400,600 grit

6.2.3 (continued)

B. Preparing the Surface

1. Saturate a white cloth with acetone.

2. Wipe scratched area with the saturated cloth to remove all loose debris. If not removed, debris can cause additional scratches.

C. Removing the Scratch

1. Block sand the scratch with 220 grit sandpaper until scratch disappears.

2. Wipe the sanded area clean with a white cloth saturated with water. This step is necessary to prevent large particles of dust from scratching the gel coat.

IMPORTANT

Carefully observe the scratch while sanding it so that you can stop sanding immediately when the scratch has been removed. If you are not careful you might sand all the way through the gel coat and thus have to replace it.

D. Sanding, Buffing, and Spraying

1. Wet sand the repaired area as instructed in Section 6.2, Procedure E, Steps 4 and 5.

2. Buff the repaired area as instructed in Section 6.2, Procedure F.

3. If the gel coat has been sanded through during Procedure C, above (that is, fiber glass is visible), you must spray the area with a finishing coat. For the proper finishing procedures see Section 6.4.

6.2.4 Repairing Air Bubbles

TOOLS	MATERIALS
White cloth (2)	Acetone
Sanding block	Water
Putty knife	Gel coat
Cellophane	Cab-o-sil
Single edge razor blade	Catalyst
	Sandpaper 220, 400, 600 grit

6.2.4 (continued)

B. Preparing the Surface

1. Remove all the damaged gel coat surrounding the air bubble (or "air void") with a putty knife. The damaged gel coat chips off easily when you apply pressure to the putty knife. Don't stop chipping until you have worked your way back on all sides to gel coat that is undamaged, sound, or firm.

2. Clean the resulting void thoroughly with a white cloth saturated with acetone. If the void is not cleaned properly, a black ring will appear around the area after it has been patched.

C. Preparing the Patch

1. Make a smooth, thick, manageable putty by mixing Cab-o-sil and a matching gel coat. Mix thoroughly until all lumps have been removed.

IMPORTANT

If all lumps are not removed from the putty they will trap air that in turn will leave tiny pin holes in the area being patched. The lumps also will appear as white spots in the patched area.

2. Add catalyst to the putty in accordance with the manufacturer's instructions. Mix thoroughly so that no uncured spots will occur in the patched area on the unit.

D. Patching the Void

See Section 6.2, Procedure D, Steps 2 thru 6.

E. Sanding the Patch

See Section 6.2, Procedure E.

F. Buffing the Patch

See Section 6.2, Procedure F.

G. Spraying the Patch

If the gel coat has been sanded through during Procedure E above (that is the fiber glass is visible) you must spray the area with a finishing coat. For the proper finishing procedures see Section 6.4.

6.2.5 Repairing Nicks and Small Holes

TOOLS	MATERIALS
Heavy duty polisher	Harsh grit buffing compound
Buffing pad (for polisher)	Acetone
White cloth (2)	Water
Sanding block	Gel Coat
Putty Knife	Catalyst
Cellophane	Milled fibers
Single edge razor	Sandpaper 200, 400 & 600 grit

B. Preparing the Surface

1. Remove the damaged material from the nick or small hole with the edge of a putty knife.

2. Clean the damaged area thoroughly with a white cloth saturated with acetone.

C. Preparing the Patch

1. Make a thick, creamy, manageable putty by mixing equal amounts of milled fibers and a matching gel coat.

2. Add catalyst to the putty in accordance with the manufacturer's instructions and mix thoroughly.

D. Patching the Nicks and Small Holes

See Section 6.2, Procedure D, Steps 2 thru 6.

E. Sanding the Patch

See Section 6.2, Procedure E.

F. Buffing the Patch

See Section 6.2, Procedure F.

G. Spraying the Patch

If the milled fibers in the patch affect the color of the gel coat so that the color does not match that of the unit being repaired, you should spray finish the area with a matching color. For the proper finishing procedure see Section 6.4.

6.2.6 Repairing Gel Coat Crazing

TOOLS	MATERIALS
Heavy duty polisher	Harsh grit buffing compound
Buffing pad	Water
White cloth	Gel coat
Sanding block	Cab-o-sil
Putty knife	Catalyst
Cellophane	Sandpaper 100, 220, 400 & 600
Single edge razor blade	

B. Preparing the Surface

1. Remove the crazed (cracked) area entirely by block sanding with 100 grit sandpaper.

IMPORTANT

If all the crazed area is not removed it will continue to spread after the unit being repaired has been returned to normal use.

2. While sanding, be careful not to make ripples and indentations in the gel coat surrounding the craze. If ripples and indentations do appear after the craze has been removed, go to Procedure C below.

3. If, after you have completed sanding the surface, the craze appears in the fiber glass below the gel coat, to to Section 6.3, Fracture & Puncture Repairs.

4. If, after you have completed sanding the surface, there are no ripples or indentations and the craze does not appear in the fiberglass go to Procedure D below.

C. Patching Ripples and Indentations

NOTE: This procedure applies only if ripples and indentations appear in the gel coat as a result of sanding the crazed area (Procedure B above).

1. Make a smooth, thick, manageable putty by mixing Cab-o-sil and a matching gel coat. Mix thoroughly until all lumps have been removed.

6.2.6 (continued

IMPORTANT

If all lumps are not removed from the putty, they will trap air that in turn will leave tiny pin holes in the area being patched. The lumps also will appear as white spots in the patched area.

2. Add catalyst to the putty in accordance with the manufacturer's instructions. Mix thoroughly so that no uncured spots will occur in the patched area.

3. Apply the putty to the ripples and indentations as instructed in Section 6.3, Procedure D, Steps 2 through 6.

4. Sand the patched area as instructed in Chapter 6.3, Procedure E.

5. Buff the patched area as instructed in Section 6.3, Procedure F.

6. Spray finish the area with a matching color as instructed in Procedure D below and in Section 6.4.

D. Spraying the Repaired Area

NOTE: This procedure applies only when all necessary repairs to the crazed area have been completed: that is, the area has been sanded, any craze extending as a fracture into the fiber glass has been repaired, and any ripples and indentations have been patched.

Spray finish the repaired area with a matching color. For the proper finishing procedures, see Section 6.4.

6.2.7 Repairing Gel Coat Wrinkling

TOOLS	MATERIALS
White cloth	Acetone
Sanding block	Gelcoat
Putty Knife	Cab-o-sil
Rubber Squeegee	Catalyst
	Sandpaper 100 grit
	Cellophane

6.2.7 (continued)

B. Preparing the Surface

1. Remove as much of the wrinkled area as possible with a putty knife.

2. Remove the rest of the wrinkled area by block sanding smoothly with 100 grit sandpaper.

3. Clean the area thoroughly with a white cloth saturated with acetone.

C. Preparing the Patch

1. Make a smooth, thick manageable putty by mixing Cab-o-sil and a matching gel coat. Mix thoroughly until all lumps have been removed.

IMPORTANT

If all lumps are not removed from the putty they will trap air that in turn will leave tiny pin holes in the area being patched. The lumps also will appear as white spots in the patched area.

2. Add catalyst to the putty in accordance with the manufacturer's instructions. Mix thoroughly so that no uncured spots will occur in the patched area.

D. Applying the Patch

1. Apply the putty smoothly over the damaged area with a rubber squeegee.

2. Cover the area with cellophane and allow putty to cure.

E. Sanding the Patch

Block sand the patched area with 100 grit sandpaper to remove excess putty and to restore the original contour of the area.

F. Spraying the Patch

Spray-finish the patched area with a matching color. For the proper finishing procedure see Section 6.4.

6.3 FRACTURE AND PUNCTURE REPAIRS

6.3.1 Basic Procedures for Repairing Fractures and Punctures

The purpose of this chapter is to give you the basic procedures for repairing fractures and punctures (holes) in the fiber glass (that is, below the gel-coat surface) of a fiber glass product or part. Sections 6.3.2 thru 6.3.7 give specific variations in the basic procedures according to the type of fracture or hole.

IMPORTANT

To determine how to repair a fracture or puncture, refer first to the appropriate section.

Fractures are classified as (1) simple fractures, which do not penetrate the fiber glass structure and (2) compound fractures which do penetrate the structure but which can be reached from both outside and inside the structure (Section 6.3.3) or only from the outside (Section 6.3.4).

Punctures are classifled as (1) holes that can be reached from both inside and outside the structure (6.3.5) or only from the outside of the structure (6.3.6) and (2) holes that are larger than 1/4 inch (6.3.7).

TOOLS	MATERIALS
Power sander	Fiber glass mat
24 grit sanding disc	Fiber glass cloth
Sanding block	Resin
Rubber squeegee	Catalyst
Putty knife	Sandpaper 50 & 100 grit
Scissors	Gel coat
Stirring stick	Cab-o-sil collodial silica
Paintbrush	Cardboard
White cloth	Acetone
Cellophane	Woven roving
Wire	Masking tape
Stick	Milled fibers

B. Removing Damaged Fiber Glass

1. Remove the damaged fiber glass from the fractured area or puncture with a power sander and 24 grit sanding disc. To restore the strength to the damaged area you must sand outward (on all sides) from the fracture or puncture at least 2". This technique allows the subsequent fiber glass patch to bond to structurally sound material. Also, be sure to cup out the sanded area smoothly so as to achieve a smooth, even buildup.

6.3.1 (continued)

2. Clean the area with a white cloth saturated in acetone.

C. Cutting the Fiber Glass Patch

1. Cut pieces of fiber glass mat to build up the sanded area. Cut the first piece to the size of the lowest point of the sanded area and continue outward with other pieces for an adequate buildup. The last piece of mat should overlap the others about 1/4 inch.

2. Build up the sanded area about 1/8 inch above the top to allow for shrinkage of the resin. Press the pieces of dry fiber glass mat firmly in the area with your hands to insure a sufficient buildup. If there are any low spots add more pieces of mat.

IMPORTANT

Fiber glass mat will not maintain its thickness when wet out with resin. That is why it is so important to press the pieces of dry mat firmly into the area with your hands to insure a sufficient build-up.

3. Cut a piece of fiber glass cloth that completely overlaps the built-up patch about one inch.

D. Wetting Out the Patch

1. Mix resin and catalyst thoroughly with a stirring stick to prevent uncured spots. Follow the resin manufacturer's directions for proportions.

2. One at a time, place each piece of fiber glass mat on a piece of cardboard and apply the catalyzed resin ("wet out") with a paint brush. Saturate the pieces of mat thoroughly and work out air bubbles with the paint brush before applying the pieces to the sanded area. Using the cardboard prevents resin from draining into the sanded area being repaired.

6.3.1 (continued)

E. Applying The Patch

1. As you apply each piece of wetted mat to the sanded area, work out the air bubbles with the paintbrush and your index finger.

IMPORTANT

If air bubbles are not removed they will leave deep voids in the patch after sanding so that you might have to apply additional fiber glass mat.

2. Place the piece of dry fiber glass cloth over the patch immediately after the last piece of mat has been applied.

3. Apply a rubber squeegee over the cloth. Hold the squeegee at a 45 degree angle and apply it from one end of the cloth to the other. Let the undamaged area surrounding the patch serve as a guide for contouring the patch properly.

NOTE: Besides restoring the approximate original shape to the area, the squeegee removes the remaining air bubbles in the patch. Also, the cloth makes squeegeeing possible. It is impossible to squeegee directly on wetted mat.

IMPORTANT

Take extreme care to remove as little of the resin as possible from the patch. If too much resin is removed with the squeegee the patch will be resin poor: that is, not enough resin will remain in the patch to combine with the fiber glass.

4. Remove the piece of cloth immediately after the patch has been properly squeegeed. Removing the cloth reduces the amount of sanding that has to be done later.

5. Allow the patch to cure before going to Procedure G.

F. Sanding the Patch

1. When the patch has cured, remove the majority of the excess fiber glass and restore the original contour to the area with the power sander and 24 grit sanding disc.

6.3.1 (continued)

2. Remove the remaining excess fiber glass and all ripples from the patch by block sanding the area thoroughly with 50 grit sandpaper. Apply the sanding block in a continuous pattern across the patch so that ridges will not be left from the block.

3. Clean the area thoroughly with a white cloth saturated with acetone.

G. Finishing the Surface

1. Mix Cab-o-sil with gel coat to form a thick creamy putty.

2. Add catalyst to the gel coat putty in accordance with the manufacturer's instructions.

3. Apply the catalyzed gel-coat putty to a rubber squeegee.

4. Apply the putty smoothly over the patch with the squeegee to fill all the tiny pin holes. Hold the squeegee at a 45 degree angle, and fill in any minor indentations in the fiber glass patch with the gel coat putty.

5. Allow the putty to cure.

6. Remove the excess putty and properly contour the area by block sanding with 100 grit sandpaper.

7. Spray finish the area with matching gel coat. For the proper finishing procedures see Section 6.4.

6.3.2 Repairing Simple, Non-penetrating Fractures

TOOLS	MATERIALS
Power sander	Fiber glass mat
24 grit sanding disc	Fiber glass cloth
Sanding block	Resin
Rubber squeegee	Catalyst
Putty knife	Sandpaper 50 & 100 grit
Scissors	Gel coat
Stirring stick	Cab-o-sil
Paintbrush	Cardboard
White cloth	Acetone
Cellophane	

6.3.2 (continued)

B. Repair Procedure

A simple fiber glass fracture is one that does not go all the way through the structure being repaired. To repair this type of fracture see Section 6.3, Procedures C through H.

6.3.3 Repairing Compound Fractures From Outside And Inside The Structure

TOOLS	MATERIALS
Power Sander	Fiber glass mat
24 grit sanding disc	Fiber glass cloth
Sanding block	Resin
Rubber Squeegee	Catalyst
Putty Knife	Sandpaper 50 & 100 grit
Scissors	Gel coat
Stirring stick	Cab-o-sil
Paintbrush	Cardboard
White cloth	Acetone
Cellophane	Woven roving

B. Repairing Outside of Structure

When a compound fiber glass fracture is accessible from both outside and inside the structure, begin on the inside. Repair the fracture as instructed in Section 6.3, Procedures C through G.

IMPORTANT

Omit Step 3 (cleaning patch with acetone) of Procedure G in Section 6.3 for now. Also, when removing damaged fiber glass with the power sander (Section 6.3, Procedure C, Step 1) do not sand all the way through the structure.

C. Repairing Inside of Structure

1. On the inside of the structure, remove the remaining damaged fiber glass as instructed in Section 6.3, Procedure C, and until you can see the patch that you have applied on the outside of the structure.

6.3.3 (continued)

2. If the fiberglass design on the inside of the structure resembles a heavy woven material, build up the sanded area with alternating pieces of fiber glass mat and woven roving - instead of just mat - as instructed in Section 6.3, Procedures D through F. If the design resembles a light woven material, use alternating pieces of fiber glass mat and cloth. In either case, apply a piece of mat as the first layer in the sanded area, and then continue alternating the cloth with the mat.

NOTE: The final piece of fiber glass cloth applied is the one that overlaps the built-up patch about 1 inch on all sides (Section 6.3, Procedure D, Step 3).

3. Continue the repair as instructed in Section 6.3 Procedure G, Steps 1 and 2 (sanding the patch).

D. Finishing the Outside and Inside Surfaces

1. Clean the outside and inside patched areas thoroughly with a white cloth saturated with acetone.

2. Apply gel coat putty to the outside and the inside patched areas as instructed in Section 6.3, Procedure E.)

3. Spray finish the outside and inside repaired area with matching gel coat, as instructed in Section 6.4.

6.3.4 Repairing Compound Fractures From Outside the Structure Only

TOOLS		MATERIALS	
Power sander	Scissors	Gelcoat	
24 grit sanding disc	Stirring stick	Cab-o-sil	
Sanding block	Paintbrush	Cardboard	
Rubber squeegee	White cloth	Acetone	
Putty knife	Cellophane	Fiberglass clo	
	Fiberglass mat	Resin	
	Catalyst	Sandpaper 50 & 100 grit	

6.3.4 (continued)

B. Repair Procedure

When a compound fiber glass fracture is accessible only from the outside of the structure, repair it as instructed in Section 6.3, Procedures C through H. However, when removing the damaged fiber glass initially with the power sander (Procedure C, Step 1, in Section 6.3), do not sand all the way through the structure so that a hole is formed. Leave just enough damaged material to serve as a backing for the patch.

6.3.5 Repairing Punctures From Outside and Inside The Structure

TOOLS	MATERIALS
Power Sander	Fiber glass mat
24 grit sanding disc	Fiber glass cloth
Sanding block	Resin
Rubber squeegee	Catalyst
Putty knife	Sandpaper 50-100 grit
Scissors	Gelcoat
Stirring stick	Cab-o-sil
Paintbrush	Cardboard
White cloth	Acetone
Cellophane	Woven Roving
	Masking Tape

NOTE: A puncture is a hole that goes all the way through the fiber glass structure being repaired. When the hole is accessible from both outside and inside the structure, repair it as instructed in this chapter, beginning on the outside (Procedure B, below).

B. Repairing Outside of Structure

1. Remove all damaged fiber glass as instructed in Section 6.3, Procedure C.

2. Now go to the inside of the structure and cut a piece of cardboard that overlaps the hole by at least one inch. Shape the cardboard so that it conforms perfectly (comes in complete contact) with the hole.

3. Place a piece of cellophane over the INSIDE of the cardboard (the side that will come in contact with the hole and surrounding area).

6.3.5 (continued)

4. Place the cardboard firmly over the hole, with the cellophane between the hole and the cardboard.

5. Secure the cardboard over the hole with masking tape.

IMPORTANT

To restore the strength to the damaged area, the cardboard must be placed flush against the hole. Areas that do not come in complete contact with the cardboard will be structurally weak.

NOTE: The cardboard serves as a backing against which the patch on the outside of the structure can be applied. (Step 6 below).

6. Return to the outside of the structure and patch the hole as instructed in Section 6.3, Procedures D through G.

IMPORTANT

Omit Step 3 (cleaning patch with acetone) of Procedure G in Section 6.3 for now.

C. Repairing Inside of Structure

1. Remove the piece of cardboard and cellophane from inside of the structure.

2. With the power sander and 24 grit sanding disc, remove enough of the fiber glass from the area so that at least two pieces of fiber glass patching material can be applied. Following the general instructions of Section 6.3, Procedure C, sand outward about 2 inches on all sides from the patch that you have applied from the outside of the structure. Complete both Steps 1 and 2 of Procedure C in Section 6.3.

3. Patch the hole as instructed in Section 6.3, Procedures D through G.

IMPORTANT

Select the layers of patching materials according to the type of fiber glass visible on the inside of the structure (see Section 6.3.4, Procedure C, Step 2).

6.3.5 (continued)

D. Finishing the Outside and Inside Surfaces

1. Clean the outside and the inside patched areas thoroughly with a white cloth saturated with acetone.

2. Apply gel-coat putty to the outside of the inside patched areas as instructed in Section 6.3, Procedure H.

3. Spray finish the outside of the inside repaired areas with matching gel coat as instructed in Section 6.4.

6.3.6 Repairing Punctures From Outside the Structure Only

TOOLS	MATERIALS
Power sander	Fiber glass mat
24 grit sanding disc	Fiber glass cloth
sanding block	Resin
Rubber Squeegee	Catalyst
Putty knife	Sandpaper 50 & 100 grit
Scissors	Gel coat
Stirring stick	Cab-o-sil
White cloth	Acetone
Wire	Milled fibers
Stick	
Cellophane	

B. Removing Damaged Fiber Glass

1. Remove the damaged fiber glass from the area as instructed in Section 6.3, Procedure C.

NOTE: If the hole is small and roughly contoured, shape it with the sander so that a piece of cardboard can be easily inserted through the hole.

2. When cleaning the area thoroughly with acetone, (Section 6.3, Procedure C, Step 2), insert the saturated cloth through the hole and clean around the edges underneath. This underneath area must be completely free of water, oil, and wax so that the patch to be applied there will bond properly.

6.3.6 (continued)

C. Inserting the Back-up Patch

1. Cut a piece of cardboard so that it overlaps the hole at least one inch on all sides.

2. Insert a piece of wire through the cardboard, in a U-shape, so that the wire enters at one end of the cardboard, passes along the length on the reverse side, and comes back to the front at the opposite end.

3. Insert the cardboard through the hole.

4. Pull the ends of the wire toward you to determine whether the piece of cardboard comes in complete contact with the hole from the underneath area. If the cardboard does not come in complete contact with the hole, remove and properly shape the cardboard with your hands so that it conforms to the hole. Then insert it through the hole again to determine whether it is flush against the hole.

IMPORTANT

The cardboard must be removed from the hole and reshaped as many times as necessary until it conforms perfectly. This procedure is necessary for the area to be restored to its original structural soundness.

5. When the cardboard has been properly shaped, remove it from the hole.

6. Remove the wire from the cardboard.

7. Make a backup patch for the hole by cutting a piece of fiber glass cloth and mat to the size of the cardboard.

8. Place the piece of cloth on top of the cardboard and the mat on the top of the cloth.

9. Wet out the patch by applying catalyzed resin (see Chapter 6.3, Procedure B, Step 1) to the cloth and mat with a paintbrush. Be sure to work out all the air bubbles as you go.

10. Reinsert the wire through the cardboard and the fiber glass patch.

6.3.6 (continued)

11. Insert the cardboard through the hole.

12. Pull the wire toward you until the patch is flush against the hole. The fiber glass cloth and mat should be in complete contact with the hole from the underneath area.

13. Place a stick across the sanded area.

14. Tie the ends of the wire around the stick to hold the backup patch securely in place.

NOTE: This patch serves as a backing against which additional layers of fiber glass patching can be applied.

15. Allow the patch to cure.

16. When the patch has cured, separate the wire from the stick.

17. Cut off the ends of the wire as soon as possible to the patch.

18. Remove the remaining visible ends of the wire with the power sander.

D. Sealing the Backup Patch

1. Mix resin and milled fibers in equal proportions.

2. Add catalyst to the mixture in accordance with the manufacturer's instructions.

3. With a putty knife, apply the catalyzed mixture around the corners where the backup patch comes in contact with the hole to seal off any sections of the hole that have not come into complete contact with the backup patch.

4. Allow the mixture to cure.

5. When the mixture has cured, feather or roughen up the area lightly with the power sander and 24 grit sanding disc. Be sure to cup out the sanded area smoothly so that a smooth, even buildup can be achieved.

6.3.6 (continued)

E. Patching the Remaining Area

Continue the repair by building up the remaining area of the hole with pieces of fiber glass mat as instructed in Section 6.3, Procedures D through G.

F. Finishing the Surface

Complete the repair by finishing the surface of the patched area as instructed in Section 6.3, Procedure H.

6.3.7 Repairing Holes Over 1/4 Inch in Diameter

TOOLS	MATERIALS
Power sander	Fiber glass mat
24 grit sanding disc	Fiber glass cloth
Sanding block	Resin
Rubber squeegee	Catalyst
Putty knife	Sandpaper 50 & 100 grit
Scissors	Cardboard
Stirring stick	Acetone
Paintbrush	Woven roving
White cloth	Masking tape
Cellophane	Milled fibers

B. Sanding the Hole

1. With the heavy duty sander and 24 grit sanding disc, sand all sides of the hole outward at least 2 inches.

2. Cup out the sanded area smoothly so that at least two layers of fiber glass mat can be applied later.

C. Applying the Backup Patch

1. From outside the structure being repaired, fasten a piece of cardboard and cellophane over the hole as instructed in 6.3.5, Procedure D, Steps 2 through 5.

NOTE: The cardboard serves as a backing against which the milled-fiber putty can be applied from outside the structure. (Step 2, below).

6.3.7 (continued)

2. Make a putty of equal amounts of resin and milled fibers. Mix thoroughly, and then add catalyst in accordance with the manufacturer's instructions.

3. From outside the structure, apply the catalyzed putty in the hole with a putty knife. Build up the hole smoothly and evenly.

4. Allow the putty to cure.

5. After the putty has cured, remove excess putty with the power sander and 24-grit sanding disc. Cup out the sanded area smoothly so that a smooth even buildup can be achieved.

6. Clean the area thoroughly with a white cloth saturated with acetone.

D. Patching the Outside of the Structure

Continue the repair from outside the structure by building up the remaining area of the hole with pieces of fiber glass mat as instructed in Section 6.3, Procedures D through G.

E. Finishing the Outside Surface

Complete the repair from the outside by finishing the surface as instructed in Section 6.3, Procedure H.

F. Patching the Inside of the Structure

1. Inside the structure, remove the cardboard that you fastened over the hole in Procedure C, Step 1, above.

2. If the patch applied to the outside of the structure in Procedure D, above, CANNOT be seen from inside the structure (for example, it is behind the instrument panel of a boat), complete the inside repair as instructed in Procedure G, below.

3. If the patch CAN be seen from inside the structure, complete the inside repair as instructed in Procedure H, below.

6.3.7 (continued)

G. Repairing Hole That Cannot Be Seen Inside the Structure

1. Feather the area thoroughly with a sanding block and 50 grit sandpaper.

2. Clean the area with a white cloth saturated with acetone.

3. Cut one piece of fiber glass mat that completely overlaps the hole (filled with the back up patch of catalyzed resin and milled fibers) at least 1 inch.

4. Make a mixture of resin and catalyst with a stirring stick in accordance with the manufacturer's instructions. Mix thoroughly to prevent uncured spots.

5. On a piece of cardboard, and using a paintbrush, wet out the piece of mat with the catalyzed resin.

6. Apply the piece of mat over the hole. Remove air bubbles with the paintbrush and your index finger.

NOTE: Now that the hole has been filled with a mixture of catalyzed resin and milled fibers, the fiber glass mat has been applied over the interior and exterior of the hole, the area has been restored to its original structural soundness.

IMPORTANT

Because the repaired area cannot be seen from inside the structure, it does not have to be sprayed with gel coat.

H. Repairing Hole That Can Be Seen Inside the Structure

1. Sand outward at least 2 inches on all sides of the hole with the power sander and 24 grit sanding disc so that additional fiber glass materials can be applied. Cup out the sanded area smoothly so that a smooth, even buildup can be achieved.

6.3.7 (continued)

2. Clean the area thoroughly with a white cloth saturated with acetone.

3. Select the layers of patching materials (mat and woven roving, or mat only), according to the type of fiber glass visible on the inside of the structure. (see Section 6.3, Procedure C, Step 2).

4. Patch the area as instructed in Section 6.3, Procedures D through G.

5. Complete the repair by finishing the surface as instructed in Section 6.3, Procedure H.

IMPORTANT

Spray finishing the surface is necessary when the repaired area can be seen from inside the structure, such as a boat or shower stall.

6.4 FINISHING TECHNIQUES

NOTE:

It is recommended that small areas be finished with gel coat because the color and texture of the surrounding surface should be matched. For new surfaces, it is best to obtain the gel coat in the original color from the manufacturer of the part being repaired. If for any reason matching gel coat is not available, obtain a gel coat that matches the surrounding color as closely as possible and, if necessary, shade the gel coat with polyester paste colors to more closely match the surrounding color.

TOOLS	MATERIALS
Suction spray gun	Gel coat
White cloth	Catalyst
100, 400, & 600 grit wet & dry sandpaper	Acetone
Masking tape	Polyvinyl alcohol (PVA)
Sanding block	Buffing compound
Paper	Water
Stirring sticks	
Buffing pad	
Heavy duty polisher	

B. Preparing the Surface

1. Prepare the surface as instructed in Section 6.2.1.

2. After the area has been thoroughly sanded and feathered, apply masking tape. Where possible, place the tape on a sharp break or contour adjacent to the area. This technique minimizes slight color or texture differences after spraying.

NOTE:

Mask a large enough area so that you will not have to spray closer than 2 inches to the tape. If you spray up to the tape, a thick lap line that is difficult to remove will result.

3. It is of extreme importance to sand and feather evenly to the tape after it has been applied. If you don't, the gel coat overspray will not bond, and peel-back or flaking will occur.

6.4 (continued)

4. Cover with paper any areas that may possibly be exposed to overspray.

5. Clean the area thoroughly with a white cloth saturated with acetone to remove all dust or debris.

C. Preparing the Gel Coat and Spray Equipment

1. Thin the gel coat approximately 25 percent with acetone to get sprayable consistency. Do not thin more than 50 percent; otherwise the acetone will dull the finish.

2. Adjust the air pressure to between 30 and 40 pounds.

3. Add the exact amount of catalyst recommended by the gel coat manufacturer. Mix thoroughly to avoid uneven cure.

4. Test spray gun on a piece of cardboard and adjust pattern control and trigger to regulate pattern. The two should be balanced. The smaller area to be sprayed, the more the pattern and trigger nozzles should be closed.

D. Applying Gel Coat

1. Position surface and/or lights so that you can see the spray pattern as it forms on the surface.

2. Spray gel coat on the area. Spray uniformly to avoid producing light and heavy areas. Apply 10 to 15 mils of gel coat -- approximately 6 mils per pass - to allow proper flow and thus minimize "orange peel" and to produce sufficient buildup for final sanding and buffing.

CAUTION: MOVE GUN SLOWLY OR GEL COAT WILL RICOCHET OFF THE SURFACE.

3. Spray a very light film of polyvinyl alcohol (PVA) over the gel coat immediately. This film seals off the air and speeds up the cure to a non-tacky surface that can be sanded. It also protects the finish from dust.

6.4 (continued)

4. Remove the masking tape; and, as soon as the gel coat has cured, block-sand it with 400 grit sandpaper and water to remove orange peel and any lap lines that may have developed. Hand-sand if necessary to smooth stubborn areas.

5. Wet-sand with 600 grit sandpaper.

6. To restore gloss, buff with harsh grit buffing compound and heavy duty polisher.

6.4.1 Finishing Large Areas with Epoxy Enamel

When a large area needs to be refinished, it is recommended that the entire section be done with a good quality epoxy enamel.

Manufacturers of epoxy enamels supply application instructions on the labels of the cans and in published booklets. The manufacturer's instructions should be followed since different types require different solvents and/or handling.

The following is a typical epoxy enamel finishing system which can be used as a guide.

TOOLS	MATERIAL
Suction spray gun or Paint brushes (good quality bristle) White cloth 100, 400, 600 grit wet or dry sandpaper Masking tape Sanding block Paper Stirring sticks	Sanding surfacer - if required by enamel manufacturer Epoxy enamel of desired color Thinner - as specified by manufacturer

B. Preparing the Surface

1. Prepare the surface as instructed in Section 6.2.

6.4.1 (continued)

2. After the area has been thoroughly sanded, mask off the area to be finished with tape and paper. Be sure to cover all areas that will be exposed to overspray, or spatter if you are using a brush.

3. Clean the area thoroughly with a white cloth saturated with the thinner specified by the enamel manufacturer. Remove all dust or debris.

C. Preparing the Epoxy Enamel and Spray Equipment

1. Follow the manufacturer's instructions printed on the package label. If a two-part enamel is used, be sure to measure accurately and mix thoroughly.

2. Follow manufacturer's instructions for thinning. It is important that you do not over thin the enamel and that you use the specified thinner.

3. If you are going to spray the enamel, test the spray pattern on a piece of cardboard and adjust pattern control and trigger to regulate pattern.

D. Applying the Epoxy Enamel

1. Position surface and/or lights so that you can see the spray pattern as it forms on the surface.

   If you use a brush be sure it is a good, properly prepared bristle. Brush the enamel on evenly.

2. If multiple coats are specified by the enamel manufacturer, allow proper drying time and sand lightly between coats.

6.4.2 Protective Maintenance

One of the major benefits of a fiber glass reinforced structure is the reduction of maintenance chores. There are only three relatively easy maintenance rules to follow to keep the surface looking like new.

6.4.2 (continued)

1. Clean the exterior surface with detergent and a soft sponge, and apply a good automotive type wax. Do this about as often as you would clean and wax your car.

2. Touch up and patch scratches, scars, and small breaks.

3. Repair any major breaks as soon as possible to avoid additional damage to the structure.

The outside surface of a fiber glass structure is usually formed by a colored gel coat. This is a special resin material containing concentrated color. It produces a smooth, finished surface that will give many years of service when these simple maintenance steps are followed.

COLUMBIA YACHT CORPORATION

Launching & Commissioning Record

DEALER _____

_____

OWNER _____

_____

HULL NUMBER _____

CLASS MODEL NUMBER _____

DATE BUILT _____

DATE SOLD _____

PLANT _____

OPERATION BEFORE LAUNCHING:

All hose clamps tight	
All thru-hull fittings O.K.	
Bottom clean and paint O.K.	
Hull sides clean and finish O.K.	
Bright work clean and finish O.K.	
Decks clean and finish O.K.	
Interior finish O.K.	
Upholstery clean and fits	
Mast clean and complete	
Thru-hull valves closed	
All keel bolts right	
All bonds O.K.	

WITH BOAT IN WATER:

No leaks, outboard well, thru-hulls shaft log, rudder post	
No leaks thru-hull fittings when open	
Hose test window & cabin leaks	
All electrical equipment operates	
Water system operates - 1 hour test	
Fuel & water tanks checked for leaks	
Check battery water level	
Stove system holds pressure	
All toilets operate O.K.	
Engine and shaft alignment O.K.	
All keel bolts tight	

RIGGING & EQUIPMENT:

PRIOR TO STEPPING MAST

Check hardware & opt. items against Invoice	
Wind and thru-hull instruments work	
Check pins in rigging	
Winch handles fit	
Halyard lengths O.K.	
Rigging, including toggles correct length	
All mast lights work before stepping	
Check steering inside lazarette	
Install sealer around mast where applicable	

OPERATION BEFORE STARTING ENGINE:

Contact engine dealer for warranty inspection	
Check prop shaft set screws and wire	
Check engine mounts nuts	
Ignition and wiring connected	
Throttle and choke cable O.K.	
Clutch control and cable O.K.	
Crankcase oil level at "Full"	
Reverse gear oil level "Full"	
Engine intake water open	
Dual fresh water cooling expansion tank "Full"	
Check bilges for gas fumes	