

ALUMINUM PAINT SPECS

What follows is a very detailed specification from Doug Templeton at DETCO. If you follow Doug's prescription to the letter, you have an excellent chance of getting a paint job which will last for years.

1.0 Surface Preparation

1.1 Structural Hull Completion

As all internal fabrication and external welding are completed, but before the application of any exterior coatings, grinding of the entire plated hull surface on the outside should be undertaken with 36 grit or heavier abrasive, taking care to thoroughly scour the plating to provide adequate "tooth" for coating system.

Sandblasting is an option but should be followed by a thorough grinding.

1.2 Weld Grinding

Surface grind to flush level all external weld beads as closely as is structurally possible, with commercial rotary grinder, to achieve as fair surface as possible. All hollows and voids noted after grinding should be rewelded and ground to flush level. All corner beads should be ground.

1.3 Fairing of Plating

After weld beads and plates have been ground, final fairness should be checked with long battens and any possible corrections accomplished at this level by cold forming. Consideration should be given to as fair a surface as possible at this point, to eliminate unnecessary accumulation of fairing compound.

1.3.1 Removal of Existing Coatings from Previously Painted Surfaces

Most effective for the removal of an existing enamel, epoxy, or polyurethane system with their attendant low-density fairing compounds, is the process of grinding with 16-24 grit abrasive. Because low-density fairing compound is absorbent enough to the shock of sandblasting, substantially more-abrasive media is required. The efficiency of sandblasting tends, therefore, to be less, compared to aggressive abrasive grinding.

Care should be taken after removal of all traces of coatings from the broad surfaces, to do the same on all weld beads, using either rotary wire brushes, 3M surface-conditioning abrasive discs, die grinders, or a combination of the three. When most of the coating system has been removed from weld beads, lower-capacity sandblasters or waterblasters may be used to cleanup the rough welded surfaces.

1.4 Degreasing and Acid Etching

Remove all obvious accumulations of grease or surface contamination manually and follow with aggressive scrubbing using C-8762 or C-8761, if there is any doubt as to the presence of grease or oil deposits.

Alumiprep 33 is an acid etch combined with a surfactant to accomplish minor grease and oxide removal in one operation. Apply full strength or dilute no more than one part Alumiprep 33 to one part water, and apply liberally to all surfaces to be coated using thick plastic scrub brush. Workers should be protected with appropriate eye and skin protective gear. Wire brushes shall not be used. Mix etch in plastic containers only.

As Alumiprep 33 is applied to surface, scrubbing action will reveal clean, shiny metal. Surfaces should be scrubbed until complete wetting is noted. Material shall be reapplied to all areas where incomplete wetting is evident.

After metal is thoroughly clean and surface is completely wet, rinse with water and *do not allow to air-dry*.

1.5 Treatment with Conversion Coating

As soon as Alumiprep 33 has been washed from surface and *before drying*, apply Alodine 1201, full strength, preferably with low-pressure garden sprayer (using plastic equipment only) or large, soft, full bristle brush and continue applying so that surfaces do not dry. After 3-5 minutes surface should turn a watchband gold color, after which a full water wash is undertaken. It is not abnormal when Alodine 1201 has been applied in this manner for the surfaces treated to be less than perfectly uniform. Do not be alarmed for this is the ordinary result. The predominance of the surface should have an iridescent coloration, however.

1.6 Any areas where stain does not appear to have "taken" should be retreated with Alumiprep 33, rinsed with water, and Alodine 1201 should be reapplied. Excess stain, indicated by a dark amber, less-transparent color, shall be avoided.

1.7 After copious water wash, allow to air dry and proceed immediately to the instructions in Section 2.

1.8 Before the application of primer, do not recontaminate treated surfaces, do not use dirty rags thereupon, and do not weld without retreating involved areas.

2.0 Application of Strontium Chromate Primer to Hull Surfaces

2.1 Make sure surfaces are dry and well stained with Alodine 1201. Take care to use clean, filtered high-pressure air to blow any traces of residual water from corners, non-welded joints, and weld beads.

2.2 Thoroughly mix equal parts Sterling U-2554 Chromate Primer and Sterling U-2566 Primer Catalyst and allow to pre-react for 30 minutes. Thin to appropriate viscosity with Sterling U-1289 Reducer after pre-reacting and apply by conventional spray with pressure pot or via airless. Airless application should require very minimal thinning, while conventional requires 15-20 percent. Primer should be applied in film thickness of at least 10-15 mm, surface should be allowed to dry for 1-2 hours, and a second application should be undertaken to a similar coating thickness.

2.3A third application of primer after a 2-hour wait, or overnight at the latest, may be made with Sterling U-2555 White High Build Primer, catalyzed and reduced similarly. This provides a distinct color contrast with the U-2554, thus, when fairing compound is sanded, a showing of white denotes the time to cease sanding in that area until more compound is added to the surrounding sub-flush areas. This guide coat helps prevent cutting through the chromate barrier in the high spots.

2.3.1 Sterling's U-4747 High Silver Chromate Primer may be used as an improved alternative to the U-2554. This material is low VOC and thus compliant with the most stringent of air-pollution regulations. Importantly, it is far easier to sand.

Mix equal parts U-4747 with U-4748 Catalyst and allow 30 minute pre-reaction time. Thin approximately 25 percent with Sterling U-1289 Reducer and apply by conventional spray with pressure pot or airless equipment. This primer may be applied in film thickness of 10-15 mm in one application. A second pass to a similar film thickness should be applied as soon as first pass is tack-free. This may take a few hours in cooler conditions. After several hours, when firm to the touch or overnight, it may be recoated with High Silver Buff High Build Primer (U-4749), mixed 1:1 with U-4748 Catalyst, thinned about 25 percent, to be applied as a guide coat as described in paragraph 2.3.

3.0 Fairing of Hull Surfaces

3.1 After primed surface has thoroughly cured, sanding with 60-100 grit abrasive is recommended to provide adequate "tooth" for fairing compound.

3.2 Using long, flexible fairing batten, mark all obvious low spots.

3.3 Mix equal parts Sterling U-2706 Epoxy Fairing Compound and Sterling U-2710 Catalyst (allow to stand for 15 minutes in temperatures below 65 degrees Fahrenheit) and apply by trowel to all low spots. *Do not add solvent.*

3.3.1 An applicator may choose to utilize another brand of low-density fairing compound or may make up their own using generic epoxy, West epoxy, or other similar products. While Sterling and Detco can make no warranty of fitness for such materials, generally those manufactured by the prominent marine coatings companies and West are found satisfactory.

It is felt, most definitely, however, that using a pre-manufactured fairing compound is the best method of retaining uniformity from batch to batch, preventing the incidence of "hard spots" or irregularities in the faired surface due to differences in compound density.

It is the opinion of Detco and Sterling, furthermore, that the use of extremely low-density filler for fairing compound may result in diminished impact resistance and vulnerability to softening or movement in high heat conditions in tropical and subtropical exposures. Easier sanding, therefore, has its trade-offs.

3.3.2 Do not use polyester fairing compound, for these materials tend to be water attractive or hygroscopic and contain solvents which may result in blistering substantially after a vessel has been launched.

3.3.3 Do not add solvents to fairing compounds, to facilitate spreading.

3.4 After all low spots have been filled to desired thickness, all hull surfaces should be coated with at least 1/8 to 1/4 inch or more of prepared fairing compound to provide adequate "cushion" for subsequent grinding and longboard sanding, to protect the integrity of primed surfaces.

3.5 After cure period of at least 24-48 hours, depending upon ambient temperatures, coarse abrasive grinding will remove obvious high spots. 24-36 grit abrasive will speed the process.

3.6 Long and somewhat flexible sanding boards should be used to bring high and low spots together. Use grinders only for significant highs.

3.7 Longboards should be moved horizontally, vertically, and at varying angles during the board-sanding process to achieve the fairest possible surface.

3.8 After completion of all filling, fairing, and sanding, use high-pressure, filtered air to remove all dust and sanding residue.

4.0 Priming Faired Hull Surface

4.1 Thoroughly mix Sterling U-2555 Epoxy Primer and Sterling U-2566 Catalyst in equal proportions, allow to stand 30-60 minutes, reduce to desired viscosity with U-1289, for airless or pressure pot conventional spray application.

4.2 At temperatures above 70 degrees Fahrenheit, apply 15-20 mm wet film thickness in at least two passes to cover porous surface of sanded fairing compound. A second application is applied after 1-4 hours' drying time, when first coat should be firm to the touch.

4.2.1 An improved alternative to the above primer is Sterling's U-4749 High Silver Epoxy Primer, which is mixed 1:1 with U-4748 Catalyst, pre-reacted for 30 minutes and reduced to desired application viscosity with U-1289 Reducer. This product is low VOC and complies with the most stringent of air pollution regulations. Importantly, it is far easier to sand.

4.2.2 CAUTION: In cooler climates or in application or post-application conditions below 65-70 degrees Fahrenheit, there is a danger of solvent absorption by the fairing compound if the first coat of primer is applied in an excessive film thickness. Restrict the first application, therefore, to approximately 10-15 mm wet and

allow overnight drying before applying additional material which should build to a total of 15-20 mm dry. For application in temperatures above 70 degrees Fahrenheit, a 10-15 mm wet film may be applied, followed by a second application after several hours' drying time, or when first coat is firm to touch. Recoat may be delayed to overnight in cooler conditions.

4.3 Using longboards with 80-150 grit abrasive, depending upon spray profile, sand surface to expose remaining highs and lows. Refair or reprime as necessary and resand all resurfaced areas.

4.4 Glaze as necessary to fill nominal low spots and deep sanding grooves with epoxy putty (International Red Hand as an example) and sand fair with 120-150 grit abrasive, using firm boards to maintain surface fairness. A tight glaze of entire surface is the most cost effective way to fill deep scratches, at this stage, to make ready for finish priming.

5.0 Intermediate/finish Priming

5.1 Mix Sterling U-1000 Primer and Sterling U-1000C Catalyst in 2:1 ratio, reduce approximately 10 percent with Sterling U-1014 Reducer, and apply by conventional or airless spray to entire surface in sufficient coating thickness to cover the abrasive profile from board sanding.

5.1.1 As an alternative to U-1000, Sterling's new Fine Silver Epoxy Primer may be used to comply with the most stringent of air pollution regulations. U-4750 White or U-4751 Grey Epoxy Finish Primer, mixed 1:1 with U-4752 Catalyst may be used. This product is pre-reacted 30 minutes before thinning as needed with U-1289 up to 25 percent for VOC compliance. Application by airless, pressure feed, siphon feed, roller/brush, or HVLP is appropriate.

5.1.2 The two Fine Silver colors permit the guide coat technique at this level as a final test of surface fairness and to indicate complete defect filling. Use either color for the first coat and switch to the other for a final thinner pass. Sand until a uniform base coat color is attained.

5.2 Complete sanding operation to remove all texture from primer and residual abrasive profile, up to 220 grit dry.

5.3 All remaining imperfections should be filled with epoxy putty and spot-primed.

5.4 After final sanding, blow dust from surface with clean, uncontaminated air and do not allow to be contaminated prior to gloss application.

6.0 Gloss Application

6.1 Catalyze Sterling Linear Polyurethane Color Base 1:1 with Sterling U-1001C Catalyst, adding up to 1/4 ounce per catalyzed gallon Sterling U-2900 Accelerator in cases where application temperatures are not expected to reach 65 degrees Fahrenheit, or when faster film cure time is desired. Allow to stand 30-45 minutes. Do not use accelerator if ambient conditions do not require it or use less than noted maximum.

6.2 Reduce catalyzed urethane mixture approximately 25-30 percent with Sterling U-1014 Reducer at temperatures above 70-75 degrees Fahrenheit and Sterling U-1385 Reducer in lower ambient temperatures. U-1275 may be used where temperatures exceed 75-80 degrees Fahrenheit.

6.3 Using at least 60 psi air pressure at gun, fine atomizing air cap and fluid orifice no greater than 0.045 inches, apply first or "tack" coat of urethane so that surface is wet and film has good surface continuity. Thickness will be about 1.5-2.0 mm wet, just enough material to wet out surface.

6.4 Allowing first coat to dry until firm (approximately 45 minutes to one hour at 70 degrees Fahrenheit) apply second coat, in final application process, to achieve full flow (to thickness of about 2.0 mm wet). Some applicators apply Sterling Gloss Polyurethane in three passes, but it is not necessary to achieve desired coating thickness.

6.5 Allow surface to dry at least 24-48 hours before applying tape for striping, unless testing proves film to be cured so that tape imprint will not occur.

7.0 Application of Coatings to Engine Room, Bilges and Interior Utility Spaces

7.1 If acid washing and Alodine application are impractical, substitute Sterling U-3225 Acid Reduced Chromate Primer, mixing same in 1:1 ratio with M-3226 Catalyst, reducing approximately 25 percent with Sterling U-1014 Reducer. This primer is applied in very minimal coating thickness, one pass with just enough to cover metal, after sanding metal with 100 grit and degreasing with solvent wipe.

7.2 Allow chromate primer to thoroughly dry for 1-2 hours and apply Sterling U-2554 Chromate Primer to achieve desired build as aforementioned.

Topcoat may be applied over primer after overnight wait with no further surface preparation. Finished film will not appear as glossy, however, as surface texture of primer will print through. Intermediate priming and sanding are required for a finer finish. All subsequent steps will follow the outlines used for exterior hull coating.

STEEL PAINT SPECS

While steel is very demanding in the initial surface preparation, paint, once applied, seems to adhere better to it with less problems than with aluminum.

1.0 Surface Preparation

1.1 Sandblast all surfaces to be coated to near-white metal (SSPC10) or better, round all welds, sharp edges, and prominences to smooth curves and remove all weld spatter before blast cleaning. Blasting shall be done with proper containment, using clean, compressed air and clean, appropriate abrasive, to obtain a profile of at least 1.5 mm.

1.2 Blow dust and grit from surface with clean, dry air and apply first prime coat as soon as practical, before rust or contamination occurs.

2.0 Application of Inorganic Zinc Primer

2.1 Apply only in good weather when air and surface temperatures are above 0 degrees Fahrenheit and surface temperature is at least 5 degrees Fahrenheit above wet bulb air temperature reading.

2.2 Maintain product in heated storage or bring material to at least 70 degrees Fahrenheit prior to mixing and application.

2.3 Mix inorganic zinc primer according to factory specifications from product's manufacturer, while stirring with power mixer. Mix at least 5-10 minutes and allow to stand for 30 minutes thereafter. Remix and strain into air agitator-equipped tank, container, or pressure pot.

2.4 Operate air agitator at low speed throughout spraying process, sufficient to keep powder in suspension and keep system closed, free of moisture.

Use thinner recommended by product manufacturer, if required, and always add thinner after powder and liquid have been mixed and have induced for requisite time period.

2.5 Apply primer by conventional or airless spray to a 2-3 mm dry-film thickness, not to exceed 4-5 mm dry-film thickness, or otherwise as specified by product manufacturer.

2.6 Film should have wet continuity and dry spray should be avoided. If dry spray residue is encountered, it should be sanded lightly from surface and blown free with clean air, before surface is recoated.

2.7 Recoat time will vary with different products in different application conditions. Consult manufacturer's recommendations or Detco Marine for re-coat instructions.

Within appropriate re-coat time envelope, apply Sterling U-2554 or U-4749 high-build chromate epoxy primer, and proceed with fairing and finishing specifications.

FIBERGLASS PAINT SPECS

Fiberglass is the easiest of the materials we've been discussing to get a primer coat to adhere to. However, the fairing process, especially when repainting existing hulls, is somewhat different.

1.0 Surface Preparation

1.1 Structural Hull/Superstructure Repairs

All structural defects shall be exposed by power grinding, relaminated, and filled to flush level as necessary so that existing defects are structurally bridged to prevent future cracking. Allow 48-hour cure before application of primer.

2.0 Fairing of Repaired or Large Sub-Flush Areas

2.1 Sand all newly-laminated surfaces with 60-grit or coarser abrasive to provide adequate "tooth" for primer.

2.2 Apply barrier coat of Sterling U-2555 or U-4749 per Specification 3.0.

2.2.1 Allow 48-hour cure time, sand primed area with 60-grit, blow dust away with clean, filtered air, and proceed with fairing.

2.3 Mix equal parts Sterling U-2706 Epoxy Fairing Compound and Sterling U-2710 Catalyst (allow to stand for 15 minutes in temperatures below 65 degrees Fahrenheit) and apply by trowel to all low spots.

2.3.1 Applicator may choose to utilize another brand of low-density fairing compound or may make up their own using generic epoxy, West epoxy, or other similar products. While Sterling and Detco can make no warranty of fitness for such materials, generally those manufactured by the prominent marine coatings companies and West are found satisfactory.

It is felt, most definitely, however, that using a pre-manufactured fairing compound is the best method of retaining uniformity from batch to batch, preventing the incidence of "hard spots" or irregularities in the faired surface due to differences in compound density.

It is the opinion of Detco and Sterling, furthermore, that resorting to extremely low-density filler for fairing compound may result in diminished impact resistance and vulnerability to system motility or movement in high heat conditions in tropical and subtropical usage.

2.3.2 Do not use polyester fairing compound, for these materials tend to be water-attractive or hygroscopic and contain solvents which may result in blistering substantially after a vessel has been launched.

2.3.3 Do not add solvents to fairing compounds, to facilitate spreading.

2.4 After cure period of at least 24-48 hours, depending upon ambient temperatures, coarse abrasive grinding is used to remove obvious high spots. 24-36 grit abrasive will speed the process.

2.5 Long and somewhat flexible sanding boards should be used to bring high and low spots together.

2.6 Longboards should be moved horizontally, vertically, and at varying angles during the board sanding process to achieve the fairest possible surface.

2.7 After completion of all filling, fairing, and sanding, use high-pressure, filtered air to remove all dust and sanding residue.

3.0 Priming Faired Hull Surface

3.1 Thoroughly mix Sterling U-2555 Epoxy Primer and Sterling U-2566 Catalyst in equal proportions, allow to stand 30-60 minutes, reduce to desired viscosity with U-1289, for airless or pressure pot conventional spray application.

3.2 At temperatures above 70 degrees Fahrenheit, apply 15-20 mm wet film thickness in at least two passes to cover porous surface of sanded fairing compound. The second application is applied after 1-4 hours' drying time, when first coat should be firm to the touch.

3.2.1 An improved alternative to the above primer is Sterling's U-4749 High Silver Epoxy Primer, which is mixed 1:1 with U-4748 Catalyst, pre-reacted for 30 minutes and reduced to desired application viscosity with U-1289 Reducer. This product is low VOC and complies with the most stringent of air pollution regulations. Importantly, it is far easier to sand.

3.2.2 CAUTION: In cooler climates or in application or post-application conditions below 65-70 degrees Fahrenheit, there is a danger of solvent absorption by the fairing compound if the first coat of primer is applied in an excessive film thickness. Restrict the first application, therefore, to approximately 10-15 mm wet and allow overnight drying before applying additional material which should build to a total of 15-20 mm dry. For application in temperatures above 70 degrees Fahrenheit, a 10-15 mm wet film may be applied, followed by a second application after several hours' drying time, or when first coat is firm to touch. Recoat may be delayed to overnight in cooler conditions.

3.3 Using longboards with 80-150 grit abrasive, depending upon spray profile, sand surface to expose remaining highs and lows. Refair or reprime as necessary and resand all resurfaced areas.

3.4 Glaze as necessary to fill nominal low spots and deep sanding grooves with epoxy putty (International Red Hand as an example) and sand fair with 120-150 grit abrasive, using firm boards to maintain surface fairness. A tight glaze of entire surface is the most cost effective way to fill deep scratches, at this stage, to make ready for finish priming.

4.0 Intermediate/Finish Priming

4.1 Mix Sterling U-1000 Primer and Sterling U-1000C Catalyst in 2:1 ratio, reduce approximately 10 percent with Sterling U-1014 Reducer, and apply by conventional or airless spray to entire surface in sufficient coating thickness to cover the abrasive profile from board sanding.

4.1.1 As an alternative to U-1000, Sterling's new Fine Silver Epoxy Primer may be used to comply with the most stringent of air-pollution regulations. U-4750 White or U-4751 Grey Epoxy Finish Primer, mixed 1:1 with U-4752 Catalyst may be used. This product is pre-reacted 30 minutes before thinning as needed with U-1289 up to 25 percent for VOC compliance. Application by airless, pressure feed, siphon feed, roller/brush, or HVLP is appropriate.

4.1.2 The two Fine Silver colors permit the guide coat technique at this level as a final test of surface fairness and to indicate complete defect filling. Use either color for the first coat and switch to the other for a final thinner pass. Sand until a uniform base coat color is attained.

4.2 Complete sanding operation to remove all texture from primer and residual abrasive profile, up to 220 grit dry.

4.3 All remaining imperfections should be filled with epoxy putty and spot primed.

4.4 After final sanding, blow dust from surface with clean, uncontaminated air and do not allow to be contaminated prior to gloss application.

5.0 Existing Coatings Surface Preparation

5.1 Sand all surfaces requiring only finish priming with 150-180 grit abrasive to eliminate glossy surface. Any existing subsurface defects should be filled with epoxy putty.

5.2 Using two-rag method and Sterling C-8762 Surface Preparation, wipe down all surfaces, following sanding, to remove surface contamination prior to priming.

5.3 Apply Sterling U-1000 or U-4750 Primer as described in Paragraph 4.1.1.

5.4 Sand entire primed surface to remove all texture from primer, with 220-grit, dry.

5.5 After final sanding, blow dust from surface with clean, uncontaminated air and do not allow it to be contaminated prior to gloss application.

6.0 Gloss Application

Follow instructions as indicated under the aluminum paint specification.

CUSTOM YACHT SPECIFICATION

The following specification was developed between ourselves and a very experienced owner. It ties down the details that need to be clearly defined, yet leaves the builders room to do their work in an efficient manner.

You will note in several areas references to other vessels as a quality standard. This is the best way we know of to define something as difficult as “quality”.

1. General Description
 - a) This specification is for a ketch rigged vessel to be known as a Sundeer 80. It is the intent of these specifications to describe such a vessel, complete in all regards, ready for sea trials.
 - b) When the contract drawings and specifications are in conflict, the specifications shall be deemed the controlling document.
 - c) Dimensions
 - i) Loa 80'0"
 - ii) LWL 79'0"
 - iii) Beam 16'6"
 - iv) Draft (1/2 load) 6'4"
 - v) Displacement 67,000 pounds (full load).
 - d) Fuel Capacity: 1000 US Gallons (integral tanks).
 - e) Fresh Water Capacity: 400 US Gallons (integral tanks).
 - f) Hull Construction: aluminum alloy to ABS (as a minimum) standards.
 - g) Systems: in accordance with general Sundeer practice, as modified herein.
 - h) Interior: as per contract drawings.
2. Quality Standards
 - a) This vessel is to be constructed to the highest standards.
 - b) Metal work: To be in accordance with ABS standards for weld allowance, material specifications, as modified by Sundeer structural practice to increase scantlings where necessary. It is understood that the hull above the bottom paint line is to be left bare and hull fairness must be to the highest standards. The same applies to deck and superstructure.
 - c) Joinery: To be of the highest quality.
 - d) Systems: To be neatly executed, identified, and executed as more fully detailed in the specifications which follow. Wherever feasible, materials with the longest practical service life shall be used.
3. Structural Standards/Factors of Safety
 - a) ABS Racing Yacht construction standards are to be used as a reference for Sundeer normal structural practice. In all cases the factors of safety used in the Sundeer 78, Beowulf, are to be used as a minimum.
 - b) Framing and plating bow area: to be 2.5 times ABS.
 - c) Framing and plating center of vessel: to be 2.0 times ABS.
 - d) Framing and plating aft end of vessel: to be to ABS.
 - e) Keel, keel floors, and surround structure: to be 4.0 times ABS
 - f) Rudder shaft: to be 1.5 times ABS
 - g) Chainplates: to be designed to 2.0 times breaking strength of wire for weld attachment to hull, and shroud attachment point.
 - h) Mast steps: to be 1.5 ABS requirement.
 - i) Standing rigging, side shrouds: to maintain a minimum factor of safety of 1.75 at 60 degrees angle of heel.
 - j) Aluminum welded values: to be in accordance with ABS standards.
 - k) There shall be a forward and aft water tight bulkheads.
4. Changes in specifications:
 - a) These specifications may be modified to improve the quality of the vessel under construction.
5. Dock/Sea Trials shall be conducted in a thorough manner to test all systems for infant mortality and or weak points. Sea trials shall include:
 - a) Running all systems at maximum, average, and medium loads over a period of three weeks.
 - b) Testing propulsion system at low, medium and high speed including high speed stops.
 - c) Steering system for ability to handle sailing loads and responsiveness under power.
6. Aluminum Hull
 - a) All aluminum to be used in accordance with ABS alloy specifications.
 - b) Certification on alloy to be obtained from suppliers and kept on hand for Purchaser's inspection. All aluminum materials to be marked at factory with alloy number
 - c) A series of X rays or Ultra sound tests are to be made (20 total) to check weld integrity of the following areas:
 - i) Chainplates.
 - ii) Keel floors.
 - iii) Propeller "P" bracket.
 - iv) Sample areas of hull welding.
 - d) Exterior welds shall be ground smooth on the hull and where appropriate on the deck (but not deck seams).
 - e) Exterior of hull, deck, and coamings to be ground to a 60 grit finish (excluding tread plate).

f) Tread plate to be used for deck area with sheets kept as large as possible to minimize welding. A 2" water-way area inside of toe rails shall be ground smooth.

g) Deck hatches will be welded to coamings. Deck hardware will be blind fastened to prevent leaks into the interior (except for hardware which overhangs the forepeak or the coamings).

h) Tankage is to be integral with the hull.

i) Fresh water tanks are to have a capacity of approximately 400 US gallons. These will breathe, and be filled through the aft watertight bulkhead. There will be pick ups at the forward bottom of the tanks. A single clean out per tank, over the low point, shall be furnished. Tanks are filled via the deck drains, with drain valves in the "collection position.

ii) There will be a "coffer dam" between fuel and water tanks.

iii) Fuel tanks will have a capacity of 1000 US Gallons. These will breathe, and be filled through the forward watertight bulkhead. Fuel will be delivered via a standpipe at the lower aft end. There will be a single clean out port over the low point of each of the aft end of the tanks. Volume to be checked via standpipe and stick at aft end.

a) RACOR LG100 vents to be plumbed in parallel with the combination breather pipe from both fuel tanks in the forepeak. Fuel flow from these units to be diverted back to one of the two fuel tanks..

iv) Salt water ballast tanks will be fitted port and starboard with approximately 4000 pounds of capacity per side. These shall have a single 2" drain point at the forward end and a single 1.5" fill at the aft end (top). Air vents will be 1.5" and be located at the high point or points as is required for proper venting of air.

v) There shall be a fridge tank for fresh water to be circulated through fridge compressor condensers welded into the engine room (water circulated by separate electric pumps connected to each fridge system).

vi) A day tank to supply diesel fuel to engine, genset, and diesel heater shall be welded into the engine room and have a capacity of 20 US Gallons.

vii) Tanks will be cleaned as carefully as possible before tops are welded in place.

i) Through hull fittings will be welded to the hull and occur as follows:

i) One incoming 2" fitting in the engine room for salt water supply.

ii) One exhaust fitting aft of the fridge box (standpipe).

iii) One toilet exhaust (standpipe) for forward head.

j) Other plumbing fittings as follows:

i) In forepeak topsides exhaust fitting for forward bilge and sump pumps.

ii) Separate forepeak topside exhaust for washing machine.

iii) Allowance in forward watertight bulkhead for clothes drier exhaust.

iv) In transom allowance for engine exhaust, genset exhaust, toilets, and a combination for deck drains, bilge pumps, watermakers, etc.

v) Deck drains aft to be welded to deck.

vi) Diesel heater exhaust.

k) Gas Locker provisions shall be made at the end of the hull, port and starboard side, with doors opening onto the swim step.

l) Attachment points on deck shall be provided as follows:

i) Aft deck chocks for RIB style dink.

ii) Life Raft on aft deck

iii) Cleats at aft deck (2), bow (2), and amidships (2) (midship cleats mounted on center of lateral resistance).

iv) Stern Flagstaff.

v) Stern gangway (provided by Purchaser) attachment to aft deck.

vi) Spinnaker pole

vii) Mizzen jib tack (2)

viii) Base of main and mizzen mast for turning snatch blocks.

ix) Corners of cockpit coamings for attachment of snatch blocks to lead halyards to electric main/mizzen sheet winches.

m) Hatch coamings shall be provided as follows:

i) Forepeak (Bomar 160)

ii) Forward dressing room (Bomar 160)

iii) Forward toilet (Bomar 139 Medium)

iv) Purchaser's cabin (Bomar 139 Large)

v) Main Saloon (2 Bomar 160)

vi) Pilot House (4 Bomar 139 Medium)

vii) Aft shower (Bomar 139 Medium)

viii) Aft engine room (Bomar 160)

ix) All hatch coamings shall be provided with a lip to catch "storm covers" and hold them in place.

n) Opening window (frames) shall be welded into the coamings on the inboard side of the aft toilet compartments.

i) Hull windows shall be provided as per Sundeer practice in:

ii) Purchaser's cabin forward (2)

iii) Saloon (4)

iv) Galley/Office area (4)

v) Aft guest cabins (2)

o) Pilot House structure will be as per Beowulf.

- i) With access into coamings from inside pilot house with Bomar opening hatches.
 - ii) Exterior door shall be in the form of "washboards" (Lexan).
 - iii) A sliding hatch and garage shall be provided as per Beowulf.
- p) Isolation.
 - i) All stainless steel hardware shall be isolated from aluminum with sleeves (for life line sockets) and dielectric materials for other hardware.
 - ii) Bronze winch bases shall be isolated with high density rubber (40 shore).
- q) Anchor sprit.
 - i) A single anchor sprit shall be provided for a Bruce 240 pound anchor. Allowance shall be made for the use of a self launching "wobble toggle". The sprit shall have a strut at its outboard end and shall be capable of taking asymmetric spinnaker up loading as well as anchor loads.
- r) A rubbing strake shall be incorporated around the perimeter of the hull, right at the shear line.
- s) Keel
 - i) The keel shall incorporate a sump into which batteries can be placed, along with general storage.
 - ii) Lead shall be placed in an aluminum weldment below the sump and shall be approximately 16,000 pounds of 695 pound per cubic foot lead, or better.
- t) Rudder/Steering
 - i) The rudder shall be a "spade" type, with aluminum rudder shaft, tapered as per engineering calculations.
 - ii) Quadrant shall allow for the attachment of dual hydraulic rams (Hynautics K-3) and an emergency tiller.
 - iii) A galvanized steel emergency tiller which fits on the steering tiller arm and is used via relieving tackles on deck, shall be supplied.
 - iv) Tiller arm to be carved out of 4" thick solid aluminum stock.
 - v) Rudder Bearings shall of UHMW or comparable material.
 - a) Provide one spare set of bearings.
 - vi) A Binnacle mount shall be integrated into the aft end of the cockpit table.
- u) "P" Bracket/Propeller wash reinforcement.
 - i) A high strength "P" bracket which forms a bond beam with internal structure shall be used for support of prop and prop shaft. The area of hull plating in the way of the P bracket and propeller, all the way back to the rudder bearing carrier, shall be increased to a thickness of 1/2" between the centerline longitudinal girders.
 - v) Framework for a cockpit table shall be provided from welded aluminum. Actual table to be constructed from Acrylic as on Beowulf.
 - w) Provide bolt on outboard bracket for swim step (and suitable reinforcement under swim step) to take a 25 HP outboard to be used for emergency propulsion.
 - x) Aluminum pipe frames to be installed in Forepeak for use with sail bins.
- 7. Stainless steel work:
 - a) Life line system:
 - i) Tapered, 1.25" diameter X 32" high life line stanchions to be supplied with upper and middle life lines.
 - ii) Gates to be provided on port and starboard side and to swim step, as well as just aft of main mast chainplates.
 - a) Gate fittings to be double safety style (Wichard or equal).
 - iii) Aft pushpit top rail to be solid and extend forward to side boarding gate. In this area, no middle life line will be present to allow for better dinghy storage.
 - a) Allowance to be made for storage of "Lifesling" on pushpit.
 - iv) Bow pulpit to be split with bales for attachment of halyards.
 - v) Supply two spare life line stanchions.
 - b) Exterior hand rails to be supplied as follows:
 - i) Side and aft edges of pilot house.
 - ii) Over Dorade cowl on forward coamings (2 sections each side)
 - iii) Over Dorade cowl on foredeck (1 section)
 - iv) Around perimeter of cockpit table.
 - v) On each side of swim step.
 - c) Interior hand rails are to be supplied as follows:
 - i) On each side of main bulkhead (4).
 - ii) On each side of aft shower entrance (4)
 - iii) On outboard side of aft cabin toilet bulkhead, both sides (4)
 - iv) At pilot house companionway (2).
 - v) In forward toilet compartment (2).
 - d) Overhead handrails will be supplied as follows:
 - i) In forward closet (2).
 - ii) In Purchaser's cabin (2)
 - iii) In main saloon (1)
 - iv) In aft cabins (2)
 - v) In pilot house (2)
 - vi) In engine room (2)
 - e) Ladders will be supplied as follows:
 - i) Swim step to aft deck.
 - ii) Cockpit to pilot house sole.
 - iii) Pilot house sole to main cabin sole. This ladder incorporates side rails (banisters).

f) Additional miscellaneous stainless work:

- i) Saloon table bases.
- ii) Centerline foot brace in pilot house.
- iii) Cockpit seating back rests.

8. Insulation:

a) In the living area, the topsides and deck head shall be cleaned, and chemically treated in preparation for spraying of foam.

b) Foam shall provide an "R" value of at least 6 when in a new state (equivalent to 1.5" of sprayed, two pound per cubic foot density, polyurethane foam).

c) Cabin soles shall be insulated from tank tops with at least 3/4" of structural foam.

9. Painting:

a) The hull shall be painted underwater up to a level approximately 7" above the waterline in the bow, 4" above the waterline amidships, and 5" above the waterline aft.

b) Paint system shall be in accordance with best specifications for high quality aluminum alloy yachts.

c) Four coats of suitable bottom paint shall be applied and brought up top the top of the paint line referred to above. Bottom paint to be supplied by the Purchaser

10. Hull and Pilot House windows.

a) Hull and pilot house windows shall be glazed with Lexan MR5:

- i) Light gray for pilot house windows.
- ii) Light gray for hull side windows
- iii) Note-Bomar hatches to be darkest gray tint available.

b) Windows shall sit on a Neoprene gasket.

c) Aluminum bearing rings shall be provided outside of glazing.

11. Ventilation system

a) An allowance has been made for Dorade style down pipe vents as follows:

- i) Forward closet (1)
- ii) Forward head compartment (1)
- iii) Purchaser's cabin (3)
- iv) Saloon (4)
- v) Galley/Office area (4)
- vi) Pilot House (4)
- vii) Aft Cabins (2)
- viii) Aft toilet areas (2)
- ix) Engine room (1)
- x) Forepeak (1)

b) Vents shall be Vetus "Yogi" style. There will be a total of 13 vent cowls. Vents are to be supplied with screens and cover plates.

c) Down pipes into living area shall be adjustable in air flow and sealable as per Beowulf, with directable stream of air. 8" units shall be used everywhere but in the pilot house where 6" units shall be used.

d) An exhaust fan shall be incorporated over the galley stove and exhaust through an isolated chamber within the coamings.

12. Deck Hardware shall be supplied as follows:

a) Lewmar "Solent" gear to be supplied on deck

b) Lewmar "racing" blocks to be supplied where required for halyards.

c) Toe rail tracks from main cap shrouds aft 23' to be provided.

d) Inboard jib/staysail tracks, 6' long to be placed outboard of coamings.

e) Main and mizzen sheets to be on circular travelers, with custom Lewmar cars as per Beowulf.

f) Four adjustable slider cars with internal stops to be provided for inboard and outboard tracks.

g) Six pad eye cars to be provided.

h) Six snatch blocks to be provided.

i) Lewmar Wavegrip jammers to be provided as follows:

- i) Main Sheet
- ii) Main traveler
- iii) Mizzen sheet
- iv) Mizzen traveler
- v) Main mast runner retrievers (2)
- vi) Mizzen mast runner retrievers (2)
- vii) Rail Vangs (main-2)
- viii) Main halyard
- ix) Mizzen Halyard
- x) Mizzen headsails (2)
- xi) Working jib (2)
- xii) Main spinnaker (2)
- xiii) Staysail (1)
- xiv) Roller furler (1)
- xv) Main and mizzen lazy jacks
- xvi) Spinnaker pole forguys (2)

j) Turning blocks to be provided as follows:

- i) Mizzen sheet/traveler (double-1)
 - ii) Main sheet/traveler (double-1)
 - iii) Outside tracks (double-2)
 - iv) Inboard tracks (double-2)
 - v) Return of control lines to cockpit area (quadruple-2)
- k) Miscellaneous blocks as required for:
 - i) Main mast running backstays
 - ii) Mizzen mast running backstays.
 - iii) main sheet system.
 - iv) Mizzen sheet system.
 - v) Main vang system.
 - vi) Mizzen vang system.
 - vii) Main sheet traveler.
 - viii) Mizzen sheet traveler.
 - ix) Headstay roller furler lead.
 - x) main and mizzen backstay retrieval lines.
 - xi) Main and mizzen lazy jack systems.
 - xii) Mizzen headsail to mizzen boom system.
- 13. Sail Handling Winches.
 - a) Lewmar electric Ocean Series winches with aluminum drums (2 speed manual, single speed electric) will be provided as follows:
 - i) Main sheet/traveler #58
 - ii) Mizzen sheet/traveler #58
 - iii) Main mast halyards #58
 - b) Lewmar electric Ocean Series with aluminum drums (2 speed manual, two speed electric) for headsail primaries #66.
 - c) Lewmar two speed manual Ocean Series winches are provided as follows
 - i) Secondaries #52
 - ii) Main mast halyards (2) #54
 - iii) Mizzen Mast halyards (2) #48
 - iv) Miscellaneous (4) #44
 - d) Winch handles shall be supplied as follows:
 - i) Double grip lock in (2)
 - ii) Single grip lock in (3)
- 14. Roller furling
 - a) Profurl roller furling to be installed on headstay.
 - b) Oversized "BOC" style unit to be used, model LCI 42 R 22M.
 - c) Control line to lead to cockpit area and be stopped off in such a manner as to be lead to one of the main or mizzen sheet winches (turning block inboard and after jammer may be required)
- 15. Ground Tackle
 - a) Maxwell V3500 windlass with remote operated up/down.
 - b) Chain stopper
 - c) Bruce 240 pound main anchor
 - d) Fortress #125 and #85 secondary anchors
 - i) #85 anchor to be stowed on swim step as per Beowulf.
 - e) 1000' of 7/8" "Brait" nylon for rodes and dock lines
 - f) 300' of 3/8" schedule 7 Acco chain with oversized links at each end.
 - g) Two sections of 3/8" schedule 7 Acco chain, 25' long, with oversized links at each end.
 - h) High strength shackles for attachment of anchors to chain.
 - i) Chain counter to be fitted if an acceptable unit can be found. If price exceeds existing quote, it will be adjusted.
- 16. Masts
 - a) Ketch rig, with unpainted aluminum spars. Both masts tapered, with "trisect" low friction halyards for spinners and aluminum sheaves running on oilite bearings for all halyards.
 - b) Main mast is stiffened in lower panels as required.
 - c) . Harken Batt Track to be fitted to main and mizzen masts.
 - d) Tubular, anodized, and heat treated spreaders, at 25-degree sweep angle.
 - e) Mast head running backstays for each spar. No standing backstays required.
 - f) Cutter stay for main mast.
 - g) Twin headstays, with insulators for both on mizzen mast (for use as SSB and weather fax antennas).
 - h) Steaming light fitted to main mast at lower spreader.
 - i) Mast head tri-color and anchor light fitted to main masthead.
 - j) Windex fitted to main masthead.
 - k) 50 watt spreader lights, port and starboard, fitted to main and mizzen spreaders.
 - l) Spar tight elastomeric mast partners to be cast in place.
 - m) Main mast to have conduit installed to mast head, with pull string in place for future use.
 - i) Use 1.25" conduit.
 - ii) Separate pull strings to masthead and lower spreaders.

n) Mizzen mast to have conduit installed to masthead, with pull string in place for future use to lower spreaders and masthead.

o) Port and starboard flag halyards on main mast. Eyes to be positioned at middle of spreaders to maximize clearance of signal flags from cap shrouds.

p) Jammers to be located a maximum of 74" off of deck.

q) Forespar static dissipaters to be fitted to top of both spars.

r) Halyard exit boxes and associated chafe strips to be carefully positioned to minimize line chafe.

s) Provide Lewmar #40 winches under each boom to take reefing loads.

17. Booms

a) Main and mizzen booms are fitted with internal jammer for reefing and outhaul control. Note-jammers are for transferring loads, not long term use (use winch under boom for long term loading).

b) Sheets are attached to boom via Spectra/Velcro strap as per Beowulf (straps are supplied by sailmaker).

c) Compression strut for support of both booms to be provided.

d) Stainless bales for holding sheet attachment and vang attachment in place provided.

e) Oversized gooseneck fitting to be used, mechanically fastened as well as held in place with epoxy.

i) Oilite bronze bearings to be fitted to stainless pins as wear surfaces.

ii) Supply two extra sets of bearings for each boom.

18. Standing Rigging

a) Wire to be 1 x 19 type 316 stainless steel.

b) Upper terminals to be swaged on.

c) Lower terminals on shrouds to be Norsemen or StaLok.

d) Lower terminals on runners to be swaged.

e) Open barrel turnbuckles to be used, with toggles top and bottom.

19. Running Rigging

a) Double braid Dacron, ultra low stretch running rigging to be provided as follows:

i) Main sheet (9/16")

ii) Main traveler control (9/16")

iii) Mizzen sheet (9/16")

iv) Mizzen traveler control (1/2")

v) Jib sheets (9/16")

vi) Downwind headsail sheets (1/2")

vii) Main rail vangs (1/2")

viii) Mizzen rail vang (1/2")

ix) Mizzen headsail halyards (2 - 1/2")

x) Spinnaker pole foreguys (2 - 1/2")

b) Conventional double braid Dacron to be provided as follows:

i) Headsail roller furling (7/16")

ii) Main runner retrievers (5/16")

iii) Mizzen runner retrievers (5/16")

iv) Main and mizzen lazy jack systems (3/8")

v) Main flag halyards, both sides (1/8")

vi) Pole topping lift (3/8")

c) Spectra/Dacron blend to be provided as follows:

i) Main halyard (1/2")

ii) Jib halyards (2 - 1/2")

iii) Spinnaker Halyards (2 - 1/2")

iv) Mizzen Halyard (1/2")

v) Main running backstay tails (1/2")

vi) Mizzen running backstay tails (3/8")

vii) Note-consideration to be given to the use of Vectran halyards (single part) in lieu of Spectra/Dacron.

20. Halyard shackles.

a) To be captive pin type for main and mizzen (Wichard "Allen Pin" or Schaefer captured "D" style).

b) For headsail halyards use Lewmar size three with captured bearing bales.

21. Main Engine

a) Yanmar 4LH-STE, 230 HP four cylinder turbocharged diesel to be fitted.

b) Type "C" engine panel to be installed in pilot house.

c) "Murphy" switch gauge oil pressure and water temperature gauges to be installed in engine room.

d) 3" pyrometer gauge to be installed in pilot house with probe in exhaust line.

e) Fiberglass Aqualift fitted to exhaust line.

f) Engine will be fitted with two 160 amp Electrodyne alternators, with remote diodes, controlled by a single voltage regulator. Output capacity of these alternators will be somewhat reduced by using oversized alternator pulleys so as not to exceed Yanmar PTO requirements.

g) Air filter will be replaced by a Walker Air Sep unit.

h) Stop/start buttons for main engine fitted on or near engine.

i) The following additional gauges will be fitted to engine and mounted in pilot house:

i) Engine oil temperature.

ii) Transmission oil pressure

iii) Transmission oil temperature.

- j) Anti siphon loop to be fitted to exhaust with outlet on deck.
- k) Course screen filter to be fitted on outlet side of raw water pump (for catching impeller parts).
- 22. Drive Train
 - a) Hundested VP3 propeller. Final prop diameter subject to engineering analysis.
 - i) Remote control (installed at helm in water resistant box and in pilot house).
 - b) Aqua Drive CV axle model 24800 to be used between transmission and Hundested.
 - c) Hurth 630 A-1 (down angle) gear box with 2.52-1 reduction to be employed.
 - d) A "Strong" lip seal type packing gland will be used with two spare seals installed on shaft.
 - e) Fiberglass Cutlass bearing to be used in "P" bracket.
 - f) Fit "Spurs" line cutter ahead of prop and behind "P" bracket on shaft.
- 23. Shift/Throttle system.
 - a) Hynautics hydraulic dual station, shift and throttle controls to be fitted in pilot house and at helm station.
- 24. Generator Set
 - a) 50 HP Yanmar 4JH2 (B) E genset to be fitted.
 - b) Genset will have a fiberglass Aqualift in exhaust system.
 - c) There will be two 160 amp Electrodyne alternators fitted, driven by a PTO on the flywheel.
 - d) There will be a 50 GPH watermaker pump mounted on genset.
 - e) "C" type engine panel to be fitted on interior side of engine room bulkhead (aft port toilet compartment)
 - f) A Morse type "T" handle throttle control to be fitted nearby the instrument panel.
 - g) Murphy gauges will be fitted in the engine room to water temperature and oil pressure and set up for automatic shut down of genset in event the pre-set conditions are exceeded.
 - h) Anti siphon valve to be fitted to cooling water with outlet on deck.
 - i) Fit Racor Crankvent CV400 to crankcase breather and air intake.
- 25. Expansion Tanks
 - a) Fit translucent expansion tanks to main propulsion engine, genset, and diesel heater.
- 26. Exhaust valve flap
 - a) Fit exhaust valve flaps (rubber) to propulsion engine and genset exhausts.
- 27. Prelubers
 - a) A separate preluber will be fitted to main engine and genset for pre/post lubing and changing oil.
 - b) Pre-lubers will be hard plumbed to their respective engines. A bronze T valve will be fitted to each system for removal of engine oil. To this will be attached a section of flexible hose with a 1/4" pipe plug in the end.
 - i) A welded aluminum drip tray will be constructed where it is convenient to hold waste oil containers (and the hose for engine oil removal will easily reach this point.
 - ii) Close at hand will be remote control on/off switches for each Pre-luber.
 - iii) If possible, this will be layed out so that a person can sit on the hot water heater while doing changing the oil.
 - iv) A line will be connected to the main engine suction line, controlled with a bronze steel T valve with a 1/4" pipe plug in the end. This line will be used to siphon oil from the transmission and Hundested gear box.
- 28. Diesel Fuel system
 - a) Day tank with visible sight gauge is fitted.
 - i) Sight glass to be fitted with protective cover.
 - b) Fuel is pumped up to day tank with Walbro 24V lift pump.
 - c) A spare pump with selector valves is installed
 - d) There is a day tank control float switch from National Magnetic Switches which controls on and off of pumps via a latching relay.
 - e) Alarm lights in pilot house show overfilled, pump off, pump on, 1/2 full, 1/4 full, 1/8 full.
 - f) Racor dual 75/500 FGX-2 filters (10 micron) fitted ahead of Walbro pumps. Filters are selected with built in "Y" Valve.
 - g) Dual Racor 75/500 FGX-2 series in series after 2 micron filter.
 - h) Vacuum pressure gauges to be fitted to both filters (note-comes as standard on Racor filter set).
 - i) Single Racor 500 series filter with 2 micron filter to be plumbed between heater and day tank.
 - j) Cross over valve to be fitted between hull tanks to be used to equalize fluid levels.
 - k) "Anti-theft" valve hidden under a bunk or behind joinerwork to shut off fuel supply to day tank.
 - l) Lines to all three diesels (engine, genset, heater) to be fitted with stainless steel ball valves.
- 29. Watermakers
 - a) A 24V Village Marine "Little Wonder" watermaker will be fitted
 - b) An engine drive Village Marine 1200NF will be fitted to genset.
 - c) Both systems will use the larger style NF1200 filter housings.
 - d) Both systems utilize Sur Flo 3.8 GPM 24VDC pumps for priming.
 - e) Fit 3 way PVC valve just upstream of pumps with a standard male barb hose fitting (3/4") on the open port. A second 3 way valve to be fitted downstream of membrane vessels with 3/4" male hose bar fitting in open valve port.
- 30. Coolant water conditioning system
 - a) Perry water conditioners, with shut off valves each side of filter will be fitted to main engine, genset, and diesel heater coolant system.
 - i) Note-filters come with a brazed "Y" bypass and are placed as close to the inlet/outlet ports on the diesel as possible.
- 31. Domestic hot water heater.

- a) A heavy gauge stainless steel domestic water tank, with approximate 12 US Gallons of capacity will be installed.
 - b) There will be three 30,000 BTU Cupra Nicol heat exchangers plumbed into the main engine, genset, and diesel heater.
 - c) There will be a single 1500 watt electrical heating element installed for 120V AC service.
 - d) Make tank cover removable for access to repair leaks if they ever occur.
32. Diesel Heater system
- a) A Webasto 45,000 BTU heater will be installed.
 - b) Heater will be plumbed so water circulation can be restricted to engine room when operating in warm weather.
 - c) "S" coils of copper pipe will be used under the three lower bunks.
 - d) System will be provided with drain valve, air vents at all high spots, and hot water temperature gauge.
 - i) Drain valve to be fitted at low spot in system and plumbed to closest sump.
 - e) Circulation pump will have stainless steel ball valves each side for closing off system when removing pump.
 - f) 5000 BTU blowers will be installed as follows:
 - i) Forward dressing room (1)
 - ii) Main saloon (2)
 - iii) Aft cabins (2)
 - iv) Purchaser's sleeping cabin (1)
 - g) Heater exhaust to be flexible stainless steel hose, insulated with a fiberglass blanket.
 - i) Fit condensate drain at low point.
 - ii) Provide plug for transom to prevent entry of sea-water or rain.
 - h) Thermostat to control heater and water circulation pump to be fitted in main saloon.
33. Engine room fire control
- a) Fireboy fire control system to be installed.
 - b) Fireboy automatic shut down to be connected to main engine, genset, and diesel heater.
 - c) A manual trigger is to be fitted near gen. set panel on interior side of aft water tight bulkhead.
34. Engine room sound insulation
- a) The main water tight bulkhead between engine room and living quarters shall be insulated with 2" of sound absorbing foam with one pound per square foot barrier.
 - b) Insulation to have silver Mylar coating.
 - c) Installation to be done in such a way that the insulation is mechanically captured.
35. Ballast Transfer system
- a) Ballast transfer from side to side is via gravity, using 2" schedule 40 PVC pipes. A "Y" valve controls flow from side to side or for dumping water via standpipe behind fridge system. Standpipe is fitted with 2" Forespar "Marellon" sea cock after which is fitted an Asahi 24V remote controlled valve for controlling emptying of tanks.
 - b) Tanks are fed with a 3/4HP, 24V DC Scott 60 GPM pump mounted in engine room. Flow is directed to one side or the other with a "Y" valve.
36. Steering system
- a) Hynautics hydraulic steering system to be fitted.
 - b) A Hynautics K-3 cylinder will be used for hand and autopilot steering.
 - c) A second Hynautics K-3 shall be installed for back up pilot use.
 - d) A Hynautics helm pump giving approximately 4.5 turns lock to lock shall be used.
 - e) A 40" Edson stainless steel steering wheel shall be used.
 - f) A compass will be installed (to be supplied by Purchaser).
37. Plumbing
- a) Salt system.
 - i) 2" incoming sea cock (Forespar "Marellon") hard plumbed to large capacity strainer.
 - ii) Salt water is distributed via a PVC manifold in the engine room.
 - a) There is a "T" off this manifold to feed toilets and forward anchor wash down pump in the interior.
 - iii) Deck wash provided by Sur Flow pressure pump (3.8GPM) in engine room.
 - iv) Anchor wash provided by "Y" valves on forepeak bilge pump.
 - a) Anchor wash supply to be switchable between a hose in forepeak and a fixed anchor roller fitting as on the Sundeer 64.
 - b) Domestic fresh water plumbing
 - i) Pressure provided by single Sur Flow pressure pump (3.8GPM) with one gallon pressure accumulator tank.
 - a) Fit buzzer with adjustable volume control in pilot house to enunciate when pressure fresh water pump is running.
 - ii) Hot water system to have re-circulating pump (same model as Teledyne diesel heater). Hot water to go in circle out from heater tank and back via "T" with two check valves.
 - a) Control circulation pump from main panel.
 - b) Provide stainless steel ball valves each side of this pump to ease removal during maintenance.
 - c) Circulation pump to be mounted on centerline bulkhead between two aft cabins or on aft galley bulkhead.
 - d) Make galley sink first point of connection after hot water heater.
 - iii) Hot water lines to be insulated.
 - iv) Fresh water fill.

- a) Diverter valves on deck drains are plumbed to allow catchment of rain water.
- b) Air vents for tanks are located inside of engine room.
- v) There is an allowance for installation of the following fixtures:
 - a) Aft cabin sinks (2)
 - b) Aft shower
 - c) Galley sink
 - d) Forward sink
 - e) Forward shower
 - f) Forward washing machine
 - g) Hot/cold fixture in engine room with hose which can be used in engine room or as swim shower.
 - h) Fresh water faucet at galley sink supplied by insulated line from tank in fridge.
 - (1) Install Seagull X-1F filter for this faucet. Make sure filter is located so it is easily changed.
- vi) 1 Domestic plumbing will utilize "instant connect" style fittings with "O" rings which push into a collet to connect. No special tools are to be required for this purpose. Plumbing to be rated for 200 degree F water temperature.
- 38. Miscellaneous strainers
 - a) The following devices are fitted with Surewood in line strainers, 1.25" reduced down to required sizes:
 - i) All PAR bilge pumps.
 - ii) All sump pumps except galley.
- 39. Bilge Pumping system
 - a) All bilge pumps to be PAR 3600-0010 24VDC diaphragm style units with National Magnetic Sensor heavy duty float switches triggering a 24 VDC solenoid. Bilge pumps installed as follows:
 - i) Engine room (3: port, starboard, center)
 - ii) Keel sump.
 - iii) Forepeak.
 - b) Damage control provided by:
 - i) Scott 3/4 HP 60 GPM, 24VDC pump in keel sump, triggered as per PAR pumps.
 - ii) In engine room via manifold and valving set up so either genset of main engine can draw from engine room sump.
 - c) High water float switches (National Magnetic Sensors) provided in:
 - i) Engine room.
 - ii) Keel sump.
 - iii) Forepeak.
- 40. Gray water pumping system
 - a) Galley sink evacuated via Sea Land large orifice diaphragm pump (as on Beowulf).
 - i) This pump to be mounted in engine room, with direct overboard discharge as well as connection via "Y" valve to sewage tank.
 - ii) Note-when installing the "Y" valve make connections to sewage tank, but do not cut the discharge line from pump. This will be done later if and when it is required by local ordinances.
 - b) Whale Gulper 220 to be used to pump out the following:
 - i) Aft stateroom sinks with aft shower accessed with valve.
 - ii) Forward shower.
 - iii) Forward sink.
- 41. Toilet system
 - a) Forward toilet is Raritan PH11 dumping directly overboard via standpipe.
 - b) Aft starboard toilet is Raritan PH 11 dumping directly overboard via standpipe.
 - i) Make provision for "Y" valve discharge to sewage tank.
 - c) Aft port toilet is Sea Land VacuFlush which can go to either holding tank or directly overboard.
 - i) Holding tank to be approximately 30 US Gallons, depending on space and layout of engine room.
 - ii) Holding tank to have manifold with three inlets, each accessed via a three way "Y" valve from either of aft two toilets or galley sink.
 - iii) "Y" valves to have hose barbs to match hose.
 - iv) Note-when installing "Y" valves make all connections to tank, install valves, but do not make cut into toilet discharge line. This will be done later if and when it is required by local ordinances. Allow enough slack in hose to make future connection easy.
 - d) Sea Land large orifice sewage pump to be used for evacuation (same model as for galley sink discharge).
- 42. Refrigeration System
 - a) Two parallel systems, 1/2 HP (Grunert AR50 or equal), each driving one set of fridge and freezer plates.
 - i) Systems will be fitted with suction accumulator tanks and moisture gauges.
 - ii) No soft hose will be used. Metal vibration isolators will be fitted between compressors and fixed copper lines.
 - b) Shut off valves each side of dryers.
 - c) Fridge box to be stainless steel lined, with integral eutectic tanks.
 - d) True eutectic fluid (as per Sundeer) to be used giving eighteen to 24 hours of hold over time.
 - e) Inside of boxes to be lined in stainless steel. Center shelf to be provided for.
 - f) Allowance for stainless steel basket system in fridge and freezer sections.
 - g) Holding plates to be built into stainless steel liner.

- i) Fridge cold plates are built into top.
- ii) Freezer cold plates are built into back and two sides.
- h) Expansion valves to be located on aft side of fridge box, in easily accessed area, with removable lid (insulated) which exposes total TX valve and associated plumbing.
- i) Use Danfoss or equal TX valves. Note-valves must have removable style orifices.
- j) Control system using Grunert fridge/freezer controls (or equal) to be used.
- j) Provide manual control as well as automatic.
- k) Fridge and freezer temperature gauges to be installed.
- l) Sur Flow 3.8 GPM pumps used to circulate fresh water coolant to condensing coil from hull tank.
- m) Refrigeration cabinet to have single freezer door with dual gaskets. Freezer capacity approximately eight cubic feet.
- n) Fridge doors to have single gaskets and are installed port and starboard sides. Fridge capacity approximately 18 cubic feet.
- o) Fridge insulation to be 3" Isocyanurate foam. Freezer insulation to be 6" thick Isocyanurate foam .
- 43. Propane gas system
 - a) Two, 20 pound aluminum cylinders to be provided.
 - b) The two will be stored on port side, each with its own regulator and a manual shut off valve after the regulator. Via a "T" these will feed against an electrically controlled solenoid operated from the galley.
 - c) Hose connection from solenoid to galley stove to be in one piece, without mid-point connections.
- 44. Central Vacuum system
 - a) Stainless steel, 110V canister.
 - b) Pick up points for vacuum in:
 - i) engine room.
 - ii) one aft cabin.
 - iii) at forward end of main saloon.
 - iv) In forward stateroom.
 - c) Provide two sets of hoses: one for interior and one for engine room.
- 45. Wiring
 - a) Wire type
 - i) Tinned, fine strand wire of marine grade to be used throughout.
 - b) Voltage drop
 - i) The following circuits shall be sized for a 3% voltage drop at maximum normal load:
 - a) fridge compressors
 - b) auto pilots
 - c) RADAR
 - d) SSB/Ham
 - e) Watermakers
 - f) Damage control pump
 - g) Ballast pump
 - h) all bilge pumps
 - i) all circulating pumps
 - j) all pressure pumps
 - ii) The following circuits will be sized for a 5% voltage drop at maximum continuous amperage:
 - a) Alternators on gen. set
 - b) Alternators on engine
 - c) Trace 2500 watt inverter
 - d) Power winches
 - e) Maxwell windlass
 - f) Note: 4/0 wire to be used between batteries and engine room.
 - iii) All other circuits are to be sized for a 10% voltage drop based on maximum continuous usage.
 - c) Terminals
 - i) Anchor marine grade heat shrink terminals to be used.
 - ii) To have annealed, tinned copper ends & seamless tin plated brass or bronze sleeves with serrated inside surfaces (to grip wire).
 - iii) Sleeves that extend over the wire insulation to be nylon & not PVC. Of course, all sizes smaller than 4 AWG are to be of the fully insulated heat shrink solderless type.
 - iv) These must be installed with an elliptical crimper and not an indent crimper.
 - v) Only ring, and not fork, terminals to be used.
 - vi) Liquid vinyl must be used to seal the lower end of the barrel so the wire end is sealed. (To prevent the wicking of moisture up the wire)
 - vii) For 4 AWG and larger, where fully insulated heat shrink terminals are not available, install with heavy wall with sealant heat shrink tubing.
 - viii) These larger terminals must also have annealed tinned ends with seamless, closed end, barrels. No terminals or connectors are to be soldered.
 - ix) In all applications where heat shrink tubing is used it must be of the heavy wall with sealant type
 - d) Identification

i) All wiring is to be marked at both ends using self adhesive numbers at both ends. These numbers are to be protected by installing clear heat shrink tubing over them. Each wire is to have a unique number. Numbers are to be 3 digit beginning at 100. A complete ID legend is to be provided the Purchaser.

e) Insulation from chafe

i) Wiring to be protected against chafe.

ii) Where wires pass through furniture or aluminum structure grommets or other suitable chafe protection to be placed on the surround structure.

f) Extra wires

i) Extra wires are to be pulled to the pilot house, forward, and aft to the engine room for future use.

g) Isolation

i) All electrical devices are to be isolated electrically from the hull except for the following:

a) Propulsion Engine

b) Gen. set

c) Windlass

d) Electric deck winches

h) RF (radio frequency) Ground plane

i) RF grounds from electronics to be made with capacitors so that DC current is not passed to hull but the RF ground stays connected.

j) Install "pull strings" for future installation of wires in any area not easily reached without disassembling structure.

46. 24V DC Battery system

a) Trojan traction batteries with approximately 1000 amp hour capacity based on 20 hour discharge rate.

b) "Hydrocaps" to be used on batteries.

47. 12V DC Battery System

a) Supply for main engine and genset to be taken as a tap off main battery bank.

i) The 12V positive tap will occur in the middle of the 24V bank, with the negative coming from the end of the bank (same as 24V System). Only a single extra wire is required, i.e. for the positive feed. Negative feed is taken at the same buss bar as 24V system.

b) A separate 12V section will occur on DC panel with selector switch for source. Sources will be 24V battery bank or converter.

c) A Newmar 30 Amp capacity converter to change 24V to 12V will supply light loads such as Ham Radio, weather fax, VHF, and stereo not otherwise available in 24VDC.

d) 12V DC alternators on genset and propulsion engine will be disabled.

48. Battery Switches

a) Positive on 24VDC.

b) Negative on 24V DC.

c) Positive on 12V DC.

49. DC Charging system

a) The 24V DC bank shall be charged as follows:

i) Via a 60 amp 110V AC shorepower supplied charger built into the trace inverter.

ii) Via dual Electrodyne (160 amp) alternators mounted on main engine (alternators have remote diode bridge and are controlled via single regulator with adjustable voltage control. Cooling fan is installed).

iii) Via dual Electrodyne (160 amp) alternators mounted on generator set (alternators have remote diode bridge and are controlled via single regulator with adjustable voltage control. Cooling fan is installed).

50. Heavy duty fusing

a) High capacity "ANL" style fuses shall be used as follows:

i) Within 24" of the 24V negative leg.

ii) Within 24" of the positive terminal on each Electrodyne alternator.

iii) On the positive feed to the windlass.

51. DC Circuit breakers

a) All major systems to have their own circuit breaker.

b) Breakers to be dual pole type., breaking both positive and negative legs.

c) Magnetic type breakers to be used.

d) Minor circuits with multiple fixtures, such as lights and fans will share breakers.

i) Breaker will feed a buss bar from which the individual items sharing the circuit can tap.

52. AC Electrical System

a) Shorepower

i) To come aboard via Hubbel style 110V, 30 amp cord, set up for single phase, grounded connection (ground terminates on isolation transformer case).

ii) Selector switch on main AC panel to have shore, inverter one, and inverter two (for future spare inverter available).

b) Bonding system

i) Ground system to be bonded to isolation transformer case but isolated from vessel hull as per request by Purchaser.

c) Inverteror

i) Trace 2500 watt modified sine wave inverter to be installed, including 60 amp 24V DC battery charger with three stage charging capability.

ii) Remote control for inverter to be triggered from the galley.

- d) Isolation/step down transformer
 - i) 3.5KW isolation transformer in stainless steel case to be installed.
 - ii) Transformer to have taps for converting 220V to 110V. Change over in voltage to me made with terminal strip rather than switch to avoid mistakes.
 - iii) Isolation transformer to be capable of handling 50 and 60 cycle current.
- e) GFI electrical outlets
 - i) GFI duplex outlets to be provided throughout the vessel, as follows:
 - a) Forward dressing room (3)
 - b) Washing machine (1)
 - c) Drier (1)
 - d) Purchaser's cabin forward locker (1)
 - e) Galley (2)
 - f) Galley aft centerline closet (1)
 - g) Office area (4)
 - h) Aft cabins (2)
 - i) Engine room (3)
 - f) AC control panel
 - i) All circuit breakers to be magnetic and dual pole, except main panel breaker which shall be three pole.
 - ii) There will be a "polarity" warning light.
 - iii) There will be circuit breakers provided for 12 separate circuits.
 - iv) Digital meters for amperage and voltage to be provided.
- 53. DC Control Panels
 - a) Main DC control panel for interior is located just aft of fridge box on starboard side.
 - i) LED signal lights to be fitted to circuit breakers as follows:
 - a) Pumps (to indicate when running)
 - b) Propane solenoid (to indicate when turned on)
 - c) DC circuit Positive/negative connection to hull (with audible alarm on positive LED)
 - b) An engine room control panel will be situated near the watertight door on the port side, just aft of the watertight bulkhead.
 - i) Digital meters for voltage and amperage will be provided for tracking charging and power consumption.
 - ii) LED's to be provided as follows:
 - a) Pumps (indicate when running)
 - b) Fuel pumps (indicate which pump is on)
 - c) A small auxiliary panel will fitted in the pilot house.
 - i) Digital voltage and amperage meters will be fitted here.
 - ii) The pilot house panel will allow for various remote controls/overrides as follows:
 - a) Manual control of three engine room bilge pumps
 - b) Manual control of forepeak bilge pump
 - c) Manual control of central sump bilge pump
 - d) Manual control of damage control pump
 - e) Manual control of day tank fuel lift pumps
 - f) Manual control of ballast pump
 - g) Manual control of Asahi electrically operated ballast dump valve.
 - h) Off/On via relays of all spreader lights.
 - iii) Signal lights will indicate the following:
 - a) When any bilge, damage control, or ballast pump is operating.
 - b) Day Tank status
 - c) Murphy gauge status for genset and main propulsion engine.
 - 54. Solar panel system
 - a) Supply four Siemens M-55 solar panels.
 - b) These are to be stored in a rack in the engine room and be fitted with an "extension cord" system of connection so they may be set up lose on the after deck.
- 55. Remote control of winches
 - a) Lewmar electric winches and Maxwell windlass will be remotely controlled by WH Pilot controller (furnished by Purchaser).
 - i) Lewmar air switches to be provided for each winch.
 - b) A switch in the pilot house will disconnect solenoid power so that Lewmar winches cannot be accidentally triggered.
 - c) A switch in the pilot house will disconnect power to Maxwell windlass so it cannot be accidentally triggered.
- 56. Hull protection zincs
 - a) Four units, connected near aft chain plates and forward chainplates.
 - b) Wire connections made with #8 fine strand copper wire, with end terminals soldered to wire.
- 57. Electronics
 - a) Allowance is made for the installation of the following items to be supplied by the Purchaser:
 - i) Brookes and Gatehouse instrument system consisting of:
 - a) Standard depth and speed transducers in the Forepeak.

- b) One full function display in Purchaser's cabin.
 - c) Two full function displays in pilot house.
 - d) One 20/20 display in pilot house.
 - e) One analog wind direction meter in pilot house.
 - ii) WH autopilot consisting of:
 - a) Two compass units
 - b) Two control heads
 - c) Two rudder angle sensors in engine room
 - d) Two motor controllers and pump sets in engine room.
 - e) One winch remote control relay box and remote control head.
 - f) Dual K-3 Hynautic hydraulic rams.
58. Lighting
- a) Installation of light fixtures (to be supplied by Purchaser) has been allowed for as follows:
 - i) 18 Fluorescent or dome lights with switches on light fixtures
 - a) Fluorescent lights have a second socket for a half watt night lighting bulb installed (with separate switch on fluorescent fixture case)
 - ii) 12 reading lights with switches on light fixtures
 - iii) 44 halogen spot lights switched in strings as follows:
 - a) In Purchaser's cabin from side of bunk.
 - b) For saloon, galley and office area from sight of main control panel.
 - c) In aft cabins from sink cabinet.
 - b) Tube (indirect) lighting installed as follows:
 - i) Outboard of valances in forward closet.
 - ii) Outboard of valances in Purchaser's cabin.
 - iii) Outboard of valances in saloon.
 - iv) Between two hatches in main saloon.
 - v) Under main saloon table.
 - vi) Outboard of valances in galley.
 - vii) Outboard of valances in office.
 - viii) At edge of pilot house coaming in office.
 - ix) At edge of pilot house coaming in galley.
 - x) Outboard of valances in aft staterooms.
 - xi) outboard of valance over aft two window panes in pilot house.
59. Running Lights are to be supplied as follows:
- a) Port/Starboard lights on pipe stand off at aft end of jib sheet tracks (outboard).
 - b) Stern light on port transom
 - c) Steaming light main mast at lower spreader.
60. Fans
- a) Ten 24V guest fans to be installed throughout the interior as follows:
 - i) In Forward dressing room.
 - ii) In Purchaser's cabin.
 - iii) In saloon (2).
 - iv) In galley.
 - v) In office area.
 - vi) In aft cabins (2).
 - vii) In engine room (2).
61. Interior
- a) Joinerwork style
 - i) To be overlaid style, similar to Sundeer 67.
 - b) Timber to be used
 - i) Medium grain teak to be used, selected for match interest, match, and quality.
 - c) Cabin soles
 - i) Teak, of darker grain than furniture.
 - ii) "V" grooves at approx. 3" on center.
 - iii) Walnut shell non skid in longitudinal strips 1" wide at approx. three inches on center.
 - iv) Where soles can be opened positive locks to prevent soles from lifting in a knockdown shall be fitted.
 - d) Finish of timber
 - i) Furniture to be finished with clear, UV stabilized varnish system with approx. eight coats of material.
- Final coat to be semi-gloss. Build up coats to be gloss.
- ii) Soles to be finished in same manner as furniture, but final coat is gloss.
 - e) Headliner system
 - i) Stretched headliner system.
 - f) Hull liner system
 - i) Foam backed fabric over light plywood panels, as per Sundeer.
 - g) Bulkhead finish
 - i) Fabric over vertical surfaces (non furniture) except where painted.

- h) Painted surfaces
 - i) Forward head/shower compartment to moderate gloss finish.
 - ii) Aft shower compartment to moderate gloss finish.
 - iii) Aft toilet compartments to moderate gloss finish.
 - a) Furniture in aft toilet compartments is painted to match.
- i) Counter materials
 - i) Corian
 - a) On galley counter tops.
 - b) On aft cabin vanities
 - ii) Timber
 - a) On all horizontal furniture surfaces except where Corian or HPL laminate is used.
 - iii) HPL Laminate
 - a) On forward dressing room counter tops.
- j) Appliances to be fitted (supplied by Purchaser)
 - i) Washing/dryer in forward dressing room
 - ii) Microwave oven in galley area
- k) Galley Stove
 - i) 3 burner, gimbaled, Force 10, SS oven door, 22" wide. Fit with adequate restraints to keep range in place during a 360 degree roll. Fit safety bar in front
- l) Refuse Bin in galley
 - i) Flush, integral opening in counter top. Bin formed by Rubber Maid style bucket.
- m) Sinks
 - i) Galley to be fitted with double, polished stainless steel sink, with lip underhung on Corian counter.
 - ii) Vanities to have polished stainless steel sinks (3) with underhung installation.
- n) Pilot house
 - i) Port and starboard nav boxes in timber.
 - ii) Seat fronts in timber
 - iii) Exposed vertical surfaces in timber.
 - iv) Balance of metalwork painted matte gray/black (as on Sundeer).
- o) Valances
 - i) Valances run down the hull side within the living area (except for forward toilet/bath area) and provide space for window treatments (to be supplied by Purchaser) and tube lighting.
- p) Door Hooks to be installed to hold doors open as follows.
 - i) To hold all 3 head doors open a few inches
 - ii) To hold all 3 stateroom pocket doors both open and closed
 - iii) To hold both all 3 shower doors all the way open
 - iv) To hold engine room & forward storage room doors open all the way
- q) Sliding screens
 - i) Single sliding screens shall be fitted to interior hatches as follows:
 - a) Forward dressing room
 - b) Purchaser's cabin
 - c) Main saloon (2)
- r) Lee cloth tracks shall be fitted as follows:
 - i) Pilot house seats
 - ii) Saloon seats
 - iii) Forward stateroom bunk inside/outside
 - iv) Aft cabin bunks
- 62. Watertight door to engine room
 - a) A watertight door into engine room through aft port toilet compartment shall be fitted.
- 63. Excluded items for Purchaser to furnish:
 - a) Electronics,
 - b) Sails,
 - c) Covers,
 - d) Awnings,
 - e) Dinghies,
 - f) Safety gear and related
 - g) Soft goods and related interior items
 - h) Saloon, pilot house, cockpit, and bunk cushions.
 - i) Door hardware
 - j) Sink faucets and related plumbing,
 - k) Light fixtures.
 - l) Washer/Drier