

Sencora 52

Construction Specifications



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These design specifications describe a motor yacht that has the following major characteristics - fully customized, deep sea capable, economical twin screw diesel powered long range cruising motor yacht constructed from epoxy composites and other lightweight materials



sencora

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SECTION 1 - CONCEPT

The concept of this yacht was developed over several years of study and consultation with various yacht builders and designers. The basic layout criteria, interior styling ideas and performance targets have been provided by the Client.

Other conceptual ideas, and all work related to systems design and mechanical engineering were developed by D Marine Design (DMD).

The exterior styling, innovative hull design and further ideas regarding layout have been provided by Dixon Yacht Design (DYD).

Interior design furniture layout and material specifications were provided by Focus Yacht Design (FYD).

Composite engineering has been completed to a level allowing all major structural parts to be completed. This has been completed by Engineering Materials Processes (EMP).

Acoustic engineering was developed by S. Van Capellen (SVC)

1 Hull Design

Based on the considerable experience of DYD in the design of sailing yachts, this novel hull can best be described as a “**High Speed Displacement Hull**”. The hull shape in conjunction with the very high length/beam ratio allows for a speed somewhat in excess of a typical 52m displacement yacht. Furthermore a displacement hull has always proven to be the best for reliable performance in heavy seas with good fuel economy.

The hull form is a displacement type with a plump stem and transom stern. A bulbous bow is not included. Hull stiffening is principally longitudinal in nature with appropriately spaced continuous girders.

2 Structural Materials

For the hull structure advanced composite materials mostly in sandwich form have been chosen.

The principal fibre will be E-glass, although over 1 ton of unidirectional carbon fibre will be as reinforcements in hull framing, girder construction, deck beams and window mullions to increase usable interior space.

The principal core will be linear PVC foam although other materials like epoxy saturated marine ply and mahogany will be used in areas requiring high shear or compressive loads.

Epoxy resins will be used because of their greater strength, and light weight construction abilities, as well as a much higher resistance to shrinkage and chemical deterioration.

The final choice of manufacturer of these materials will be chosen depending upon availability and the shipyard's own building method criteria, but they will all be commonly used in shipbuilding and Classification type approved materials.

3 Powering

A twin engine diesel propulsion system is intended with this design. The engines will deliver enough power to attain 16 knots. This will mean that they will be capable of producing 746kW each.

In order to maintain low noise and vibration characteristics for the ship, the engine will develop maximum power at 1800 rpm.

The main engines to be chosen will exhibit high power at low rpm and years of proven service, robustness and worldwide serviceability. The Caterpillar C32 series is therefore engine of choice.

Coupled with the azimuthing thrusters, this system gives the following advantages:

- Flexibility of design regarding placement of the engines, which allows for a better internal layout and saving of space.
- As the propeller thrust is absorbed by the thruster, then the engines can be completely flexibly mounted and if required enclosed. The result is very low noise and vibration.
- The main propulsion shafts remain inside the ship, lowering maintenance and resistance.

However, the design still allows for the possibility of using more conventional propellers coupled with straight shafts. This option reduces overall build cost.

4 Propulsion

A fully azimuthing twin thruster system will be used for the following basic reasons :

- Reduction of hull appendage resistance,
- High manoeuvrability,



- Very low noise and vibration
- Better shaft angle

Included in the propulsion package is a 160 kW mechanically driven bow thruster.

5 Gear Boxes

An innovative reduction and transfer system using 2 custom built gearboxes and 3 multi-plate hydraulic clutches will allow the vessel to cruise using both thrusters so full manoeuvrability, balance and steering are maintained, but only using one engine.

A typical usage scenario would be as follows –

- Leaving port – start both engines and manoeuvre with each thruster powered by its own engine.
- Outside port – initiate command to PLC to bring both engines to an idle state, stop one, engage the central clutch thus allowing the captain to increase speed on the still running engine to achieve 12 knots maximum (limited by PLC)
- Should a higher speed be desired – (for example to avoid a storm, make a charter deadline) again initiate command to PLC to bring engines to idle, disengage the central clutch, start the second engine, allowing the captain to increase speed on both until maximum possible power that can be delivered by the engines – a minimum of 16 knots.

The effective load at each engine for a cruising speed of 12 knots will be around 310 kW and at 16 knots it is 660 kW. As each engine is required to deliver a maximum of 746 kW to achieve the maximum speed of 16 knots, then therefore with one engine there is more than enough power to drive both propellers.

Use of the thrusters in this way will give the following benefits -

- Safety in case one engine breaks down
- Engine maintenance and oil changes will be reduced by as much as you run with only one engine
- Better fuel economy as you would not have the heat and mechanical losses of the second engine and shaftline
- Less engine noise
- And finally, the driving engine would be better loaded when the vessel is cruising at 12 knots – again increasing overall fuel economy and reducing engine maintenance.



6 Economy

The hull shape, the high length/beam ratio, the low superstructure profile, the diesel-azimuthing drive system and most importantly the light weight construction materials will allow for a much greater fuel economy than found in more classic vessels.

7 Roll Damping

The yacht will be equipped with a fin actuated "Zero Speed" type stabilization system. This will almost eliminate roll at sea, vastly improve roll stability at anchor.

8 Noise and Vibration

Use of the above mentioned systems, namely the azimuthing propulsion, coupled with the ease of isolation of the power sources provides very high reductions in noise and vibration. As other major power consumers such as windlasses etc. are also electric, the background noise of hydraulics is eliminated except for when the stabilization system is active.

Also, the azimuthing thrusters are resiliently mounted and have twin propellers, vastly reducing hull vibrations. The propulsion engines are also fully resiliently mounted engines because they do not need to transmit thrust (and therefore vibrations) into the structure as do conventional engines.

The service generator room is itself in an enclosed space in the engine room. As most yachts spend more than 95% of their time at anchor or in port, often with the generators running, this is a very important improvement. Both engine rooms will have an exceptional sound insulation, so that virtually no sound will be transmitted to the accommodation.

9 Running Costs

9.1 Administration Regulations

The yacht is designed to be under 500 GRT. This is due principally to the low superstructure profile and the slender hull shape.

Over 500GRT denotes a rather major change in the administration costs regarding crew, inspections, safety and structural fire. Thus the yearly running costs are kept to the minimum compared with other conventional vessels that are usually restricted to around 45 meters LOA if they should not exceed 500GRT

9.2 Certification



The yacht will be built in full accordance with the latest rules of Bureau Veritas and the British MCA LY2 safety code. This will ensure that the vessel is acceptable as a charter vessel.

9.3 Fuel Economy

Due to the bow and stern vertical profiles, and the slender hull shape, the beam/length ratio is very low compared to a traditional 52m. Due to the light weight of the vessel, the displacement will be very light compared to a traditional 52m. These two features greatly reduce hull resistance thus allowing the yacht to either attain a higher speed for the same fuel consumption, or the same speed for less fuel consumption than as compared to a traditional 52 meter motor yacht.

9.4 Modern Materials

Furthermore, the concept of this yacht is to find and equip it with modern materials in every area. Materials that lend themselves to easy and/or low maintenance. The use of epoxy resin is one of the best examples of this concept.

Lower maintenance will translate into savings during shipyard refits and general crew labour, which in turn means less crew members.

10 Mooring

To allow for anchoring in small secluded anchorages with limited swinging radius, and to be able to orient the bow towards any incoming swell or waves, the yacht will be equipped with a stern anchor and chain that is equivalent to the bow anchors.

This also provides a spare anchor for the bow, a much desired advantage for a long range world cruising yacht.

The bow anchors are to be hidden as much as possible in enclosed pockets very near the waterline.

11 Interior Design

The design and decoration of the interior is intended to be minimalist style with the use in general of light coloured woods, fabrics and other materials. All materials will be provided in a form that meets MCA fire requirements and light weight.

Most furniture that is attached to walls or bulkheads will be suspended as much as is possible so that the floor space is maximized.



Final choice of materials and furniture layout to be decided by the client.

Interior lighting will be a major concern and will be designed by a specialist consultant.

SECTION 2 – TERMINOLOGY

The term “**vessel**” shall mean the yacht or ship that is described in these specifications outlined below.

The term “**Builder**” shall mean the shipyard that undertakes the entire construction as outlined below.

The term “**Owner**” shall mean the person, persons or company that has engaged the Builder to construct the Vessel.

The term “**OWR**” shall mean the Owners Representative. A person who has been engaged by the Owner to act on his/its behalf to inspect the ongoing work on the Vessel and make minor decisions.

The term “**specs**” or specification shall mean this specification.

The term “**contract**” shall mean the construction contract executed between the Owner and the Builder which sets out the terms and conditions as well as the technical requirements for the Vessel including this specification.

The term “**class**” shall mean the Classification Society who has been contracted to approve the drawings and engineering, and survey the construction work as it progresses.

The term “**CS**” shall mean Class Surveyor, the person or persons acting on behalf of the Classification Society.

The term “**MCA**” shall mean the UK Marine Coast Guard Agency and their regulations LY2 for large unrestricted charter yachts.

The term “**MS**” shall mean the MCA Surveyor, the person or persons acting on behalf of MCA .

The term “**NA**” or naval architect shall mean the person or company named in this specification whose responsibility it is to complete the naval architecture of the vessel.

The term “**ID**” interior designer shall mean the person or company named in this specification whose responsibility it is to complete the interior design of the vessel.



The term "**SE**" system engineer shall mean the person or company named in this specification whose responsibility it is to complete the mechanical and systems engineering of the vessel.

The term "**EE**" electrical engineer shall mean the person or company named in this specification whose responsibility it is to complete the electrical design and engineering the vessel.

The term "**CE**" composite engineer shall mean the person or company named in this specification whose responsibility it is to complete the structural composite engineering the vessel.

The term "**dwgs**" or drawings shall mean the drawings and engineering details which are made a part of the construction contract and those construction details which are developed but the designer(s) for building the yacht as set out in the construction contract.

The term "**shop dwgs**" or shop drawings shall mean the drawings and engineering details that may be required to be produced by the shipyard to clarify and further detail app. dwgs for the construction of any particular part.

The term "**app dwgs**" or approved drawings shall mean the drawings and engineering that has been approved by class and /or MCA.

The term "**ven dwgs**" or vendor drawings – shall refer to all manufacturers' drawings, installation instructions and/or details provided by the vendor that relate to the installation, operation and maintenance of vendor's equipment, scope of work or supply.

The term "**GA**" or General Arrangement shall mean the dwg in plan view showing the general arrangement of the vessel or particular space.

The term "**equal**" shall mean "the equal of", "approved equal", or "equal to", as used herein shall mean the item(s) shall be equal to the specific item named in these specifications.

The term "**PST**" shall mean passivated AISI 316L (low carbon) stainless steel that will not be polished and possibly painted.

The term "**PPST**" shall mean passivated AISI 316L (low carbon) stainless steel that that is mirror polished and not intended to be painted.

The term "**MSB**" shall mean main switchboard located in the ECR

The term "**ESB**" shall mean emergency switchboard located in the EGR

The term "**LSB**" shall mean local switchboard or sub electrical panel located in or near the space supplied.



The term "**ECR**" shall mean the engineers control room situated aft and next to the engine room.

The term "**MGR**" shall mean the main generator room located forward inside the engine room.

The term "**EGR**" shall mean emergency generator room located forward beneath the crew quarters.

The term "**tbd**" shall mean yet "to be decided".

The term "**Wt**" shall mean "watertight" or in other words impervious to water leakage when submerged to a depth determined by the rules for the position of the device.

The term "**Wx**" shall mean "weathertight" or in other words impervious to water leakage when subjected to solid water spray and waves that may be possible in the area of the device.

The term "**bkhd**" shall mean "bulkhead" or in other words a vertical transversal or longitudinal structural wall within the vessel.

SECTION 3 – DESIGN CRITERIA

1.1. Principal Characteristics

➤	General concept	Client / DMD
➤	Naval architecture	Dixon Yacht Design
➤	Hull Form Testing	Sea Speed
➤	Interior design	Focus Yacht Design
➤	Composite engineering	Engineering Material Process
➤	Systems engineering	D Marine Design
➤	Acoustic/vibration eng.	S. Van Capellen
➤	Electronic Design	Imtech
➤	Lighting Design	Sekles
➤	Galley Design	DMD/FYD
➤	Classification	Bureau Veritas
➤	Safety Certification	MCA LY2
➤	Builder	Sencora S.A., France
➤	Shipyard	Sencora A.S., Turkey
➤	Main Engines	Caterpillar C32 Acert

1.2. Principal Dimensions

➤	LOA	52.00m
➤	LWL	58.10m
➤	Max Beam	8.9m
➤	Light Displacement	245,000 kgs
➤	Full Displacement	384,000 kgs
➤	Draft	2.35m
➤	Freeboard	2.6m
➤	GRT	around 498 tons *

* A calculation as per rules of the **IMO Convention System (GT = K₁V)** showing that the vessel is less than 500 GT has been calculated.

1.3. Principal Capacities (these are minimum capacities)

- Water Capacity 15,000 litres
- Fuel Capacity 75,000 litres
- Black/Grey Water 6,000 litres
- Complement
 - Owner 2
 - Guests 8
 - Crew 8 + Captain double

2. Performance

2.1. Speed, Range, & Powering

The naval architects DYD have produced a calculation showing the maximum speed, and the long range speed, or speed of maximum fuel range can be achieved. This calculation also takes into account the running of the main generators at 65% load.

For long range cruising with :

- Cruising speed - 12 knots
- Minimum range - 5,000 nautical miles at 12 knots
- Power - 2 x 310 kW each engine, or in single engine mode, 1 engine producing 620 kW

For short range higher speeds :

- Maximum speed - 16 knots
- Power - 2 x 746 kW each engine

2.2. Model Tank Testing

To determine optimal hull form, lines plan, speed, consumption figures, stability criteria and sea keeping, DYD, and Sea Speed, using a scale model completed tank testing in a recognized towing tank facility. The testing was also carried out at sea using a radio controlled model equipped with azimuthing thrusters and stabilisers.

3. Stability & Trim

Stability has been determined to meet the criteria as laid down by the IMO Code on Intact Stability (IS Code) including the addition of the IMO

A.749 weather criterion with calculations & graphs for each loading condition.

Trim by the head, or excessive trim by stern will be avoided.

Maximum trim by the stern at full load will not to exceed 0.25 meter.

4. Acoustics & Vibration

A preliminary acoustic and vibration study has been carried out by S. Van Capellen (SVC) from Silent Line a well known respected company in this field. This study has provided the overall insulation weight required for naval architecture as well as all the thicknesses of the insulation in all areas as is required for providing net space available for the interior designers.

During construction SVC will continue to monitor the insulation installation and undertake studies to provide a vessel that is low on structural vibration. AS required the shipyard will install insulation with the acoustic properties required to meet the below listed criteria.

The insulation will be as required for meeting MCA structural Fire regulations.

SVC will undertake to advise the shipyard on all necessary anti-vibration measures required to achieve the vibration levels as listed below.

A torsional vibration analysis will be carried out to determine the critical frequencies of the drive train as a function of the main engines, gearboxes, couplings, shafting, propellers, and other rotating components. The shipyard will obtain these calculations from the manufacturer of the prime movers.

All on-board noise measurements shall be carried out according to ISO standard #2923, "Acoustics Measurements of Noise Onboard vessels."

During measurements, the vessel shall be fully furnished and outfitted with all fabric and carpet materials.

Values

These shall meet or exceed those listed below:



Noise Level Limits - dB[A]		Anchor	Anchor	Underway
Lower	Crew cabins	50	55	60
	Crew mess	50	60	65
	Galley	55	65	70
	Guest Cabins	50		55
	Engine	90		110
	Owner's	50		55
	Aft Gym	55	66	70
	Main	Dining	50	
Salon		50		55
Wheelhouse		50	55	65
Upper Deck	Salon	45		50
Anchor 1	one generator on line, air conditioning plant running, all air conditioning fan coils set at low fan speed			
Anchor 2	two generators on line, air conditioning plant running, all air conditioning fan coils set at medium fan speed, all galley equipment operational			
Underway	All equipment operational that is required for being under way at the normal cruising speed of 12 knots. Includes air conditioning plant and fancoils set at low fan speed			

SECTION 4 – CONTROL & DOCUMENTATION

1. Quality & Survey

1.1. Quality Control & Standards

1.1.1. The Quality Benchmarks

The quality of the following work and craftsmanship shall be identical or superior to that produced by Perini Navi –

- Exterior teak decking design- synthetic teak will be used
- Exterior stainless steel work
- Exterior paint work
- Interior furnishing woodwork and polishing The execution of and the installation of the technical systems

- Another benchmark will be the motor yacht Phoenix.

- The interior styling will be minimalist, and shall have a similar style to that found aboard Phoenix.
- The electronic installation shall be of a quality equal or superior to that on Phoenix, with special attention to the wheelhouse control panel.
- The galley shall be mostly stainless steel and shall have the same philosophy of work flow and quality equipment as on Phoenix as a minimum

1.1.2. The Quality of Equipment & Materials

All types of equipment and material will be of high quality and proven design. The quality level of all equipment and material will be addressed under the appropriate section below in which it belongs.

1.1.3. Workmanship / Protection

- All work to be performed only by experienced workers.
- The use of plastic sheeting and light plywood for the protection of installed equipment shall be mandatory.
- No smoking shall ever be allowed on the vessel.
- The Builder is to provide protection, watchmen and full fire-fighting facilities, at all times during construction.
- All lamination work shall be carried out while observing the highest standard of cleanliness, as well as permissible temperature and humidity.

- Most lamination work will be undertaken where it is practical before the installation of cables, piping equipment and furniture.
- Any damage, loss or breakage resulting from the Builder's omission to observe these requirements, shall be made good at the Builder's expense.

1.1.4. Builder Project Control

The Builder shall nominate one Project Manager (PM) with authority to coordinate all design and construction work of all trades and be in a position to make all technical decisions for the project.

This PM will be an expatriate (North American or European) and have a great experience in large yacht building and operation.

The Builder is to notify the Owner who the PM will be at time of contract. The Builder is to confirm that the nominated PM is to be occupied solely with the Owners project, or if he has other duties as well, and what these other duties are.

The Owner shall be notified immediately if a change of PM is required at a later date. The Builder will immediately replace the PM with someone of equal experience and abilities as the former.

Furthermore, the Owner has the reasonable right to refuse the replacement PM chosen by the Builder, if he, the Owner, feels that the new PM is not experienced or reliable enough to manage the project.

The Builder will also nominate and hire fully experienced expatriate managers to fulfil the roles of electrical engineer and composite engineer. The electrical engineer will be solely dedicated to the project.

1.1.5. Owner Project Survey

The Owner may nominate one project manager, surveyor or responsible person (OWR) with authority to check all on-going work at the shipyard and at the premises of the subcontractors. This person will be given access to all drawing and engineering information at the shipyard in order to control the work in progress. Only this OWR will have the authority or power of attorney, in writing, from the Owner to authorise minor agreements or changes.

2. Technical Regulations

2.1. Classification

The yacht will be classified by **Bureau Veritas**. The Class notation will be - I **Hull** • **Mach Charter Yacht/ C Unrestricted Navigation**, as per the regulations of Bureau Veritas for the Classification of Yachts 1993, as revised until date of contract.

(Note - BV will soon issue a complete revision of the rules that will be available beginning January 2011.

2.2. Certification

The ship will be constructed so as to comply with the standards of the MCA - **Large Commercial Yacht Code (LY2) - MSM 1792** as revised 12/10/05, and including all amendments issued until date of vessel delivery.

Inspection will be carried out by the Istanbul office of BV. All plan approval will be carried out by this office except for that of structural engineering which will be approved by the BV engineering offices in Nantes, France.

An MCA Certificate of Compliance will be delivered for the ship. As the vessel is intended for long range cruising (and is over 300GT) then this certificate must be unrestricted.

The survey will be carried out by an inspector from **Large Yacht Services of the Maritime and Coastguard Agency** if the flag is UK or another European country. If the flag is a UK jurisdiction, (for example Bermuda, Cayman Islands, Gibraltar, or the Isle of Man) then by an MCA inspector from that jurisdiction.

In addition to the MCA compliancy, the ship will also be built to comply with the Rules of the Luxembourg Maritime Register "Technical Regulations for ships of 24 meters or more, displacing less than 500 tons and carrying a maximum of 12 passengers". This will enable the ship owner, (or any future ship owner) to have a Luxembourg Registry if desired. However, no certificate will be delivered, unless agreed to in the contract.

Finally, the ship will be built to meet any flag/state rules that may apply to the vessel with regard to its intended country of registration but only if this is known at the time of contract.

All amendments to all the above BV, MCA and Lux rules are to be considered, when applicable, and incorporated into the design and construction of the ship up to the time of delivery to the ship owner.

2.2.1. Other Rules & Regulations to Respect

Most if not all these regulations will be included or enforced by either Class or MCA.

- International Convention on Load Lines (ICLL66)
- MARPOL as it is applicable to yachts over 400GT
- SOLAS as it is applicable to yachts under 500GT
- International collision regulations (COLREGS72)
- International Convention on Tonnage (ITC69)
- Noise and Vibration Standards

3. Documentation

3.1. General

All documentation listed below shall be :

- Created and supplied in English language.
- Those that are required to be supplied to the owner shall be done so in 1 paper and 1 electronic copy. Electronic copy means a high resolution PDF document.
- Supplied documentation shall filed in labelled ring binders, to be stowed in appropriately sized dedicated shelving in the wheelhouse and/or in the engine control room, or both, (to be decided).

3.2. Contractual Plans, Drawings & Calculations

The following drawings **and documents** are to be generated, prior to, and will form part of the Signed Contract :

- Final specifications (this document)
- General arrangement
- Longitudinal profile
- 3d design and rendering from various view points
- Tank plan & capacities
- Engine room equipment GA and 3 longitudinal/transversal profiles
- Weight estimate
- Fuel range calculation
- Gross tonnage calculation
- Speed & fuel range calculation

3.3. Minimum Required Drawings & Calculations Generated

As a minimum, the following Plans, Drawings, Schematics, and Calculations will be generated by the Builder, and will become part of the specifications when generated.

Many of these drawings and documents will be approved by the Classification Society and MCA. These drawings and documents will remain the sole property of the Builder. They will be accessible to the OWR for examination at the shipyard only.

These are listed below **in no particular order**.

- Aft cockpit fittings and furniture
- Aft gangway and hydraulics
- Sports garage side shell door and hydraulics
- Aft shell door and hydraulics
- Aft terrace fittings
- Air conditioning system (piping and ducting)
- Alarm command circuits
- All Electrical schematics and documents
- All lighting circuits
- Anchor and mooring equipment layout
- Antenna plan
- Bilge and fire system
- Black water system
- Boot top line
- Bow thruster and hydraulics
- Ceiling panel layout for establishing lighting positions
- Ceiling removal process dwg
- CO2 installation
- Complete original manufacturer's manuals, handbooks, drawings and spare part lists, as supplied by all the equipment manufacturers. These shall be supplied in two paper copies, or 1 paper and 1 electronic copy based on the manufacturers normal standards
- Compressed air installation
- Dock testing and sea trial report noting all parameters achieved.
- Dry docking plan for dry-dock and slipway
- Dry docking plan for Travelift
- Engine room layout and 3 longitudinal sections

- Fire Fighting Plan
- Fly bridge fittings and furniture
- Fly bridge hardtop or bimini (to be decided)
- Fly bridge hot tub drawing
- Fuel system
- Fwd garage cover and hydraulics
- General Arrangement Plans
- General Arrangements and Profile Views
- Generator engine installation
- Generator exhaust piping system
- Graphic layout on transom of ships name
- Grey water system
- Hot and cold fresh water system
- Hull openings, transducer locations, appendages
- Hull rub rails and fendering construction
- Hull shell scantling drawing showing materials and methods required to make repairs
- Internal communication systems
- Load balance
- Main electric panel
- Main engine exhaust piping system
- Main engine installation
- Navigational lights circuits
- Plan view and elevations of all accommodation spaces. 1:10 scale
- Power pack circuits
- Profile View
- Rudder construction and rudder bearings
- Safety and Emergency Plan(s)
- Shaft line, flexible coupling, stern seals and shaft bearings
- Side boarding ladder and hydraulics
- Stabiliser and hydraulics
- Steering gear and system
- Sub-panels
- Switch and socket plan
- Tank calibration tables, centres and sounding tables
- Tank capacity plan
- Transom platform door and hydraulics
- Typical details of crew spaces
- Typical details of guest accommodation spaces
- Typical details of technical spaces – galley, pantry, gymnasium etc.

- Upper cockpit fittings and furniture
 - Upright hydrostatic table
 - Windlass installation
- One reference copy of all manufacturers' installation manuals and documentation shall be made available for review by the QWR as soon after receipt by the Builder as is practical (generally at time of reception of the equipment in the shipyard)

3.4. Plans, Schematics & Drawings To Be Delivered "As Built"

These shall be supplied in two paper copies, or 1 paper and 1 electronic copy. They will be supplied in the English language.

- A list of names, addresses, telephone, fax, e-mail numbers for all manufacturers and suppliers of equipment.
- 2 copies of all third party manufacturer's operation and installation manuals and documentation
- A custom made operation and maintenance manual on paper containing start-up procedures, maintenance procedures and emergency instructions etc. for all custom or shipyard built equipment, including the hull structure. The manual will be written following all international standards for such documents.
- An operating schematic of each and every piping system on board.
- A complete set of all electrical wiring systems.
- Drawings of all mechanical installations so as to allow repair and maintenance understanding.

3.5. Certificates and Safety Documents To Be Delivered

The Builder shall supply the following documents and certificates to the ship owner, (in English) at the time the Yacht is handed over. If any certificate or other document should be preliminary, it will be the Builder's task to obtain the final issue within the warranty period (less than 1 year)

- Bill of Sale
- Builder's Certificate
- B.V. Interim Class Certificates [without restrictions]
- MCA Certificate
- Test Certificates - for all materials and equipment and systems, as issued by the manufacturers themselves that are required by Class.
- Intact Stability Booklet - (which will include approved hydrostatic tables, tank capacity, and sounding tables)
- International Tonnage Certificate
- International Load Line Certificate

- Panama Tonnage Certificate
- International Safety Radio Certificate
- Radio Licenses and Certificates as per GMDSS
- IOPP Certificate (Marpol)
- SOPEP shipboard oil pollution plan
- Oily water separator Certificate
- Safety and Emergency plans
- Fire fighting equipment certificates as applicable
- Lifesaving equipment certificates with log cards.
- Compass certificate and deviation card.

4. Testing & Sea Trials

4.1. General

All materials, machinery, equipment, instruments and systems, installed under these Specifications are to be thoroughly tested to the requirements set out below and Class.

4.2. Testing During Construction

Shall include the following –

- Structural Material Testing - This is fully described in Section 5
- Pressure testing of all structural tanks. Tests will be done a with water column level of 3.5 meters above tank top. Pressure to remain for a minimum of 24 hours and monitored frequently. Each tank to be done individually – i.e. no adjoining tanks shall be tested at the same time. Testing to be witnessed by OWR and/or the classification inspector.
- High pressure hose testing of weather-tight and watertight testing openings as required. This included windows, port-lights, hatches, and external doors
- A Testing report will be established by the Builder indicating all the tests carried out during construction, the results and parameters noted and achieved. This report will form part of the documentation delivered to the ship owner.

4.3. Dock Trials

Shall include the following –

- Main engine tests during commissioning

- Steering gear start up testing
- Main and emergency electrical system tests.
- All generators will undergo operational tests for at least 24 hours, including a shore side load bank test to the limit of each generators specified capacity.
- Megger testing of all electrical circuits
- Starting from dead ship, condition test
- Calibration of all tanks
- Sewage system, bilge pumping and fire fighting system tests as required.
- Galley, domestic equipment and systems
- HVAC System tests
 - Functioning of temperature controls,
 - Functioning of pumps and compressors and comparison of values achieved by each redundant unit.
 - Interior air change capacity
 - balancing of whole system, with fresh air makeup
- Boat cranes, launching and recovering of all watercraft. Load testing all tender lifting davits / cranes. 5 minute rescue boat launching test.
- Anchoring and mooring equipment pre-testing
- Safety equipment checks and tests
- Fire fighting equipment checks and tests
- Monitoring and alarms
- Radio communication and navigation aids

4.4. Inclination Experiment

Following the launching, and once the outfitting of the ship is sufficiently complete (to the satisfaction of Class), the vessel shall be subjected to a "Inclining experiment", prior to the Sea Trials, in order to determine the weight of the ship unloaded and dry (Lightship Displacement), as well as the longitudinal and vertical position of the centre of gravity.

The experiment shall be carried out in accordance with the rules of MCA and to the satisfaction of the Class surveyor and/or the MCA surveyor.

The OWR shall be advised of the date and may attend the trial.

The Builder shall draw up a report on the experiment, and the report shall be approved by both the Class and by the MCA.

The weather conditions will be: wind BF>1, wave height> 0.01m

Prior to the experiment and sea trials, the Builder shall control, in the presence of the inspectors –

- The drafts of the ship and the calculation of the trial displacement
- The recording of the density and the temperature of the sea water
- The recording of the ambient air temperature
- The chemical-physical characteristics of the fuel
- The trim of the vessel shall be left to the discretion of the Builder, though the draft difference shall be no greater than 0.2% of the length of the vessel.

4.5. Official Sea Trials

4.5.1. Conditions

The sea trial conditions will be: wind BF>3, wave height> 0.1m, sea depth will be over 45m (80m for speed trials)

4.5.2. System Testing

The official sea trial schedule shall include as a minimum the following tests of systems –

- All auxiliary machinery, pumps and compressors are to be run under normal service conditions while the vessel is at sea.
- All automatic control systems to be tested while the vessel is at sea.
- The HVAC System shall be operated throughout the trials and monitored. The air temperatures in all spaces are to be recorded at intervals throughout the trials especially in engine room and other technical spaces.
- Functional/capacity testing [and adjustments as necessary] of all equipment, instruments, and systems.
- Navigation electronics testing, proving and adjusting under all working conditions.
- Compass calibration

4.5.3. Propulsion Trials

- Mechanics employed by the manufacturer of the engines will be on hand for the fine tuning of the engines, and the final commissioning.

- Endurance trial [1 hour at MCR]
- All engine parameters will be monitored at all times, particularly main engine exhaust backpressures.
- Crash stops as per engine manufacturers recommend procedure
- Speed Trials
 - Vessel will be at 50% load displacement
 - Progressive speed trials will be carried out at six different RPM settings of the main engines. The following levels of maximum engine power: 50%, 75% and 100% will be included in these five rpm levels. 1 level will include the speed of 11 knots, and a second a speed of 12 knots.
 - Each speed shall be carried out twice, once each on two opposing courses, each with a length of 2 nautical miles (or 5 prime minutes) and in a depth of water of 80 meters or more.
 - Distances will be measured by a suitable GPS differential system, or shore based transits, or official nautical mile markers.
- Range Calculation
 - During all the 6 speed transits, the fuel consumption over the measured mile will accurately measured.
 - The fuel consumption is to be gauged by means of either, flow meters, or calibrated tank, or the engine manufactures software – best method to be decided between Builder and OWR at a suitable time before the trial.

4.5.4. Steering System Trials

- Steering testing at high speed
 - 2 full circles in opposite directions
 - A series of "S" turns – 35 degrees each way
 - Half of these tests should be on each steering pump
- Manoeuvring trials (low speed)
 - with both engines (thrusters) running
 - with only 1 engine (thruster) running (to do both sides)
 - with bow thruster only – full circle in both directions
- steering at 12 knots using the manual emergency steering system

4.5.5. Sound and Vibration Tests

- Acoustic level readings are to be taken during sea trials by a noise and vibration consultant, agreed on by both parties, and equipped with the professional recording equipment. The conditions of the tests are described in See Section 2.

- Vibration level readings are to be taken during sea trials by a noise and vibration consultant, agreed on by both parties, and equipped with the professional recording equipment. The conditions of the tests are described in See Section 2.

4.5.6. Deck System Trials

- Anchor trials, proving that windlass can recover the weight of the total length of cable and anchor Both anchors and their chains shall be set to the bitter end in no less than 80 meters of water. Both anchors will be recovered simultaneously.
- Both capstans will be demonstrated to perform satisfactorily with the use of mooring lines.
- Both launches will be lowered, disconnected and recovered at sea.

4.5.7. Safety System Trials

Most safety testing will be done during docking trials, however the Class or MCA surveyor may require some carried out at sea.

4.5.8. Stabilisation System Trials

Stabiliser trials as per the maker's schedule. The stabilising systems trial is to be conducted during a separate time when the sea state is more suitable. These trials will also include roll stabilisation while the vessel is at rest and beam on to the prevailing waves or swells

4.6. Sea Trial Report

A Dock and Sea Trial Report will be established by the Builder indicating all the tests and trials carried out from the time of launching, the results and parameters noted and achieved. This report will form part of the documentation delivered to the ship owner.

The Builder shall produce a graph showing the fuel consumption curve against different main engine rpm for the Owner's future reference. The graph will also show fuel range as accurately as possible when the yacht is cruising at 12 knots.

5. Acceptance & Delivery

Prior to the delivery of the yacht, the Builder, and the OWR will prepare a list of all items of work which may be found to be incomplete or unsatisfactory and submit this list to the Builder, who will there upon perform the work promptly as provided for in the contract.

Upon completion of the vessel's tests and trials, and after completing any corrective work resulting from the trials, the vessel shall be delivered to the Owner at the wharf of the Builder's shipyard. The Builder shall deliver the vessel in a clean state, ready for the embarkation of supplies, consumable materials and the crew, and with all machinery functioning and ready for use.

Any remainders of diesel fuel following the Sea Trials (half load condition, minus what has been consumed) shall be charged to the Owner at the price paid by the Builder.

The Builder will supply and deliver, in cans, sufficient engine lubrication oil to cover the next two oil changes for the main engines and generators.

The Builder will supply and deliver, one 20-25 litre can, of each and every type of hydraulic oil used by the systems on-board.

SECTION 5 – LAYOUT & INTERIOR

1. Description of Layout

1.1. Tank Deck – not an actual deck, except for some areas where access is possible.

1.1.1. Bow Thruster Tunnel Compartment – no interior access. Drive passes through bulkhead into next space

1.1.2. Emergency Room – emergency generator, bow thruster engine, fire and bilge pumps, valves, batteries etc. with access hatch to crew quarters. Access hatch in crew corridor.

1.1.3. Forward Tanks - fresh water ballast. Access hatches in crew cabins.

1.1.4. Refrigeration Space – deep freeze and cold room with 4 access hatches in crew quarter deck. Space also contains the Fog pump, AC pump for crew area and all the refrigeration equipment.

1.1.5. Mid Tanks – diesel fuel – with access hatches in guest accommodation. Also 4 cofferdams containing sewage evacuation equipment. Access hatches in each bathroom.

1.1.6. Engine Room Bilge – contains black and grey water, generator diesel fuel and lube oils tanks. Contains numerous pumps, sea chests and piping.

1.1.7. After Tanks – diesel fuel and fresh water – with a central space for shafting and general storage. Access hatches in Owner's accommodation deck.

1.1.8. Lazarette – storage area and main thrusters. Access from aft terrace deck WT hatches.

1.2. Lower Deck

1.2.1. Bosun's Locker – small area right forward and fwd of the collision bulkhead. A sealed compartment in the bottom serves as a crash box. Used for deck supply storage, with access via WT hatch on windlass deck.

1.2.2. Chain Lockers – situated above the bow thruster tunnel aft of the collision bulkhead and each side of the forward crew access ladder. Access to lockers is via WT hatches either side of the ladder casing.

1.2.3. Forward Crews Mess, Full beam just aft of chain locker. Access by ladder up to the windlass deck by way of a WT hatch, and aft via central crew corridor. Crew mess is large and will sit six persons and is equipped with a large wall mounted TV, two tables that can be joined in the centre during dining. There is a portlight in each side.

1.2.4. Crew Cabins – Comprising 4 double bunk (1 over the other) crew cabins, 2 each side of central crew corridor. Each cabin has en-suite toilet and shower. Access from corridor aft, or stairway up to the bridge walkway via a WT companion type hatch, or forward from crew mess. There is a portlight in each cabin.

1.2.5. Galley & Laundry Room – Either side of aft crew corridor, access from forward, from main deck pantry stairway or stewardess passage to guest accommodation via a WT bulkhead door. Galley is all stainless steel and contains as far as practical only professional equipment. The dedicated laundry room with professional equipment (2 washers 2 dryers and 1 press) located opposite galley. Access from fwd (cabin area), aft via a WT door to guest accommodation, and above via stairway to wheelhouse. There is a portlight in each room.

1.2.6. Twin Guest Cabins – 2 cabins forward, identical in size with 2 twin berths each. 1 or both of the interior berths can be fitted with pull-down Pullman type beds. Both cabins with en-suite bathrooms. There are 3 portlights in each room, and one in each bathroom.

1.2.7. One large VIP cabin with double berth on port side and large divan on stbd side. Cabin has 2 en-suite bathrooms for his and her use or the cabin can be divided to form two identical cabins. The divan can be converted into a double berth. There are 3 portlights in each side, and one in each bathroom.

1.2.8. Guest Corridor. Access to all three cabins with stairway up to main deck or escape via the stewardess passage forward.

1.2.9. Generator Room – extra soundproofed and resiliently mounted enclosure in forward engine room. Contains 3 main gensets and all the exhaust equipment. Access from the engine room.

1.2.10. Engine Room – access from the ECR aft and fwd from the stbd air shaft. Contains the main engines, roll stabilizers and all other equipment that are not listed in other spaces of this description.

1.2.11. ECR – Engineers Control Room – access from stairway to port side deck and aft to sports garage, or forward to engine room. Contains a

desk, all the main electrical panels, and the engineers monitoring equipment. 3 windows allow a view of the engine room.

1.2.12. Sports Room - located on port side just forward of the owners bathroom. It is equipped with a large fold down hull shell door that can become a swim platform and be used for tender boarding on the port side. The room is surrounded by watertight bulkheads. Access through WT shell door, WT door to stairway up to port side deck or engine room/ECR. Also via WT door to owners office. Containing gymnasium equipment, diving gear, wind surfers etc. There is a portlights in the shell door.

1.2.13. Owners Office – Along stbd side with access stairway up to main salon, WT door to Sports Room or aft through WT door to owners cabin. Contains a large desk and chairs. There are 3 portlights in the stbd side.

1.2.14. Owners Bathroom & Dressing Room – bathroom is centrally located with door into office on stbd and port into dressing room. Dressing room has WT door to owner’s cabin. Bathroom is fitted with shower stall, toilet stall, and double sinks. Dressing room has various hanging lockers. There is a portlights in the dressing room.

1.2.15. Owners Cabin – aftermost space on lower deck accessed by WT doors because of stability regulations from Office and Dressing room. Double sliding glass doors give access to the Aft Terrace. There are 3 windows each side of the cabin.

1.2.16. Aft Terrace – the terrace has a bulwark that is about 1.30m high. The after part of the transom bulwark is a gate that can fold down to become a swim platform and be used for tender boarding. There are stairways each side of the owner’s cabin to access the main deck. From the terrace deck mooring lines will be controlled by way of fairleads, bollards, and capstans. Also the stern anchor in a hull pocket will be controlled from here. A fish tank and baitwell are incorporated in the bulwarks each side.

1.3. Main Deck

1.3.1. Windlass Deck – Contains hatches down to the crew mess and Bosun’s locker. Also both windlasses and forward fairleads and mooring bollards. Access through the deck covering above is by way of 3 hatches, one for windlass operation, and one each side for line handling.

1.3.2. Tender Bay – an enclosed non WT area housing two 6m tenders, 2 jet skis, and a central launching crane. It is covered and accessed by two large hydraulic hatches in the foredeck. The hatches are WX and will be capable of withstanding heavy seas, but this deck covering and hatches are not a structural to the ship. Operation of the launching the tenders is controlled from the bridge wing controls.

1.3.3. Fore Deck Storage – an enclosed WX area aft of the tender bay housing air conditioning and galley ventilation equipment. It is divided into two parts by the crew companion way. The custom companion way also serves as steps up onto the fore deck. There will be extra space for garbage storage and fender storage.

1.3.4. Fore Deck – it is the surface above the last 3 mentioned compartments. It is totally flush fitted with 2 large hatches (tenders) and 4 smaller hatches. It is covered in synthetic teak and the only features on the deck is the forward light mast and the wave breaker.

1.3.5. Bridge Walk-around – Forward of wheelhouse has access to fore deck storage, crew companion hatch, and on each side an enclosed bridge wing console.

1.3.6. Wheelhouse – full beam with access aft via a central corridor that is enclosed with doors both ends. Access through port and stbd hinged WX side deck doors and aft on port side into upper crews mess. On port side aft a GMDSS radio station will be fitted over the stairway up from the galley and facing the chart table. On stbd side aft there is a divan, and forward a full beam console housing all navigation equipment. There will be a helm chair located centrally that can be swung to use the chart table, and two helm chairs for the control console. The wheelhouse space is entirely enclosed by windows forward and each side. Via a hatch in the sole, a technical space below the wheelhouse containing electronic equipment and some storage can be accessed.

1.3.7. Upper Crew Mess & Pantry – these are located port side and food coming up from the galley can pass through the mess and receive final preparation before being served. Access is from forward via from the port wheelhouse deck door, staircase down to the galley and from aft via an automatic sliding door into the dining salon, a staircase up to the sky lounge, and a hinged WX door onto the port side deck. The mess can sit six comfortably, has a large TV, the pantry has various food preparation equipment. Both rooms have windows. Opposite the pantry door there will be a bulwark door to allow the use of a side boarding ladder primarily to use when alongside a dock for crew to access the vessel. Guest will use the main gangway when alongside portside too.

1.3.8. Captains Cabin – located on the stbd side with entrance from the wheelhouse corridor. It has an en-suite bathroom and double bed. Both rooms have windows.

1.3.9. Entrance Lobby & Day Toilet - located aft of the captains cabin. This entrance lobby is fitted with a large sliding WX door entrance door. The day toilet contains counter sink and toilet. Opposite the lobby is the central staircase leading down to the guest cabins and up to the sky lounge. Opposite the lobby door there will be a bulwark door to allow the use of a

side boarding ladder primarily to use when alongside a dock or for a tenders so guests can board and enter via the lobby.

1.3.10. Main & Dining Salon – a large open space with multiple seating and divans aft and dining table for 10 forward. There is a low counter dividing the areas. Access forward is from the stbd lobby door, wheelhouse corridor, main staircase, or steward’s pantry. Aft is from the staircase to the owner’s accommodation and through balanced sliding type glass doors opening onto the cockpit deck. The area is well lit with very tall windows on each side.

1.3.11. Cockpit Deck – a recessed and protected deck for exterior dining. Contains aft fixed seating for 4 and movable seating for 6. There are two fixed counter tables for serving, one contains a wine bar and the other a barbeque.

1.3.12. Aft Sun Deck – a raised deck above the owner’s accommodation that will be used primarily for sun bathing. A retractable passerelle that extends out from under the deck on the port side up to length of six meters and will pivot 45 degrees to port will allow access on board when alongside to port and stern to in most normal marinas. When the dock is too low for good access with this passerelle, then a smaller one can be used from the lowered transom gate.

1.4. Upper Deck

1.4.1. Sky lounge – a large salon with seating area with large bar and possibility for dining. With access via the main staircase forward and the stewards staircase to the pantry below. The pantry staircase exits behind the bar. Access aft is via balanced sliding type glass doors opening onto upper sun deck. This salon is almost fully enclosed with windows. The dining table will seat 10 guests, be movable, but with facility to fix in 2 or 3 different positions.

1.4.2. Upper Sun Deck – large open area aft of the sky lounge. Equipped with sun beds. Access below to the cockpit deck is via a staircase on the port side. The life rafts will be stowed in lockers in the coamings each side of this deck so one person can easily roll them overboard.

2. Interior Installations

2.1. General

An interior designer will be retained at the discretion of the Owner. The designer chosen is Focus Yacht Design (FYD). Details of the equipment mentioned below will be found in the equipment list in annexe. No detailed



description of the final colours or finished is mentioned here as they have not yet been fully developed.

Below is a description of the equipment that will be installed and where, as well as technical details about how the interior will be fitted or installed.

2.2. Guest Accommodation Concept

The interior design concept will be minimalist (Reference Phoenix). The use of light coloured materials with some limited high contrasting colours will predominate. Lines will be clean, straight and unbroken as far as is possible.

A strict continuity of horizontal surface heights and lines derived from necessary valences, window sills, etc. will be required not only in the space they are found, but also in most cases with all other adjacent spaces.

2.3. Materials

All materials will be top quality and meet the requirements of light weight where needed.

All woods, both massive and laminate, will be free from defects such as knots and shakes and match piece by adjoining piece in colour and texture. All panels covered in laminate shall be book matched.

All fabrics (curtains, carpets, furniture upholstery, wall and ceiling linings) will be provided in a type of material, or with an approved treatment system, that meets MCA fire requirements.

All metallic hardware shall be made from AISI 316L stainless steel or other equally non-oxidizing material unless otherwise chosen by the interior designer and accepted by the owner.

2.4. Furniture Sub Construction

Interior wall coverings, ceiling panels and/or treated hardwood fixed furniture will be attached to a rigid and strong extruded aluminium framework. The framework will be soft mounted by way of elastic mounts and straps to the ship's structure.

This will avoid the transmission of structural vibrations to the furniture as well as any structural movements that might cause the furniture joints to create noises.

In some cases, larger pieces of furniture will be mounted to the framework by way of flexible gaskets between the frame and the furniture.

2.5. Built in Furniture

Generally most furniture next to bulkheads or walls will be suspended on the vertical structure. Fixed furniture such as beds will have large overhangs from a central plinth. The effect of the above two methods is to maximize visual floor space.

Most furniture, such as sofas, tables, chairs will normally be loose, with special arrangements to fasten them at sea.

2.6. Furniture Part Construction

Furniture will be a mixture of solid and light weight construction, depending upon the usage of the part and the area it is found as it affects weight balance required by the naval architect.

Light weight construction will entail the use of fire retardant foams as the core of the panel using the shipyards own proprietary method. Solid construction will entail the use of okume marine plywood as the core of the panel.

Generally all furniture parts will be solidly built and fully glued for the totality of the piece. However wherever access to equipment, piping or electrical junction boxes is required for maintenance purposes, a part of the piece will be designed to be removable by way of fixed bolts and wing locknuts. No wood screws will be used for these removable parts. In some cases the entire piece will be removable.

Wherever a removable panel or furniture piece is found, the panel or piece will sit atop a soft rubber or neoprene gasket.

All laminates on furniture will be fully balanced. A top quality laminate may be balanced by a low quality laminate on the back side if that side is not normally seen. However the two laminates must have the same tensile characteristics and the same thickness. Both laminates must be treated in the same way – if one is varnished the other should be as well.

All hinges on furniture locker doors will be the hidden type. All catches on furniture locker doors will also be hidden and be the push-release type.

All hinges on cabin doors will be the hidden type. All catches on cabin locker doors will be as chosen by the interior designer.

All metallic hardware, hinges, catches etc shall be top quality and made from AISI 316L stainless steel unless otherwise chosen by the interior designer.

2.7. Lighting

An advanced system using discreet switching, and making good use of reflected light will be installed. A lighting specialist will be involved, by preference Sekles. All lighting shall be LED as far as it is possible to achieve the desired effect. Fluorescent and Halogen lighting may be used in some areas. Incandescent lighting will not be used.

2.8. Air Conditioning

Because of space constraints, the AC system will be a classic chilled water system using fancoils. For acoustic purposes the fancoils will be buried deeply in the furniture behind multiple layers of insulation and protected by sound plenums or mufflers at intake and exit points. The preferred position for the units in cabins is under the beds. This provides good insulation as well as good maintenance access. Full details will be found in the HVAC section of these specifications.

2.9. Galley

The galley will be all brushed stainless steel for all appliances, vertical surfaces behind stoves and all horizontal surfaces. Other vertical surfaces will be finished with matte finished fireproof Formica in colours as chosen by the interior designer, but probably a mixture of off-white, silver and light grey colours.

Sinks will be seamlessly (welded) attached as part of the counter surfaces. Cooking appliances will all be flush with the adjacent surfaces. As far as is practical there will be no visible or tactile joins between any items in order to be able to maintain the surfaces as clinically clean as possible.

Type and quantity of equipment will all be from top quality suppliers as would be found in professional restaurants.

Main equipment shall include –

- 1 x six plate induction stove top, type MKN or equivalent
- 1 x large microwave oven
- 1 x large baking oven
- 1 x large steam oven
- 1 x double level salamander
- 1 x professional dishwasher, type Hobart or equivalent
- 1 x double door under counter refrigerator**
- 1 x full height fridge cabinet with freezer compartment**

3 x integrated sinks – 2 large in the clean-up area, and one near cooking counter. Also there will be a spigot over the stove section for filling pots. Hot air extraction shall exist wherever there is a heat source from an oven, salamander, or stove.

(** connected to the forward central reefer system – full details in the Reefer Section of these specifications **)

2.10. Pantry

The pantry will be all brushed stainless steel for all appliances. Vertical surfaces will be finished with matte finished fireproof Formica in colours as chosen by the interior designer, but probably a mixture of off-white, silver and light grey colours. Horizontal surfaces will be brushed stainless steel.

Sinks will be seamlessly (welded) attached as part of the counter surfaces. All appliances will all be flush with the adjacent surfaces. As far as is practical there will be no visible or tactile joins between any items in order to be able to maintain the surfaces as clinically clean as possible.

Type and quantity of equipment will all be from top quality suppliers as would be found in professional restaurants.

Main equipment shall include –

- 1 x large microwave oven
- 1 x double level salamander
- 1 x professional dishwasher, type Hobart or equivalent
- 1 x six minute glassware washing machine
- 1 x large capacity icemaker type Scotsman or equivalent
- 1 x double door under counter refrigerator**
- 1 x full height fridge cabinet with freezer compartment **
- 1 x professional café - espresso machine
- 2 x integrated sinks

2.11. Sky lounge Bar

The finish of the bar and its surfaces will be determined by FYD.

Main equipment shall include –

- 1 x small microwave oven
- 1 x six minute glassware washing machine
- 1 x large capacity icemaker type Scotsman or equivalent
- 1 x double door under counter refrigerator**
- 1 x professional café - espresso machine
- 1 x integrated sinks

2.12. Cockpit Deck Equipment

Main equipment is a large electric professional barbeque, and a wine bar installed in two fixed low counters. The wine bar will be part of the aft central refrigeration system^^, and the deckhand over the barbeque will have a recessed extraction fan venting out of the port side upper deck coaming.

(^^connected to the aft central reefer system – full details in the Reefer Section of these specifications ^^)

2.13. Other Refrigeration Equipment

Also connected to the aft central refrigeration system will be a small refrigerator in the owner's office and the bait well on the aft terrace.

2.14. Safes

Installed in all 5 guest cabins and the captain's cabin will be hotel style electronic combination safes. Positions yet to be decided.

2.15. Crew Cabins

To be constructed with careful attention to the acoustic insulation as is found in the guest accommodations. Finish will be wood grained light coloured low maintenance, fireproof Formica or equivalent, with varnished teak wood trim.

2.16. Crew Mess Areas

Finish will be wood grained light coloured low maintenance, fireproof Formica or equivalent, with varnished teak wood trim. Each mess will seat six persons. There will be a large TV screen and video equipment in each mess. Both the upper and lower mess will be fitted with a small built in drinks refrigerator**

2.17. Laundry

A large laundry equipped with 5 machines (2 washing machines and 2 dryers and 1 press) is next to the galley with close access to the guest area via a central corridor through a WT bulkhead.

3. Owner Furnished Items

In principle there may be many decoration items, water sports equipment, and loose items or articles that will be specified and/or supplied by the owner.



For simplicity sake, the majority of all possible owners supplied loose or semi-loose equipment, no matter where it is found onboard, are listed here.

It is the responsibility of the shipyard to install (arrange chocks or securing devices suitable for all sea conditions) for all items listed below.

Items that will be supplied by the owner are found in this list below. The shipyard will take note of these items and be ready to supply any and all necessary Plexiglas or other securing devices inside any cabinets or lockers built for these purposes. It will also be the shipyards responsibility to provide any cabinets or lockers for this purpose.

No extra costs will be charged for supplying these securing devices or for constructing any cabinets or lockers needed to accommodate these items.

The shipyard will establish a latest date for delivery of these items.

- 2 jet skis – type to be defined
- 2 windsurfers
- 1 diving compressor type Bauer 4hp
- 4 standard scuba diving bottles
- 1 aluminium, water tank and filling pump system for scuba diving tank recharging.
- 2 standard fishing rods
- 1 standard fishing tackle box
- All galley loose cooking equipment, pots and pans and serving items – list to be supplied by owner
- All bed covers
- All curtains or window blinds
- All exercise equipment – list to be supplied by owner
- All loose sundeck furniture and cushions – list and material specification to be supplied by owner
- All spare parts (see separate section below)
- Tools (see separate section below)
- All dinner ware in porcelain – list to be supplied
- All drinking glassware – list to be supplied
- All bed linen
- All bed blankets
- All bath-robies
- All bath-towels – all sizes
- Table cloths
- Napkins
- Crew uniforms – 3 sets for all crew as a minimum
- Crew foul weather gear – 4 sets
- Loose furniture ornaments
- Fixed table lamps – if any
- Statues or table sitting art works
- Wall paintings
- 100 Books



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- 200 Video DVDs
- 500 Stereo CDs
- 4 sets of standard personal diving equipment – fins, masks, snorkels, wet suits, regulators, lead weights diving lights, etc.
- Charts, pilots, almanacs, chart table navigational equipment and publications.

SECTION 6 – STRUCTURAL

1. General Criteria

2.1. Light Weight Requirement

The hydrostatics of the design requires the production of the complete hull and superstructure using a light weight structural material. Only a composite sandwich system or high strength aluminium are suitable.

2.2. Structural Material

2.2.1.1. General

The preferred materials for hull and superstructure construction are predominately sandwich composites using laminates of epoxy resin and multi-axial E-glass fibre reinforcements encapsulating a linear structural PVC foam core. Monolithic laminates will be used in defined areas.

The use of hybrid aramid (Kevlar / E-glass) fabrics in some areas of high potential abrasion, like the bow section, and around the thrusters will be included. Also there will be use of about 0.9 tons of unidirectional carbon fibre reinforcements in areas requiring high strength, such as parts of frames, beams, mullions, and girders.

The properties and trade names of the composite materials are listed in Section 14. All reinforcing fibres, core materials and resins materials in our composite structures are supplied by European companies that have been type approved by one of the major (**IACS**) classification societies.

In some areas, the final covering layers of lamination will use special epoxy or vinylester resins with fire retardant characteristics.

The main reasons the composite system has been chosen over aluminium are as follows -

- An all composite hull using epoxy composites has the following advantages over an aluminium hull
- The lack of corrosion problems or special joining methods experienced when joining two dissimilar metals.
- minimal maintenance
- and ease of repair.

Besides the above advantages, an all composite superstructure using epoxy composites has these further advantages over aluminium.

- Ease with which complicated curved shapes and detail can be moulded into the design
- The heat insulating properties of composite material
- And of course, lighter weight which is an important consideration on any upper structure.

2.2.1.2. Resin Specifications

- The resin used for the construction of the yacht will be MGS L135 Epoxy resin, manufactured in Germany or SR 8500 manufactured by Sicomin, France. These resins have been specially formulated for marine construction.
- The resin hardeners used will be MGS 133-135 (fast hardening) and MGS 136-138 (slow hardening) or / SD 860x
- Some specialty parts may use epoxy resins by SP Systems, UK
- For some non-structural parts, small quantities of fire retardant vinylester resin, may be used.
- These resins have an **IACS** Class Type Approval certificates
- The selection of the resins will be based upon the particular application, availability, and in part on the Builders preference.

2.2.1.3. Fibre Reinforcement Specifications

- The primary reinforcement material will be stitched multi-axial E-glass unidirectional, biaxial, and double bias fabrics manufactured by Cotec UK or Selcom Italy or Metyx Turkey and other suppliers.
- Orthotropic E-glass laminates will have the following minimum properties
 - Tensile Strength 21,000 Psi
 - Tensile Modulus 1.50×10^6 Psi
 - Compressive Strength 21,000 Psi
 - Compressive Modulus 1.50×10^6 Psi
- In some high strength areas Carbon and/or Aramid stitched or woven fabrics may be used. Suppliers for these fibres will be SP Systems, UK and EPO, Germany.
- These fabrics have an **IACS** Class Type Approval certificates.
- The selection of the fabrics will be based upon the particular application, availability, and in part on the Builders preference.

2.2.1.4. Sandwich Core Specifications

- The cores will be expanded closed cell cross-linked PVC foam, as manufactured by Diab (Sweden) or Alu-Suisse (Switzerland) or ATC (Canada) This material is used in varying thickness (20 mm to 50 mm) and densities (30 kg/m^3 to 120 kg/m^3).

- Higher density foam or marine plywood shall be substituted in areas of high loading and in way of bolted-on hardware.
- These core materials have an **IACS** Class Type Approval certificates
- The selection of the core materials will be based on the particular application, availability, and in part on the Builders preference.

2.3. Scantlings

The basic hull and superstructure scantlings using the above composite materials have been engineered by EMP to the latest revised rules of BV.

These scantlings are clearly described in the drawings produced by EMP.

2.4. Composite Testing

2.4.1. NDT Testing

Class will require areas of the hull structure for NDT testing. Exact details of the NDT program will recorded here when established by the attending surveyor. However in general the procedure is as follows –

The Shipyard will engage a specialist in detecting voids and delaminations. The test will be carried out principally on the shell. The test method will be performed by use of specialised Ultrasonic equipment. The shipyard will determine a pattern of testing to follow. Additionally the class surveyor will have the option of choosing random or specific points of testing.

THE tests will be accompanied by a report from the expert and be presented to Class for their examination.

2.4.2. Destructive Testing

A comprehensive set of composite mechanical tests, as defined in Section D of the ASTM rules, on selected parts from defined places on the hull structure, may be carried out on the vessel to the satisfaction of Class.

Each set of tests is accompanied by a report from the testing laboratory and is presented to Class for their examination. The tests and the report verify that the required scantlings have been respected and that the required mechanical properties of the laminate meet or exceed design values.

Class will determine where samples of areas of the hull structure for destructive testing. Exact details of the program will recorded here when established by the attending surveyor. However in general the procedure is as follows –

Every major part of the structure, when fabricated will have a test panel created using the same materials and laid up under the same conditions by the same workers at the same time as the major part is fabricated.

This part is then labelled and marked with the surveyors stamp and code and then cut into the proscribed testing sections, Finally the sections are sent to an approved testing facility for the testing as proscribed by Class. These tests will follow, or be similar to –

- ASTM D695-02a and ASTM D3410-D3410M-03 for compression testing
- ASTM D4255-D4255M-01 for shear testing
- ASTM D 2584-02 for fibre content testing.

Additionally, the surveyor may select miscellaneous cut-outs of the structure and have them tested. Usually this is only for fibre content as these cut-outs do not match the size / shape criteria for correct destructive testing.

2.5. Quality Control

Workshop conditions shall be in accordance with the requirements of Class and the resin manufacturer. In general a controlled environment that allows year round lamination will be maintained as follows

2.5.1. Environment

- In winter the temperature will be kept above 17°C.
- In summer the temperature will kept below 23°C and the humidity is kept below 75%.
- At all times the temperature will be kept as constant as possible.
- Workshop temperatures and humidity levels shall be constantly monitored by means of an automatic recording apparatus. The Class surveyor will check these levels periodically.
- The PVC foam, E-glass and epoxy will, if necessary, be pre-heated prior to the initial resin application
- The Builder will follow the procedures laid out in the Class approved Building Process Manual (BPI) and the Class approved Quality Control Manual (QCM)
- Materials shall be stored under conditions as recommended by the manufacturer and by Class.

2.5.2. Cleanliness

- Nylon peel-ply fabrics shall be applied to all surfaces, which shall require secondary bonding, and to all laminates when the period up to the application of the next layer will exceed 48 hours, and to all exterior hull shell surfaces.
- All trash will be removed after each day's lamination session.

- All laminating workers will wear special over-boots when walking on laminated surfaces.

2.5.3. Control

- A complete record of the laminating process will be maintained by the composite manager and will be available at any time for examination by Class.
- The OWR will be able to examine the laminating records and test results in the shipyard offices.

2.6. Building Process Description

2.6.1. Lamination Process

- The hull shell bottom will be produced in a female mould, the surfaces will be fair and smooth with a maximum tolerance of plus or minus 5 mm over a span of 1 meter.
- The remaining hull shell structure will be produced by male molding and later faired with filler.
- Lamination of some major parts will be fabricated by the time honoured hand lay-up method. Followed by vacuum consolidation to ensure maximum strength and minimum weight will be achieved. as most part are very large and laminated vertically, this method allows for the minimum of void creation and a better control of final product free from any deficiencies in resin content. The parts concerned are –
 - Hull shell inner and outer skins
 - All longitudinal stringers.
- All flat panel and deck parts will be fabricated using the infusion process, which is faster and as all these panels are laid up horizontally so easier to control void occurrence. The parts concerned are –
 - All hull and superstructure bulkheads both transversal and longitudinal
 - All decks
 - All tank floors and tank tops
 - All lower deck soles
- All curved superstructure parts will be fabricated on purpose built male molds by the hand lay-up method with out vacuum consolidation and later faired with filler.

2.6.2. Cured Laminate Characteristics

- The expected glass contents of all the laminates are :
 - 52% for hand laminated components
 - 52% for secondary bonding
 - 50% for vacuum bagged panels
 - 48% for infused panels
- In order that epoxy composite parts remain solid under the influence

of high temperatures that may be seen later on in the life of the vessel it is essential all its molecules are fully cross-linked. Therefore the complete exterior parts of the hull structure will be post cured in a specially designed curing oven, and/or another proprietary method of the builder.

- The post curing will take place for a prolonged period at a high temperature, as recommended by the resin manufacturer, until a "tg" (glass transition temperature) is reached that will exceed that for which the hull structure will see in its service environment.

2.6.3. Construction Techniques

The shipyard has developed many proprietary building techniques that will aid in construction speed, over all reliability, control and solidity, some of these are –

- Generally in order that the completed structure shall have the least amount of joints possible, the individual components of the composite structure shall be fabricated as large as possible.
- At all places where joints are unavoidable, the Builder shall make recesses, permitting the application of sufficient layers of laminate on the joined surfaces, which are to be faired flush.
- The bonding together of separately prefabricated components shall always be through laminating bonding tapes to both the interior and the exterior side of the joint.
- Wherever possible, large flat sections such as bulkheads and decks will be fully laminated and cured on heated laminating tables before installation.
- Generally no fibre will be required to make a bend with a radius less than 25mm. If a sharp corner is required cosmetically then this shall be created later using fairing materials.

3. Structural Description

3.1. Subdivision - Watertight Bulkheads

The hull will be sub-divided by 7 watertight (WT) structural transverse bulkheads, forming 8 watertight compartments. This meets the requirements of MCA intact and damage stability. Below deck communication between compartments, where necessary will be provided with approved watertight doors.

The WT bulkhead positions are –

- Bulkhead "A" located at builders frame of xx
- Bulkhead "B" located at builders frame of xx
- Bulkhead "F" located at builders frame of xx
- Bulkhead "H" located at builders frame of xx
- Bulkhead "J" located at builders frame of xx
- Bulkhead "L" located at builders frame of xx
- Bulkhead "M" located at builders frame of xx

3.2. Shell & Deck Laminates

The finished shell will be fair and smooth. Rebating of the foam core will be carried out at all fibre overlaps so that the hull shell has a maximum distortion limit of +/- 5mm over a 6 meter length in all directions before any filler is added to the surface

Reinforcements or thicker laminates and denser core materials will be fitted to, or into, the shell plating as required for appendages such as the stern thruster openings, bow thruster tunnel, stabilizer fins, exhaust ports and sea chests. Reinforcing inserts will be fitted into the deck plating at windlasses, bollards, capstans and any other highly loaded or stressed areas.

All main structures will be reinforced along the edges, in way of large openings, breaks, machinery installations and elsewhere as necessary. All decks will be constructed with an 82m radius camber to allow proper drainage. All square openings in the shells will be fabricated so all corners have a minimum 50mm radius.

3.3. Internal Hull Stiffening / Framing

Will be principally longitudinal in nature. This is to provide a stiffer structure capable of resisting heavy seas and minimizing vibrations.

The main longitudinals (LG) will be in the form of 5 deeply profiled bottom girders. The central girder will be a "T" section, the outer girders will be inverted "L" sections mutually opposed. Additionally there will be an omega sectioned topside girder running just below the portlight framing. Other minor longitudinals will also be used in various places.

All LGs will be built inside the vessel and attached to the hull shell by secondary bonded tapings. Some will be fitted with carbon fibre flanges.

The LGs will have "air" limber holes in the top of the girder flanges that are central in some tanks.

The flange widths will be standardised at 150mm, 200mm and 300mm where needed for bolting down machinery

A series of transversal framing (TF) structures comprising WT and non-WT bulkheads and ring frames will make up the main transversal structure. These will be built outside the vessel and attached to the hull shell and LGs by secondary bonded tapings.

The bulkheads will be made in 7 parts, 1 large full width part that sits on the girder flanges, and below this 6 smaller parts, all laid up on the table including any required patching from DWL down to the shell. First the 6 lower parts will be taped between girders and shell. Then the big part will be fitted, trim the join, this way we only have one horizontal cut in the bulkhead which will require secondary bonding. The large upper part will have the bulkhead stiffeners as they land on the girders.

3.4. Keel

The keel will be profiled NACA section, and constructed/laminated as an integral part of the hull shell. It will be a closed section for the most part and the cavity will be filled with expanded PU foam

3.5. Deck Framing

Deck framing will be in the form of longitudinal beams. These beams will be constructed as omega sections as an integral part of the deck shell and will all include carbon fibre flanges.

3.6. Foundations

The main engines, generator room and some minor machinery will be mounted upon and connected to the LGs. At these points the girders will be specially reinforced and will contain encapsulated 304 steel inserts.

The thrusters and stabiliser foundations will be built upon the hull shell. The shell in these areas will be principally monolithic and contain encapsulated 316 steel inserts. The foundation of the equipment will be built up on the shell using engineered composite structures that will contain epoxy impregnated sipo mahogany blocks. The foundations will be gusseted to the surrounding LG and TF structures.

3.7. Rub Rail

Where shown on the GA there shall be a foam filled box section shaped rub-rail. Continuously fixed to this section will be 316 stainless steel 60 x 30 half round bar

3.8. System Passages

Pipes, wires, etc, passing through WT bulkheads will be fitted with approved watertight penetration sleeves, designed to isolate vibration, and where

necessary are to be locally reinforced. Details to be found in later sections.

Passages for access in bulkheads or girders will be locally reinforced.

3.9. Tanks

3.1.1. General

All main tanks shall be the double bottom type and constructed as an integral part of the hull and so be structural in nature. This method has the advantage of increasing usable interior volume, maximizing tank capacity, minimizing maintenance and reducing structural weight.

The following tanks shall be built into the structure –

- 7 fuel tanks – 3 each side and 1 central
- 4 fresh water tanks – 2 each side
- 1 clean lube oil tank – stbd side
- 1 dirty oil tank – port side
- 1 grey water tank – stbd side
- 1 black water tank – port side
- 1 bilge water tank – central

Any other minor tanks, usually for hydraulic fluids, will be metallic and incorporated with there associated equipment.

All other details about tanks and capacities not mentioned here above and below will be found in the Section 7

3.1.2. Impermeability

Special treatment will be given to all tanks after structural lamination is complete. First they will have a 200 gram resin rich E-glass cloth layer applied, This will be doubled over all areas of secondary bondings and structural penetrations. Second they will be entirely coated with an approved impermeable fuel or water resistant gelcoat coat. This shall be applied to the inside of the sewage and fuel tanks. For fresh water tanks, a food-safe epoxy gelcoat coating shall be applied.

3.1.3. Limbers & Vents

Limber and vent holes of sufficient size and number throughout the tank structure shall be created in the floors and girders. limber holes Arranged so as to provide for complete drainage and vent holes to avoid airlocks and ventilation under all reasonable conditions of list and trim. Radius of all holes to be approximately, but no less than 50mm

3.1.4. Free Surface Mitigation

All tanks will be equipped with non-structural and removable transverse swash bulkheads, or baffles. They will be fitted with a bolting system so they can be removed for access.

3.1.5. Access

All tanks shall have a standard 450 x 400 access manholes. Manhole covers to have two recessed lifting handles and be constructed from 6mm aluminium plate. Manhole locations will be carefully positioned in relation to furniture and floor access and will endeavour to be top mounted as far as is possible. Inside the tanks there shall be fitted lightening holes in the girders and floors for maintenance access to all parts of the tank.

3.1.0. Bilge Limbers & Drainage

Limber and vent holes of sufficient size and number throughout the bottom structure shall be created in the floors and girders (except where intentionally watertight) so as to provide for proper bilge drainage. Radius of all holes to be approximately, but no less than 50mm

Low areas in the bilges shall be levelled with a suitable epoxy filler to allow complete drainage of these areas and high enough to leave little or no water below bilge suction pipe collection sumps. All reasonable requests of the OR to place extra limber holes enlarge existing ones, or increase levelling filler over and above what the builder envisages shall be accepted.

Access to all important spaces and coffer-dams that are below the cabin soles will be provided via hatches and inspection lids.

3.1.1. Bow

This structure will be layered and heavily laminated section over high density PVC structural foam. Total fore and aft depth of the structure will be range from 200 to 400 mm.

3.1.2. Forepeak

A portion of the lower forepeak shall be arranged as a crash box. It will a sealed chamber and the cavity will be filled with off-cuts of structural PVC foam embedded in expanded PU foam. The upper part of the forepeak will be fitted for Bosun's deck stores. The Builder shall composite fixed provide racks, or shelves.

3.1.3. Chain Lockers

This area is divided on the centreline by the crew stairway and a longitudinal bulkhead to separate port and starboard chain bins. There will be reinforced attachment points on central bulkhead for the bitter ends of

the chains.

For more details see Section 10.

3.14. Forward Tender Bay and Launching Crane

The tender bay forward will have non-watertight deck covers hatches fitted above to protect the tenders from the worst of the weather.

Both of these hatches will be built by a specialist company. The hatches will have an aluminium framework, both hull and hatch side. The framework will be bolted to the hull shell onto specially reinforced structures. The shipyard will then sheathe both surfaces of the hatch frame with epoxy laminates and teak finish on the exterior.

The crane will have a reinforced base on deck that is located above bulkhead "B". The crane will be fabricated in aluminium and bolted to this base.

For more details see Section 10.

3.15. Lazarette

This area will house the main thrusters and many other smaller systems. Various local reinforcements to accommodate this equipment will be created as required.

3.16. Hull Appendages & Penetrations

3.16.1. Cowls, Scallops & Tunnels

In the hull bottom, the fixed and electronic transducers that protrude from the hull will be encapsulated in a shaped convex and tapered cowl in composite. This fairing will be an added on piece after de-molding of the hull bottom.

The bow thruster tunnel opening both sides will have a shaped convex tapered cowl forward and a concave tapered scallop aft. These items as well as the tunnel itself will be molded / created integral with the hull shell.

Both main and bypass outlets of the main engine exhausts will convex tapered cowl forward and a concave tapered scallop aft. These items will be molded / created integral with the hull shell.

All 4 outlets of the genset exhausts and the 2 discharge chests will have a convex tapered cowl forward, These cowls will be an added on piece after completion of the hull shell and possibly after the cosmetic fairing of same.

3.16.2. Sea Chests-Intakes

In the forward central engine room bilge, two vertical sections of composite tubes shall be laminated to the hull to serve as intake sea water chests.

3.16.3. Discharge Chests

In the aft engine room, two vertical sections of composite panels or pipes shall be laminated to the hull each side to serve as discharge water chests. These will be placed forward of the main exhaust outlets.

3.16.4. Exhaust Outlets

Main engine exhausts shall have 2 hull exits each. One below the waterline and another at least 200 mm above the full load waterline for the bypass or engine idle flow while stationary or manoeuvring. These outlets will be laminated integral with the hull shell at time of lay-up

3.17. Bulwarks & Details

The hull shell shall extend above the deck line to form a bulwark, the top of which shall be reduced into a flat top-plate to form a sheer rail supported by brackets. The inboard side shall be fully lined. The bulwark shall be capped with an oval composite handrail section.

3.17.1. Freeing Ports & Scuppers

Freeing ports with the same radius opening as the fairleads shall be provided, but in no case less than 50mm.

Reinforcements in the deck for inserting 50 mm scupper drains will be provided at regular intervals on the sides of all decks. These drains will be in the bottom of a 60mm wide scupper created on deck by adding / gluing an "L" section to the deck. This will also be the part to which the teak deck butts up to.

The bottom level of all recesses, bilges, stairs and any other place susceptible to collect water will be angled downward by 1 degree to prevent water from collecting.

3.17.2. Bulwark Doors

Two (2) openings one in each of the bulwarks shall be built into the bulwarks as shown in the GA. They shall be large width, opening inward in 2 half sections. These fairlead openings shall be reinforced in way of hinge points.

3.17.3. Fairlead Openings

Five (5) each side stainless steel fairleads shall be built into the bulwarks as shown in the GA, two on the windlass deck, 1 amidships and 2 in the aft terrace bulwark, for a total of ten (10) fairleads. These fairlead openings shall be heavily reinforced

3.18. Side & Deck Shell Openings

For more details of below descriptions, see Section 10.

3.18.1. Portlights

For the crew area these are standard round 400mm framed side scuttles. They shall be recessed into the hull shell so that the level of the frame / glass is flush with hull surface.

For the guest accommodation these are rectangular openings fitted with glued in glazing. The frame will be heavily reinforced and set at a level which allows the glazing to be installed flush with the hull shell.

3.18.2. Weather-tight (WX) Doors And Vertical Hatches

Reinforcements are to be provided anywhere these are located and where hinge attachments are placed. Most of the doors and some of the hatches will be built by specialist companies and may have an aluminium framework, both hull and apparatus side. The framework will be bolted to the hull shell onto specially reinforced structures. The shipyard will then sheathe both surfaces of the door frame with epoxy laminates and the appropriate finish on the interior surface. Some hatches will be custom built in composite by the shipyard and laminated to the shell.

3.18.3. Watertight (WT) Deck (Horizontal) Hatches

Reinforcements are to be provided anywhere these are located and where hinge attachments are placed. Some of these hatches will be built by specialist companies and may have an aluminium framework, both hull and apparatus side. The framework will be bolted to the hull shell onto specially reinforced structures. The shipyard will then sheathe both surfaces of the hatch frame with epoxy laminates and the appropriate finish on the interior surface. Some hatches will be custom built in composite by the shipyard and laminated to the shell.

3.18.4. Hull Shell Doors

The after sports room will have a fold down hull shell door opening on the port side. It will be built as a WT opening. The aft terrace will have a fold down transom bulwark. It will be built as a WX opening.

Both of these structures will be built by specialist companies and will have an aluminium framework, both hull and door side. The framework will be bolted to the hull shell onto specially reinforced structures. The shipyard



will then sheathe both surfaces of the door frame with epoxy laminates and teak finish on the interior surface for more details see Section 10.

SECTION 7 – INSULATION & VIBRATION CONTROL SYSTEMS

The structural fire, thermal and acoustic, requirements to achieve the db(A) sound levels and safety of a modern yacht will be attained by a variety of insulation materials and numerous anti-vibration measures.

1. Design

1.1. As far as possible all constant running noise making machinery will be located in the engine room, the Lazarette or the fore generator room. Any machinery not in these spaces will receive extra special anti-vibration and acoustic dampening attention

1.2. The yacht structure is designed to avoid vibration frequencies in the hull by incorporating special elements in the continuous structures of the hull

1.3. Tested insulation systems that have proven effective in past yacht constructions by the Sencora engineers will be used. New insulation and anti-vibration design ideas and materials will be constantly evaluated and incorporated if found to be beneficial

1.4. The design of structural parts, such as the underwater exhaust outlets, overboard drainage etc have been designed for maximum sound dampening.

2. Vibration Levels

The vessel shall be constructed to avoid excessive vibration of hull and superstructure. Deflections and vibration levels are not to be detrimental to machinery or personnel on board under normal service conditions.

Vibration levels to be measured in accordance with ISO 6954-1983 "Guide Lines for the Evaluation of Vibration in Merchant Ships"

Longitudinal, transverse and vertical vibration levels will be less than the acceleration and velocity limits stipulated below, during normal operating conditions at sea whilst underway at no more than 75% power in calm seas

In the living quarters of passengers and crew said levels shall be -

- for frequencies < 5 Hz, maximum acceleration 0.012 g
- for frequencies > 5 Hz, maximum velocity 2 mm/sec.

In all other areas said levels shall be -

- for frequencies < 5 Hz, maximum acceleration 0.028 g
- for frequencies > 5 Hz, maximum velocity 4 mm/sec.

3. Noise Levels

The International Maritime Organisation (IMO) Resolution A 468 XII "Code on Noise Levels on Board Ships" will be adopted as a minimum level to ensure an acoustically acceptable environment on board. The specified limits are to be considered within a margin of error + 2 db(A).

Limits foreseen under navigation at a 12 knot cruise speed with one genset operating and with the air conditioning system at speed level 3 speed, and all doors closed - values in db(A)

➤	Engine room	110
➤	Main saloon	65
➤	Wheelhouse	55
➤	Master cabin	50
➤	Forward guest cabins	50
➤	Aft guests cabins	60
➤	Galley	65
➤	Crew mess	65
➤	Crew cabins	60

Limits foreseen at anchor, calm sea, Beaufort 1 or less, with one genset operating and with the air conditioning system at second lowest speed, and all doors closed - values in db(A)

➤	Engine room	90
➤	Main saloon	50
➤	Wheelhouse	50
➤	Master cabin	45
➤	Forward guest cabins	45
➤	Aft guests cabins	50
➤	Galley	60
➤	Crew mess	50
➤	Crew cabins	50

4. Treatments & Measures

Treatments & measures to be taken during design and construction to alleviate the production of noise and vibration

4.1. Structural

- Stiffening of bulkheads,
- Structural pillars filled with special deadening materials
- The engine foundations shall be arranged on a separate plane from the main longitudinal that they are attached to. Alternatively they will be separate from the main longitudinal members.
- High tech modern insulation system on hull shell, all bulkheads, deck heads, and soles, and will be executed taking into consideration the structural fire requirements required by Class and MCA. (see below)

4.2. Spaces in General

- Aluminium or composite deck plates mounted on rubber pads.
- aluminium plates shall have a 5 mm anti-slip lead/vinyl sheet glued to the bottom surface.
- The empty bilge spaces and tank tops below the aft peak and after cabin decks within the area of the propeller shall be lined/filled with a 20 mm layer of flexible heavy compound and high density expanded foam in the form of removable pieces.
- The bilge space below the main engines and gearboxes and the engine/gearbox foundation members, shall be lined/filled with a 20 mm layer of flexible heavy compound then covered with 5 mm galvanized steel plates of varying sizes as is necessary for ease of removal.

4.3. Propulsion Machinery

- Stiffening of engine foundations,
- Main engines and reduction gears shall be elastically mounted as per highest spec of manufacturer. The highest resonant vibration mode of these mountings shall not exceed a frequency of 8 Hz. Both engine/gearbox shall be flexible mounted (rubber) with mounts matching (tuned to) the engine natural frequency
- The design of the propeller so vibration is minimised. Fixed pitch, high skewed, low vibration, and low cavitation type propellers shall be selected.
- a hull to propeller tip clearance of a minimum of 15% propeller diameter shall be maintained.
- Main engine shall be coupled to the reduction gears via flexible vibration dampers.
- Extra attention shall be made to the provision of an effective combustion air intake silencing. Either a silencer between the air filter and manifold or a two stage air filter can be chosen.

- All fuel, water and other connections to main engine and stern gear will be flexible to allow spatial displacement of the engine on its mounting.

4.4. Generators

- Sub-base frames with sufficient mass equal to 50% of the mass of the generator (engine and alternator). The elastic mount deflections under static load shall be between 7 and 9 mm
- The sub-base assembly will be elastically mounted at four or more points to a highly stiffened hull foundation.
- Double isolation mounts. Flexible mounted engines on sub base frame with mounts matching (tuned to) the engine natural frequency
- Generators will be installed inside sound boxes or room. Ideally, this enclosure will be made of aluminium or composite frame and exterior panels with approx 120 mm of insulation. The enclosure must have easily removable access panels, with those opened the most frequently to be hinged to the frame, a viewing window of adequate size and location
- muffled air intakes.

4.5. Exhausts

- Main engine exhaust piping will be flexibly mounted and shall be supported by shock absorbing spring type hangers. These hangers shall be fixed to a steel frame which itself is supported upon a flexible mounting attached to the ships bottom structure. The hangers shall be selected and loaded so that a natural vertical frequency of each supported exhaust pipe is no greater than 7 Hz.
- Main exhaust pipes shall be connected to the engines by a flexible metallic bellows (in the dry section) and a flexible heat resistant rubber hose where the pipe connects to the hull (in the wet section).
- The main engines shall be fitted with dry silencers. Acoustic insulation of 75 mm rock wool covered by removable sections of heavy gauge, 1.5 mm galvanized sheet. A decorative cover can be fitted over all.
- Main engine exhaust shall exit below the design waterline.
- Genset exhaust outlets to be equipped with gas separators to avoid splashing of cooling water into the sea when the yacht is moored.
- Genset exhaust will be insulated outside of the sound enclosure.

4.6. Pumps, Motors & Compressors

- The desalinator main unit comprising the high pressure pump, control box, and osmosis membranes shall be enclosed with a sound box. The sound box shall be mounted on anti-vibration mounts. The high pressure pump shall also be mounted on anti-vibration mounts within the box.

- All pumps and compressors shall be mounted on anti-vibration mounts. All piping to all pumps shall be fitted with vibration joints. If rubber pipe is used as the flexible joint then the space between each metal pipe shall be at least twice the diameter of the pipe.
- All noise generating machinery shall be elastically mounted. In general, all equipment will be mounted at 4 points. Some types of equipment may also be compound (double) mounted and acoustically enclosed, such as air compressors etc.
- all the above equipment mounts shall be made of an oil resistant material for vibration reduction between 10 and 4,000 Hz.

4.7. Engine Room Ventilation Fans & Ducts

- all fan motors shall be elastically mounted as above
- Ventilation fans to be connected to ducting via flexible bellows,
- Acoustic mufflers or mist eliminators shall be installed on all deck ventilating openings so that the noise level on deck does not exceed 70 db(A).
- Fan turbine housings in the engine room shall be covered with a 20 mm of a dense sound deadening material
- Engine room air intake and exhaust ducting will have the same insulation as the engine room space as per requirements of structural fire. In addition this insulation will have a high frequency absorbing material.
- For the most part, air ducting will be smooth walled in order to minimise air turbulence.

4.8. Air Conditioning & Ducting

- The system shall also ensure maximum acoustic privacy between cabins by eliminating transmission through ducts.
- Air returns will also be via lined ducts without use of door grilles.
- Ducts shall be lined with Armaflex or equivalent material, particularly three diameters each side of a bend.
- For the most part, air ducting will be smooth walled tube section in order to minimise air turbulence. However, in selected places, the ducting will be made up of short lengths of flexible corrugated tubing to damping sound transmission

4.9. Piping

- Expansion joints in pipelines.
- Mineral wool insulation, over a length of 1000 mm on pipes entering accommodation areas from engine room.
- all the above equipment that is connected to metallic piping systems, shall be fitted with flexible hose piping connections of 450 mm length minimum.

- The bend radius of each hose shall not be more than 200 mm. 90 degree bends shall be made in the appropriate metallic piping. Hoses of the same size diameter and same use shall as far as is possible be of the same length to facilitate interchange ability. The flexible hose shall meet the requirements of the system and in all cases shall be fitted with a braided metallic sheathing to reduce hose destruction from chafing.
- Piping, in order to reduce structural born noise, will be provided with flexible connections or
- expansion joints of an approved type.
- Flow velocity in all piping will be kept to an acceptable minimum to avoid noise, basic velocities will
- not exceed 2 m/sec.
- all piping and valves shall be fixed to their supports with rubber or similar lined pipe clamps. Metal to metal or wood contact is not acceptable. The toilets will receive special attention to reduce night flushing annoyance (to be defined). Toilet waste piping shall be sheathed in 10 mm of foam rubber pipe insulation. Fresh water supply piping, both hot and cold, shall be insulated with 15 mm (hot) and 5 mm (cold) of black foam rubber pipe insulation.
- Flexible hoses and fittings shall be installed to provide the necessary piping flexibility and to decrease transmission of noise through piping connected to resilient mounted equipment

4.10. Electrical & Electronic Equipment

- all electrical and electronic equipment installed on the vessel, such as gyrocompass, battery chargers, transformers, etc shall be mounted on soft rubber pads to eliminate the hard vibration contact with the deck.
- all the above equipment shall have a flexible electric cable length between the watertight gland on the equipment and the last point of fixation on the cable tray of not more nor less than 450 mm.

4.11. Domestic “White” Equipment

- Such as dishwashers, clothes washers and dryers etc. shall be mounted on elastic mounts as per engine room machinery. Their furniture enclosures shall be lined with 20 mm of a lead/foam composite.

4.12. Interior Furniture

- In all aspects, interior hardware shall be fitted to the correct tolerances and the correct marine type to eliminate the rattling, slamming or creaking of doors, drawers, shelving, linings etc.
- Avoiding the use of unsupported panels,
- Door construction and hinge design.

- Every effort shall be made to eliminate rattles and squeaks from within the accommodation spaces, particularly those emanating from joints between panelling, furniture, ceilings and doors.
- The interior furniture will be isolated from the ship's structure by means of flexible mountings
- All cabins and saloon overhead panels will be secured on overhead supports that are resiliently supported to the deck head.
- Bulkheads shall be lined with a sound deadening material such as Baryflor. Landings for decorative panels shall be glued onto the bulkheads using a rubber type adhesive such as Sikaflex to avoid acoustic pathways through the bulkheads.
- Every effort shall be made to eliminate rattles and squeaks from within the accommodation spaces,
- particularly those emanating from joints between panelling, furniture, ceilings and doors.
- to further eliminate noise transmission, all interior woodwork panelling, joiner work and flooring shall be installed, attached, or otherwise fastened to the bulkheads, deck heads, frames, floor members and tank tops by way of 3 mm rubber pads or gaskets
- shall be solid sandwich construction consisting of wood veneers or Formica surfaces depending on the space, epoxy laminated to 3mm marine plywood, 13 masonite fire test 80-32, 15 mm marine ply, veneer/Formica. Masonite to be on the exterior side of all cabin doors. Doors to be fitted with shear type edge gaskets and 4 hinges.

SECTION 8 – DYNAMIC MECHANICAL SYSTEMS

This section deals with all systems that propel, manoeuvre and stabilize the vessel.

1. Propulsion Power

1.1. Power

The intention is to attain the maximum hull speed of 16 knots. Therefore 2 x 630 kW of power will be required.

1.2. Main Engine Suppliers

Engine suppliers will be Caterpillar or Cummins as a preference due to the high reliability, and worldwide serviceability. The Caterpillar C 32 ACERT 2 X 76 bkw/1.000 bhp @ 1800 rpm is preferred.

1.3. Main Engine Characteristics

Builder will supply and install two Marine Diesel 4 stroke engines, maker "Caterpillar" Model C32 ACERT diesel 746 kW* / 1,000 hp "A" rated @ 1800 rpm, to ensure Constant cruising speed of 12 knots at ½ load vessel condition.

*Air temperature 25° C | Sea water temperature 25° C

The engines shall comply with current IMO regulations on gas emissions. In addition to the Standard Caterpillar engines specification, the engine package shall include the following:

The propulsion engines main characteristics are as follows:

- numbers of cylinders is 12 - configuration 90° V
- air aspiration turbocharged with after cooler
- 24 volt DC isolated ground system, with bi-pole sensors
- 24V starter motor
- Wheelhouse monitoring MPD Caterpillar of main engines will be by way of monitor/alarm system.
- tri-phase alternator 28V, 120A
- Flat oil sump.
- Lube oil dipstick to be located on the starboard side for the port engine and to the port side on the starboard engine.

- Crankcase breather with flexible connection to oil emission filter System
- Armoured stainless steel braided flexible fuel line connections
- Independent engine and gear controls at the engine side
- Silicone or equal flex bellows type connectors for raw water Jacket water heat Exchanger plate type, built on engine
- Shall be able to operate satisfactorily at +-5 degrees of trim, +-15 degrees of permanent heel, up to +-10 degrees of pitching and with a roll of up to +-30 degrees
- Engines are to be painted RAL 9003 white, to the Caterpillar "Summit" paint detail, and quality standard. No fuel, oil, water. Or air flex hoses, flex drive belts, wiring, plastic, or electrical connections, shall be painted white.
- Each engine shall be fitted with a Caterpillar instrument panel. The following functions shall be included:
 - Press. Lube oil engine
 - Press. Lube oil transmission.
 - Temp. Lube oil engine.
 - Temp. Lube oil transmission.
 - Temp. Cooling water.
 - Press. Fuel.
 - Air cleaner restriction, left/right.
 - Differential press. Lube oil.
 - Differential press. Fuel filter.
 - Ammeter.
- Tools one set of standard hand tools.
- Documentation: Parts books with CD-Rom
- Operation manuals in duplicate
- One complete service Manual, with CD-Rom, if available

2. Transmission Gears

2.1. Gearbox Suppliers

Manufacturers will be Reintjes or ZF, Models WAF464 or MPM. Gearboxes will be supplied by the engine manufacturer and connected in their factory before delivery.

2.2. Gearbox Characteristics

Two reduction gearboxes, close coupled to each main engine. Reduction gear will be horizontal offset type. The gearboxes will absorb propeller thrust. The gearboxes shall be arranged so that the propellers shall be contra-rotating in the ahead operation and be outward turning, (e.g. top of blades moving away from centreline).



The supply specification shall be, or include, but not be limited to the following:

- reduction single reduction
- reduction ratio in range of 1:3.9 - 1:4.6
- thrust bearing built into gearbox
- clutch hydraulically operated
- coupling flange SAE standard
- elastic coupling with engine Vulkan or equivalent
- oil cooling sea water heat exchanger
- transmission control electric with engine system
- lube oil pump output shaft driven
- oil filter
- painted white RAL 9003

- Monitoring
 - Mechanical gauges for
 - lube oil pressure gauge
 - lube oil temperature gauge
 - sensors for
 - Lube oil pressure, before and after filter
 - Lube oil temperature,
 - Clutch oil pressure ahead/astern.
- Alarm sensors for
 - low oil pressure
 - High oil temperature.

2.3. Additional Equipment

In addition in each reduction gear will be fitted with :

- A PTO (Power Take Off) driven by the input shaft; the PTO will be available to drive hydraulic pumps for the steering system.
- mechanical control) sensors
- The ship will be able to operate in an emergency condition with one only propulsion shaftline in operation. For this purpose the lube oil coolers will have redundant cooling water supply so the gearbox is cooled when in trailing mode.

3. Flexible Installation

Engine / gearbox supports frames will be structural type, well integrated in the ship's structure and continuing the main structural bottom girder.

The girder top flange will have a 400 x 200 x 20 mm flat steel plate imbedded inside during construction. Foundation holes for engine / gearbox must be drilled and reamed in place where required.



The void to be filled with "Chock Fast Orange" epoxy resin compound filled between the machinery bedplates and the flexible mounts in way of every hold down bolt set.

4 engineered and frequency matched elastic engine mounts capable of absorbing full thrust from the shaft propeller to the ship's structure. The elastic supports will be chosen in cooperation with vibration / noise consultant and engine's manufacturer.

Coupling of engine and gearbox will be by way of a highly flexible elastic coupling type "Vulkan". This unit shall allow the absorption of vibrations and misalignments between the engine and gearbox.

Between the gearbox and shaft there will be a flexible coupling type R&D or equal. More information below.

All piping connections will be made by way of flexible bellows or hoses between engine / gearbox and ship.

4. Main Engine Exhaust

All engine exhaust will be silenced by having water cooling and by directing them underwater through the hull shell in specially designed cowlings. Careful attention will be paid to Manufacturer's back pressure requirements.

Each engine exhaust shall have 2 hull exits each. One below the waterline, positioned for the best main flow while cruising and second at least 200 mm above the full load waterline for the bypass or engine idle flow while stationary or manoeuvring.

Main engine exhausts will be connected to the main engines with a flexible bellows system. The bellows will be of stainless steel.

If Class permits, the dry piping from the engine to the outlets will be fabricated in basalt fibre and a special high temperature resin. If classification does not approve the above, then dry exhaust piping will be mild steel and the water injection pot part will be

Sandvik 2507 or Titanium Grade 2 alloy or equal shall be used in all metal raw water-cooled sections of exhaust starting at the water injection ring and up to the flexible bellows that connects to the hull valve.

The exhaust hull discharges shall all have nodular cast iron butterfly valves at the hull exit.

For periods of idle, reversing or low speed manoeuvring electric butterfly valves on bypass piping will open to let exhaust gases escape above the waterline. These by-pass lines will be equipped with silencers.

The water cooled exhaust discharge trunks and cowlings attached to the structure will be fabricated in epoxy composite.

Pipe hanger details and vibration treatments are addressed in

All sections of exhaust lines, including all expansion joints not water cooled, shall be insulated with oil and water resistant foil-faced, high-temperature, mineral wool insulation. Insulation shall have good aesthetic appearance.

Pads at expansion joints are to be removable. High-temperature, 50 mm thick, calcium insulation with 1 mm aluminium jacket may be substituted as covering for non-water cooled piping.

Exhaust gas outlet piping will be designed according instruction of Engine's Manufacture and according to Class Rules.

It will be of wet type with "under waterline outlet".

The system will be designed for:

Reduction of noise and vibration transmission

Reduction of exhaust back pressure

The "dry and hot" part of exhaust gas pipe will be built in steel.

The "wet and cold" part will be built in stainless steel AISI 316 L and/or fibreglass.

Exhaust gas pipe will be connected to the engine with elastic joints.

Each exhaust gas outlet will be divided in two parts, as follows:

Outlet for minimum and low rpm, smaller pipe discharging above waterline to avoid dangerous back pressure (the outlet will be hidden inside the structural ship's fender)

Outlet for cruising condition, just below waterline. The system is fitted with by pass for outlet the exhaust flow in the two parts of the outlet in way to control the good engine's operation at low rpm and reduction of noise at high rpm.

5. Shaftline

5.1. Flexible Couplings

A highly flexible coupling Holset[®], Vulkan[®], Rato[™] or Centaflex[®] or equal shall be installed between the gearbox and the propeller shaft.

5.2. Shafts



The shafts shall be a high tensile duplex stainless steel such as Aquamet 22, Sandvik 2205, Marinemet® 25 or equal material.

Shaft diameter will be approximately 130mm

The shafts shall be in two parts, intermediate and tail shafts. The intermediate will be approximately 4.8 m long, the tail shaft will be approximately 7.5m long.

All shaft couplings (between transmission- shaft and between shafts) will be mild steel and painted. Coupling between shafts will be inside the vessel just before the stern gland.

Couplings will be key fitted on tapers. Shaft tapers will be 1:16. Keyway design will comply with the special recommendations of Classification Society in order to extend the survey periodicity to four years.

5.3. Stern Tube – Seal & Bearings

A Thick walled FRP tube will be accurately bonded into the hull for subsequent installation of the water lubricated bearings and shaft seals

The stern tubes shall be fitted with a mechanical shaft seal system and water lubricated bearings. The tube will be about 3m long and fitted with 2 bearings, one each end.

The internal seal will be conventional Manebar type from Deep Sea seals Ltd and using the "air seal" system seal. This seal will permit the substitution of the same while the boat is in the water.

The bearings will be of the "fluid film hydrostatic type" by means of sea water forced circulation.

The after shaft brackets will have also be fitted with the same bearing type, with vessel forward movement lubricating the seal by means of sea water natural circulation

The stern tube bearing shall be lubricated with engine cooling water after the main engine raw water cooling pump. This cooling water line shall be fitted with an isolating valve, and with high point bleed valves located dose to the stern glands.

The ship will be able to operate in an emergency condition with one only propulsion shaftline in operation. For this purpose both stern tube bearings will have a redundant backup system in place (two water inlets for cooling water, the other a cooling bypass line from the opposite engine) to ensure lubrication and cooling when a gearbox is in trailing mode on an non-working propulsion line, or other failure of the cooling system.

Both cooling water lines shall be fitted with pressure sensors connected to the alarm system.

Both cooling water lines shall be fitted with pressure sensors connected to the alarm system

Both seals will be provided with composite drip trays and removable spray shields to collect any leakage at the stern glands. These will drain to the lower bilge.

5.4. Shaft Brackets – Bearings

The "V" shaped shaft brackets or struts shall be connected through the hull, to continuous girders, floors, or bulkheads. They will be located next to the propeller.

The bracket design shall present a minimum resistance to the flow of water and shall minimize the formation of water vortexes.

The shaft bracket bearing tubes shall be aligned by the means of six adjustable stainless steel set screws in each bracket, and then the void to be filled with "Chock Fast Orange" compound.

The bearing shells shall contain a nitril rubber and will be held in place as a friction fit and with grub screws. The bearing shells shall have no internal shoulder to permit their removal by drift without removing the shaft.

5.5. Propellers

The propellers will be fixed blade (FPP), high skew and built from NIBRAL (Ni/Al/Br). They will have 5 blades minimum. Diameter will be approximately 1.65 m (58")

The design of the propeller shall be a careful balance between the requirements for efficient propulsion on the one hand and for the quietest possible operation on the other. Final diameter, pitch, number of blades, expanded area ratio, skew angle and other design characteristic will be designed by the manufacturer taking into account both the hydrodynamic's efficiency and noise and vibration reduction.

Propellers will be fitted with bronze fairwater nuts and stainless steel keys. The propellers are of key type and are fitted on the tapered end of the propeller shaft and secured by key and nut.

Propellers will be right and left handed or counter-rotating to each other (When viewing from astern the starboard propeller shall turn clockwise and the port propeller shall turn counter clockwise). They shall be

guaranteed against singing, and shall be statically and dynamically balanced, and manufactured to ISO 484/1 Class "1"

A propeller removing tool will need to be supplied, with secure stowage onboard.

5.6. Tunnels

In order to accommodate the shafts and propellers, the hull will be fitted with tunnels, Tunnel diameter at the propeller will be 1.9m.

5.7. Alignment

Shaft alignment shall be re-checked proved after installation by measurement afloat. Measurements will be taken (and realignment undertaken if necessary) after the vessels has been afloat for at least 24 hours, and again after completion of sea trials.

5.8. Protection

Shafts shall be earthed using silvered slip rings with silver graphite brushes connected to the ships bonding system. A Tecnoseal or equal system will be installed.

Half shell type sacrificial zinc anodes will be fitted to both shafts. There will be two sets on each shaft.

5.9. Torsional Calculations

A torsional vibration analysis will be undertaken by a specialist in the field, most probably S. Van Capellen. His recommendations about shaft support, engine vibration mounting, flexible couplings, etc will be taken into account during the build process.

The entire rotation system including main engines, shafting and propellers will be designed so that all harmful torsional vibrations will be eliminated for the normal operation range except for the critical range which will be clearly indicated and passed quickly.

The calculation sheets regarding the torsional vibrations will be submitted to class for approval

6. Steering & Rudders

The vessel will be equipped with a Jastram, BCS, Data, Tenfjord or equal steering system with two rudder actuator cylinders. Rudder

tiller arms to be cross connected by a bar with greased ball/socket joints.

6.1. Main Characteristics

- max total torque approximately 1,500 Nm
- max rudder angle +/- 35 degree
- full helm to full helm will be accomplished in 15 seconds
- dual system -
 - two hydraulic actuator cylinders, both rated for full load on both rudders
 - two electro-hydraulic pumps, both 400V and both rated for full load on both rudders, approximately 4 hp electric motor each.
 - two oil header tanks
- local pumps located in Lazarette next to actuators
 - main pump unit with dual solenoid units each with separate electric control wires to wheelhouse.
 - Back-up pump unit with single set solenoids and wiring to wheelhouse
- electrical breakers panel located on MSB in ECR
- control panel located in wheelhouse
 - 2 F.U. controls
 - 1 for autopilot connection
 - The other for a helm console mounted steering wheel
- 2 rudder angle pickup sensors with 2 rudder angle gauges.
 - 1 pickup on each tiller
 - 2 indicators in wheelhouse
 - 3 N.F.U. lever override manual steering joystick including a "follow me " button located at wheelhouse helm console and both bridge wing consoles.
- Alarms
 - Low oil level in both header tanks
 - Loss of power for both pumps
 - Motor overheating both pumps

6.2. Operation

The steering is comprised of two semi independent systems. Should a steering failure occur, by way of hose rupture, pump failure, actuator leak, power failure etc. the back-up other system can be brought on-line by operating 2 bypass valves, one to be closed and the other opened. These valves are ganged to together and can be operated from the wheelhouse by electric remote control, or manually from the Lazarette.

The back-up system electrical power can be selected from main power or from emergency genset power. Both main and back-up pumps / solenoid units have separate electrical control systems, running apart from each other, to the wheelhouse.

6.3. Rudders

Two semi-balanced spade type rudders. Blades will have NACA hydrofoil shape and be fabricated from grade St42 shipbuilding steel. The interior of the blade will be filled with expanded polyurethane foam. Each blade will be equipped with a recess on each side to accommodate a sacrificial zinc anode.,

The rudder stock shall be SAF2205 or other duplex high tensile stainless steel. Stocks will be fully welded into the blades.

Rudder bearings will be Vesconite or Thordon or equal bearings, with watertight glands fitted above. Shaft tubes will be fabricated in epoxy composite and fully bonded to the vessel hull shell structure by way of webs and gussets.

For maintenance threaded-in lifting eyebolts to be provided in the top of the stocks, WT hatches directly above the stocks will allow for maintenance.

7. Bow Thruster

7.1. Description

A standard Kaplan 3 blade tunnel thruster will be installed forward. Thruster will be direct driven mechanically by a dedicated marine diesel. Power will of 160kW. Tunnel diameter will be 750 / 800 mm.

The thruster will be direct mechanical driven by a dedicated marine diesel. This diesel will direct coupled to the thruster by way of a flexible coupling and shaft. The thruster will be mounted horizontally.

7.2. Thruster Manufacturer

Thruster will be supplied by Hardy, OYS, DTG or Jastram.

7.3. Thruster Engine

Technical Data

- Type Marine light fuel diesel engine
- Make Steyr
- Model MO236K42



- Compliancy TIER II
 - Prime power 230 hp (170 kW)**
 - @ RPM 4200**
 - Number of cylinders 6
 - Cylinder arrangement in-line
 - Cycle 4-stroke
- ** Engine has dual function – Bow thruster prime power and emergency genset. When in genset mode engine runs at 1500 rpm

Cooling system

- Fresh water Heat Exchanger cooling
- Raw water pump

Governor and Fuel System

- Electronic speed governor to ISO8528 G3
- Fuel pump
- Fuel filters
- Fuel inlet connection
- Fuel return connection
- Fuel shutoff valve - 24 Volt - energise to run

Intake and Exhaust System

- Turbocharger with insulation cover
- Water cooled exhaust manifold
- Dry exhaust outlet
- Flexible exhaust bellows
- Oxidation catalytic converter **

Lubricating System

- Oil pump - gear driven
- Spin on full flow lubricating oil filter
- Integral lubrication oil cooler
- Oil filter bypass
- Closed engine breather system

Primary Starting

- Auxiliary start relay
- Starter system 24volt electric starting motor
- Insulated return DC supply

Wiring, Switches and Senders

- LOP switch
- HWT switch
- Overspeed switch

Shutdowns

- Low oil pressure shutdown
- High engine temperature shutdown
- Emergency stop shutdown



- Over-speed shutdown
- Under-speed shutdown

Multiple Start Failure Alarms

- Low coolant level
- Low lube oil pressure
- High engine temperature

Digital Displays

- Lube oil pressure
- Water temperature
- Hour run clock
- RPM
- Mode of operation
- Status of engine / generator
- Alarm list
- Event timer

Control Features

- Local Start/Stop
- Local Emergency Stop
- Access Switch / local – remote start
- Local alarm siren and terminals for remote siren
- Terminals for Remote Start/Stop
- Terminals for Remote Emergency Stop

Other Features

- A speed pick-up for over-speed protection; this sensor shall monitor engine speed and initiate an over-speed shutdown to protect the engine.
- A spare digital input to be available
- A spare digital output a to be available
- A spare analogue output to be available
- Fully CANbus capable, which enables the use of CanBus/J1939 enabled engines management systems for monitoring purposes.
- RS232/RS485 port to be available
- This system must be expandable for additional binary inputs/outputs, analogue inputs/output, remote indication panel, or remote controller.
- The generating set will be painted RAL 9003 white
- Quantity 1 x Operators / Maintenance / Spare Parts manual c/w wiring diagrams will be supplied with each set

Testing

Genset to be fully tested at 25%, 50%, 75% 100% and 110 % load and all alarm and shutdown systems to be functionally checked.

**** Oxidation Catalytic Converter**



Gas flow per engine 110% Load: 21.12 m³/min
Gas temp: 459 °C max. 700 °C
Guaranteed Reduction
CO: 60%
HC: 40%
Diesel Odour: 75%
PM: 10-15%
Catalyst diameter: 235mm
Catalyst depth: 90mm 1 layer
Catalyst volume: 3.8 litres
Pressure Drop: 0.6kPa
Space Velocity: 184 000 h⁻¹
Cell density: 200cpsi
Substrate: metal
Catalysts are of metal substrate. 200 cpsi.

The above is to be supplied within a stainless steel 316 housing with cones and flanges.

8. Stabilisation

8.1. Manufacturer

The system will be the "Zero Speed" or "stabilization at anchor type" as manufactured by **Quantum**.

8.2. Location

A pair of stabilizing fins will be installed in the fwd hull bottom of the engine space. These stabilizing fins will be hydraulically operated from a stand-alone power pack located in the engine space. The power pack will consist of 2 x 3 ph 400V electro-pumps. Each pump will be capable of full operation of the system.

SECTION 9 – PIPING SYSTEMS

1. Pump, Valves & Piping Systems

1.1. General

- It is emphasised that simplicity of all different systems as well as for the whole technical installation is of utmost importance.
- Where possible, the builder will use similar equipment in the different systems, in order to have interchangeable parts.
- Pump capacities, pipe sizes, etc. are calculated as per class rules.
- Manufacturer's recommendations concerning the installation of the equipment will be observed.
- The grease nipples on board will be the same throughout the vessel, made out of sea water resistant material.
- For all fittings and valves a single source of supply (Econosto® or equal) shall be preferred.
- The same holds true for the supply of elastic mounts, flexible pipe hangers, rubber bellows and expansion joints.

1.2. Serviceability of Equipment

- Extreme care will be given to the installation of piping and equipment to ensure:
 - proper ventilation and cooling
 - acceptable accessibility
 - Sufficient clearance for possibility to draw filters, coolers, to grease and clean etc., without the need to dismantle other parts of equipment.

1.3. Tanks

All tanks shall be arranged/equipped/outfitted as follows:

- Tank interior construction to be executed in such a way that the contents will run freely to the deepest point.
- The insides shall to be fully accessible through at least two oil-tight, round bolted manholes and through lightening holes in the internal swash plates.
- Manhole rings to be bolted to the tank. The gasket material must be oil-resistant and installed in a gasket-groove in the manhole ring.
- At the manholes, handgrips shall be attached to facilitate a man to crawl in and out of the tank.
- Fill and vent pipes, flush drain plugs, connections for supply/return lines, contents measuring system, sounding pipes, alarms and level switches. In way of the sounding pipes, the hull bottom shall be locally reinforced.

- The fuel bunker tanks shall be fitted with a suction pipe and a connection for a manual sludge pump.
- Tanks in a high position will have drain valves, tanks in low position will have sludge suction pipes to the tank tops.
- Each tank provided with manholes or hand holes for cleaning and inspection, according to the tank size.
- Tanks to be air-pressure tested at 0,5 bar overpressure.

1.4. Foundations of Equipment

- The builder will ensure that all pumps, motors, switchboards, engines and other equipment when applicable, will have a strong rigged support or foundation to hold the equipment intended and to avoid vibration and noise by use of rubber mountings and shocks where appropriate.
- Where needed drip trays will be placed.

1.5. Hull Connections

- All intake through hull fittings of the different systems are arranged below the light load line. The number of hull fittings to be restricted as much as practical by use of common drains and seacocks etc.
- All hull fittings are reinforced & flange-mounted to the hull.
- All fastenings of flanges and valves is done by stainless steel stud bolts.
- All metal items that are attached to the composite structure shall be connected to the common ground system.

1.6. Pumps

- Pumps to be delivered on special base plate with a flexible coupling between the pump and the electric motor
- All pumps shall be installed on selected highly flexible V-type mounts in painted stainless steel drip-trays with fixed drain pipes to the sludge tank.
- Flanged expansion bellows at all connections between pumps and pipe work or valves.
- Vacuum and pressure gauges, fitted with closing valves, for all pumps.
- A pressure relief valve for each pump.
- Pumps to be fitted with valves on both sides, allowing removal or repair.
- Assembled pump units to be painted white RAL9003 prior to installation on board.
- Except when specifically specified otherwise, all overboard valves to be of the marine bronze screw-down-non-return type (SDNR)

1.7. Pipe Work and Plumbing

- The location of pipes will be practical for ship's use, not blocking entrances, other equipment etc.
- All pipes through bulkheads to be fitted with gland connections.
- Stress free installation on properly spaced support brackets and/or hangers.
- Metal pipes to be fitted into the brackets using rubber linings.
- Non-metal pipe systems, which are to continue into the engine room shall, at about 1500 mm before entering into the engine room, change to an acceptable metal pipe.
- All pipes susceptible to condensation, hot and cold water pipes and Freon carrying pipes shall be insulated in accordance with the manual issued by Armstrong® for Armaflex™ or equal.
- Insulation shall be continuous in way of brackets, hangers, elbows, T-connections, etc.
- Installation with constant drops and straight runs avoiding sharp bends.
- All pipe bends to have smooth radiuses. No mitred joints shall be acceptable.
- Pipe connections to be socket welded or flanged and fitted with expansion joints as necessary. Welded butt-joints shall not be acceptable.
- Watertight bulkhead- or deck penetrations to be flanged or through the use of an approved fitting.
- Straub® couplings will be acceptable in tight places.
- Where pipes are to pass through tanks or tank-type watertight compartments, a heavy walled chase tube shall be laminated into the tank or compartment.
- Pipes which are to be galvanised, shall first be completely fitted in place using untreated steel pipes of the appropriate quality, after which the fabricated pipe sections are to be removed, grit-blasted, galvanised and reinstalled.
- Sight glasses to be fitted in appropriate locations.
- Shock accumulators in all high-pressure lines.
- All exterior portions of fill- and vent pipes to be stainless steel.
- Partially completed portions of the pipe systems shall be pressure tested prior to their being covered or hidden by subsequent construction.
- Pipes to be subtly colour coded and marked, indicating their contents and the direction of flow.
- Handles and hand wheels of valves to be painted in the corresponding colour.
- English language name plates to be fitted at all valves and fittings.
- Pipe lines are installed as straight as practical, with regard to the X, Y and Z axis of the ship.
- All piping of all water containing systems will have drain valves at all low points, to enable draining the system from freezing.

- Pipes will be pressurised according the yard's standards. The Builder will deliver a journal of the pressure testing.
- Pipe expansion will be compensated by bends, compensators and flexible connections. Pipes to be mounted without initial tension or stress.
- All, main, potable hot water pipes to be insulated with suitable insulation.
- Flow velocities are related to the clear pipe diameter and are kept to an acceptable minimum to avoid erosion and noise. Basically velocities will not exceed 2 m/sec.
- All main valves flanges, connected to inlet boxes and manifolds, will be by means of stainless steel bolts.
- All secondary piping systems are made of polypropylene (PP), of the maximum pressure class.
- In certain positions ABS or vinyl-ester piping is acceptable.
- In certain positions in the grey and black water system, suitable PVC piping is acceptable.
- All valves, piping and fittings according to required consumer's capacity.
- All pipes to be colour coded, for medium and flow direction, according international practice.
- Basic material schedule of piping:
 - Sea water pipes: Polypropylene or ABS, (except for CuNiFer in Engine Room)
 - Bilge water pipes: Metallic,
 - Potable water: Polypropylene (approved for drinking water),
 - AC circulation pipes: Polypropylene,
 - Grey water pipes: Poly-ethylene or PVC,
 - Black water pipes; Poly-ethylene or PVC,
 - Tank vent pipes (non fuel) Polypropylene,
 - Filling and vent pipes below 1": stainless steel or CuNiFer
 - Filling and vent pipes above 1": Reinforced Nitryl Rubber
 - Fuel consumption pipes: CuNiFer and s/s braided nitryl.

2. Fuel System

2.1. General

- The fuel system can be divided into the following units:
 - fuel tanks
 - fuel filling and vent system
 - fuel transfer system
 - fuel consuming system
- On board are the following diesel consumers:
 - main engine SB
 - main engine PS
 - 3 main generators

- Bow thruster engine / emergency generator
- All valves shall be 90° shut-off ball type suitable for fuel use.
- Valves shall be mounted in the downward vertical position when on.
- Main shut-off valves shall be readably accessible and clearly identified.
- Shut of valves can be operated from the outside of engine room.

2.2. Fuel tanks

- The following fuel tanks are fitted:
 - Two main engine clean fuel day tanks
 - One generator clean fuel day tanks
 - a port & stbd. forward fuel tank,
 - a port & stbd. aft fuel tank.
- In total 75,000 Litres.
- Tank choice manifold in engine room for supply and return of fuel.
- Manual shut off outside the engine room (location to be determined).
- Manholes will be fitted, sufficient in size and number, to perform tank cleaning.
- Fuel tanks and associated piping are to be thoroughly cleaned, free of water or other contamination and examined by Surveyor before taking on fuel.
- Fittings on fuel tanks:
 - 2" filling pipe which enter the tank close to a baffle or bulkhead,
 - ½" suction pipe with non-return valve @ 50mm from bottom,
 - 2" main vent line,
 - ½" replenishment air vent line,
 - ½" sludge/water drain,
- electronic level gauges on all tanks.
- gauge glass with safety valves (day tank),
- low level alarm on tank (day tank).
- The day tank shall be fitted with:
 - One 1" fill pipe from the day tank pump and the separator.
 - One 1½" vent pipe to the vent tank.
 - At the deepest point, a self closing valve plumbed into the drip-tray pipe to the sludge tank.
 - At the bottom, one supply line for the two main engines, fitted with an electrically controlled SOS valve, switched from the emergency controls panel.
 - At the bottom, one supply line for the three generators, fitted with an electrically controlled SOS valve, switched from the emergency controls panel
 - A sight glass/level gauge.
 - One or more rounded bolted inspection/clean out cover(s).
 - High- and low level alarms.
 - Low- and high level pump switches.
 - Drip-tray with permanent line to sludge tank

2.3. Fuel Filling and Vent System

- Fuel bunkering pipes shall be provided Port and Starboard with a fuel tank selection manifold located in the engine room.
- The fill system shall be laid out for gravity feed filling only, with only one filling station to be used at any one time.
- The fill lines shall each be fitted with a closing valve at their connection to the fuel transfer/distribution manifold.
- From the manifold only a single line, to be used for both filling of and drawing from the tank, shall run to each double bottom bunker tank.
- In the tank this pipe shall end at about 75 mm above the bottom.
- The pipe fillers will be housed in bunkering lockers in the deck, together with the breather pipes. The lockers will drain overboard.
- Port and starboard fillers, air vents and sounding pipes shall be fitted with an appropriate nameplate.
- The whole fuel filling, vent and trim system shall be made of stainless steel pipe work up to 1" in diameter and in Nitryl lined rubber hose above 1" to Classification standards.
- All vent pipes from bunker tanks and day tank shall collect in a common vent box, which is to be located up as high as possible forward in the engine room. From this tank a single common vent pipe shall run all the way up to a flameproof wire mesh exit screen in the antenna support structure.
- This common vent box shall be fitted with a liquid level alarm, a sight glass and a permanent drain pipe to the central fuel tank.

2.4. Fuel Transfer System

- An approved AC electric fuel transfer pump Viking model 195, 1.5 HP, 240 VAC shall be provided to pump fuel from tank to tank connected to the fuel manifold which is also connected to the filling lines.
- An approved DC electric day tank pump Viking or equal, 1 HP, 24 VDC shall be provided to pump fuel from tank to tank connected to the fuel manifold which is also connected to the filling lines.
- Through the use of valves these pumps shall be interchangeable.
- At this same manifold system a couple of Alpha Laval fuel separators (see below) can be installed to fill day tank and transfer fuel to other tanks running through the separator.
- One emergency service hand pump shall be fitted to the fuel transfer manifold.
- Pressure and vacuum gauges shall be fitted either side of pumps to indicate flow.
- An automatic Tuhill 900 Fill-Rite indicator shall be installed between filling line and manifold as well between manifold and transfer pump.

2.5. Fuel System to Diesel Consumers

The diesel fuel consumers in the engine room are fed by their own fuel suction pumps from the day tank through a single Racor[®] filter for the generators and a duplex Racor[®] filter for the main engine.

- At each main engine one Racor[®] filter model 79/1000/FGMP, with metal bowls and water alarms.
- At each generator one Racor[®] filter model 900/FGMP, with metal bowls and water alarms.
- Main engine filters are of double type with switch over.
- The consumer connections shall have minimum 300mm long stainless steel braided hoses.
- The return connections on the tank top will have full flow stainless steel ball valves locked in the 'open' position.

2.6. Level Sensors

- Tanks to be fitted with Phillippi or equal level switches for indicating the 1/3 full and 2/3 full LEDs on the synoptic panel.
- Level alarms shall be calibrated / tested for their proper reading.
- Fuel tanks shall be fitted with Phillippi level indicators, or equal, on the synoptic panel, and are to be provided with calibrated sounding rods.

2.7. Fuel Separators

- One centrifugal fuel separators Alfa Laval[®] model MIB 303 SGP with a capacity of 1.000 litres/hour, complete alarms.
- The separator shall be plumbed to facilitate that all fuel drawn from a bunker tank, for transferring it to either the day tanks or to another bunker tank, shall pass through the separator.
- Installation shall be on a deep drip tray with a permanent drainpipe to the sludge tank.

3. Lubricating Oil System

3.1. General

- The lubricating oil system can be divided into the following units:
 - oil tanks
 - oil transfer pumps
- On board are the following oil consumers:
 - main engine SB
 - main engine PS
 - main generator 1
 - main generator 2

- main generator 3
- All valves shall be 90° shut-off ball type suitable for fuel use.
- Valves shall be mounted in the downward vertical position when on.
- Main shut-off valves shall be readably accessible and clearly identified.
- The tank vent lines shall be brought to a point above the main deck level.

3.2. Oil Tanks

- One fibreglass clean lubricating oil supply tank of adequate size, minimum 800l complete with all fillings, and spigot.
- The double bottom lube oil tank is to be fed via a permanent fill pipe from a stern filling station.
- Ancillary equipment include both an electric and a manual lube oil transfer pump, level alarms, level indication, sounding pipe etc.
- One fibreglass dirty lubricating oil supply tank of adequate size, minimum 1200l complete with all fillings, and spigot.
- The double-bottom sludge tank is fed via fixed pipes from the main engines, generators, the drip-trays under fuel pumps, filters, day tank, hydraulic power-pack and the filling stations.
- The used oil suction lines from the engines and the generators will be hooked into a manifold, feeding the sludge oil pump which discharges into the tank.
- Through the use of valves, the sludge oil pump will double as sludge discharge pump.
- For this purpose, a permanent pipe is laid to an international connection in the stern filling station.
- The sludge tank shall at least be fitted with permanent pipes from:
 - Supply side of sludge oil pump.
 - Three filling stations.
 - Drip trays under:
 - lube oil pump,
 - sludge oil pump,
 - hydraulic power pack,
 - fuel separator,
 - fuel pumps,
 - lube oil pumps,
 - sump of the central fuel tank.

3.3. Oil Transfer Pumps

- Oil change system for both main engines and generators with two approved reversible pump such as an Oberdoerfer model #99 2MJ08 1¾ HP, 110 VAC and manifold and all necessary plumbing.
- The electric pumps shall be interchangeable, using valves.

- One portable manual semi-rotary wing pump with a capacity of about 40 litres per minute, as back-up of the electric pumps and for connecting to and pumping out of the lube oil tanks.
- The manual pump shall be plumbed to allow it to be used for:
 - pumping out the into the sludge tank.
 - pumping out the sludge tank contents into portable cans.

4. Sea Water System

4.1. General

- In the engine room two sea chests, each fitted with identical rubber lined butterfly valves an strainers on the outlet branches, which are to be interconnected by means of a cross-over pipe.
- Except for the reverse osmosis watermakers and the emergency fire pump, all sea water consumers will draw from the cross-over.
- A butterfly valve is fitted at each branch pipe on the cross-over.
- All seacocks to be according to ABS recommendations.
- Hull thickness in the way of standpipes and seacocks and construction of these will be a point of special attention.
- All spindles will be easily accessible for operation and maintenance.
- All seawater lines, including the cross-over line shall be constructed from CuNiFer.
- No red brass fittings shall be used anywhere in the raw water system..
 - Sea water consumers are:
 - Main engines and gearboxes;
 - All 3 generators;
 - Watermakers;
 - Deck wash/fire fighting system;
 - Propeller shaft lubrications,(via main engine);
 - Engine and generator exhausts (via engine and generators);
 - Air conditioning;
 - Oil coolers
 - Refrigeration cooling pumps

4.2. Sea water pumps

- Each system using sea water for cooling will have its own circulation pump.
- All pumps to have mechanical seals.
- It is strongly recommended to choose a minimum of different pump types.
- The bilge /fire fighting pumps will have a prime connection if they are positioned above the waterline.

4.3. Sea Water Strainers

- The sea water strainers shall be standard Econosto filters (# 1287 Or # 1288) in bronze, with 3 mm strainer.
- The lid will be secured by stainless steel threaded studs and wing nuts and to be sealed with O-rings.
- The vent pipes shall be connected to the strainers with a shut-off valve.
- Additionally, there shall be connections for compressed air to permit the blowing out of the sea-chests.
- Each strainer shall be dimensioned to permit normal operation of all seawater consumers and engines running at about 1000 rpm, through only one strainer.
- On the cross-over each consumer shall be connected by means of a mono-flange type rubber lined butterfly valve to supply to the following:
 - Main engines and gearboxes;
 - All 3 generators;
 - Watermakers;
 - Deck wash/fire fighting system;
 - Refrigeration cooling pumps;
 - Two spares closed with blind flanges;
 - Air conditioning.

5. Bilge / Fire Fighting System

5.1. General

- A combined system will be installed for bilge and deck wash/fire fighting.
- Two pumps are connected to a bilge manifold built to class requirements.
- One pump will be designated as bilge pump, the other as fire-/deck wash pump.
- They will, however, be interchangeable through the use of valves.
- From the bilge manifold in the engine room, suction lines will run to the individual bilges throughout the yacht.
- The pressure lines from the pump flange to the hull discharge opening shall be fabricated from schedule 80 stainless steel tubes.
- The fire-/deck wash pump will draw its water from the cross-over line and feed the ship's fire main onto which, at strategic locations, the firehouse connection valves are fitted.
- The system can be divided into the following main units:
 - pumps;
 - piping and valves;
 - bilge system;
 - deck wash system;

- fire-fighting system .
- Extra attention has to be given to simple operation of these systems and a good access to valves, manifolds and pumps.
- Deep points to be created in areas that are flat or shallow.
- On the port and starboard side, on the main deck, there will be an International Shore Connections as part of the fire main.
- The system shall be tested as soon as practical. (Priming).

5.2. Pumps

- There will be three pumps installed in this system:
- Engine-driven pump: Jabsco 18310-0000 2" w/clutch min. 20 m³/h.
- Centrifugal pump in engine room: Flomax or equal, 240 VAC, 5 HP (2 bar)
- The 240 Vac. and the engine-driven pump are connected in parallel via a simple manifold.
- Pumps to be sea water resistant, self priming and will have mechanical seals.
- Pumps will be provided with prime possibilities if fitted above the waterline.

5.3. Piping and Valves

- Bilge, ballast and fire lines to be of galvanised steel.
- The bilge manifold is to be an assembly of SDNR valves.
- The bilge manifold shall, on the suction side, include an additional valve complete with Storz[®] (camlock) coupling.
- In case a water tight compartment has, due to the locations of tanks or other structures, multiple water collecting points, then these points are to be opened up to each other by means of bonded-in heavy wall pipe sections.
- These measures shall include the levelling-off or filling-in of the low points with an appropriate epoxy filler material.
- The overboard discharge fitting shall be large enough to handle the combined volume of the two identical bilge- and fire-/deck wash pumps.
- The fire main shall have a by-pass in way of the engine room. The valve(s) isolating this part of the system shall, besides being locally controlled, also be electrically remote controlled by a switch in the emergency panel next to the engine room entrance.
- All valves to be bronze.
- The fire- and deck-wash valves shall be fitted with Storz[®] couplings, whereby the exterior valves are to be polished and chrome plated.
- Piping to be kept straight wherever possible.
- Vented discharge pipe will have an in-line non-return valve.
- Bilge wells will be provided with strum boxes and non-return valves.

5.4. Bilge System

- The bilge compartments shall comprise of :
 - Forepeak,
 - Chain lockers
 - Crew quarters fwd
 - Reefer room
 - Central coffer dam
 - Engine room
 - Sport Room
 - Owner bathroom
 - Owner cabin
 - Lazarette,
- Each water tight compartment shall have, at the lowest point, its own bilge, each to be fitted with Mobrey[®], or equal, fully enclosed electronic level alarm sensors, a suction pipe directly connected to the bilge manifold, a strainer and a non-return valve.
- All compartments that cannot be drained will be filled with an suitable epoxy filling compound.
- The chain lockers are drained directly into the sea.

5.5. Fire Fighting System Hydrants

- The bilge/fire manifold will have a discharge connection to hydrants on deck.
- The deck-wash/fire hydrants are located on deck in the following general areas:
 - Fore main deck ,
 - Midship main deck (2),
 - Aft main deck,
 - Aft upper deck,
- Deck wash/fire hydrants on deck type 1 ¼ ".

5.6. Anchor & Deck Wash

- Basically the fire fighting system is used for anchor & deck wash.
- On board will be two hoses of suitable length provided with jet nozzles.

6. Waste Water System

6.1. General

- With the exception of the crew mess, the main galley and the pantry sinks, all sinks, vanities and showers will drain via siphons through heavy duty PVC pipes and fittings into Evac[®] stainless steel Vacuum

Interfase Valves™ model 59795 00, which shall be an integral part of the vacuum sewage transfer system.

- The crew mess, the main galley and the pantry sinks shall drain directly overboard.
- In the case that, due to its location in relation to the waterline, the draining of the crew mess sink could be problematic, then the Builder shall fit a small collection tank with an automatic pump to ensure
- proper discharging of waste water.
- The bathtubs will naturally drain into the grey water tank.
- Condensate from air handling units and refrigeration shall drain into Evac® stainless steel Vacuum Interface Valves™ model 54395 89.
- The Vacuum Interface Valves (VIV) shall be fitted with permanent vent pipes.
- Drain lines to be vented together with the VIV vent pipes to a point as high as possible above the sun-deck and fitted with activated charcoal filters.

6.2. Grey Water Tank

- Centrally located in the double bottom below the accommodation area forward of the engine room, a grey water tank as an integral part of the double bottom structure.
- The interior construction of the tank shall include both longitudinal and athwartship swash plates, fitted in such a way that the contents will run freely to the deepest point.
- The insides of the tank to be fully accessible from the accommodation area or the cofferdams through at least two oil-tight round bolted manhole covers and through lightening holes or removable plates in the internal swash bulkheads. The gasket material of the manholes must be oil resistant and installed in a gasket-groove in the manhole ring, which is thru-bolted to the top or the side of the tank.
- The grey water tank shall be fitted with:
 - A vent pipe, fitted with an activated charcoal filter to prevent smells and to stop insect infestation, running to an exit grill in the antenna support structure.
 - One or more supply lines from the bath tubs.
 - The effluent discharge line from the sewage treatment plant.
 - High level alarm.
 - Suction pipe to grey water pump.

6.3. Piping Works

- Grey water: All pipelines from the bathtubs shall be of heavy gauge PVC.
- The lines from the sewage treatment plant and to the grey water pump shall be of galvanised steel with flanged connections.

- All fresh water flushing lines shall be fabricated from polypropylene pipes and tubes with heat welded connections. No PVC shall be allowed.
- In the engine room and extending about 1.5 meter in the accommodation areas, the sewage transport pipes to be from heavy gauge stainless steel.
- Sewage transport pipes throughout the accommodation spaces to be from heavy gauge PVC, or other as specified by the equipment manufacturer.
- Only large radius bends or 450 tees shall be allowed. Tight bends are always to be avoided.
- To facilitate any necessary un-clogging exercises, sufficient readily accessible clean-out lids are to be fitted in the collecting vacuum lines to the collection tank.
- Fresh water hose connections, with a valve, shall be fitted in the vicinity of each clean out location.

6.4. Pumps

- The pump plumbing shall be laid out to allow discharging the tank contents directly overboard or, via the sewage-sludge International Shore Connection, to a shore based sewage collection point.
- One electrically driven self-priming centrifugal grey water pump, Stork® model FRES 40-110 RNBHP with a capacity 17 m³/hour, interchangeable, through the use of valves, with one of the bilge pumps.
- Pump operation with a “stop-manual-automatic” selector switch in the main switchboard.

6.5. Toilet System

- Evac® vacuum toilet system, with fresh water flushing and Hamann® Mini-Compact™ treatment plant.
- The system shall be U.S. Coast Guard certified MSD type II.
- In order to obtain the best possible guarantee, the Builder shall at the earliest moment submit his proposed toilet system layout drawings for approval to the Evac® and Hamann® representative.
- Also, the systems shall be commissioned by the equipment supplier’s technicians.

6.6. Collecting/ Treatment tank

- Centrally located in the engine room, a skid-mounted sewage collecting tank as an integral part of the Hamann® sewage treatment system. The internal volume of the collecting tank shall be determined in consultation with the equipment’s manufacturer.

- The interior construction of the tank shall include both longitudinal and athwartship swash plates, fitted in such a way that the contents will run freely to the deepest point.
- The insides of the tank to be fully accessible through at least two oil-tight round bolted manhole covers and through lightening holes or removable plates in the internal swash bulkheads. The gasket material of the manholes must be oil resistant and installed in a gasket-groove in the manhole ring, which is welded to the top or side of the tank.
- The sewage collection tank shall be fitted with:
 - A vent pipe, fitted with a charcoal filter to prevent smells and to stop insect infestation, running to an exit grill in the antenna support structure.
 - Permanent fresh water flushing lines from the domestic water system.
 - Permanent sludge discharge line with International Shore Connection at the stern.
- An Evac® AHE 0022 Collecting Unit with two ejectors, two pumps, ventilated cabinet with soft starters, control box and all necessary valves, switches etc.
- Hamann® Mini-Frame™ sewage treatment plant with minimiser, mixing and draining pump, whirl container, dosing pump, chlorine tank with low level alarm, fresh water solenoid operated dry running protection, sludge pump, ventilated cabinet with soft starters, control box and all necessary valves, switches etc.
 - electric remote control discharge selector valve.
 - Inspection/clean-out lids.
 - High level alarm.
- The manufacturer's scope of supply shall include:
 - Spare parts as per surveyor's requirements.
 - Three sets of English language technical manuals.
- Sewage shall be supplied to the collecting tank by means of the Evac® AHE 0022 Collecting Unit.
- After treatment, the effluent shall through the electric remote control discharge selector valve, either be discharged directly overboard or into the grey water tank.
- The alarm functions: "High Level" and the "Treatment System Require Attention" lights in the Hamann® system control panel, shall also be included in the ship's integrated alarm system. Additionally, there shall be a discreet red warning light at each toilet, to indicate a "do not use" (high level or shut-down) situation.

6.7. Toilets and Bidets

- 11 toilets, Evac® VT-90 Silent, model 5266101 for all bathrooms.

7. Freshwater System

7.1. General

- A complete fresh water system will be installed throughout the vessel.
- The system can be divided into the following main units:
 - plumbing,
 - fresh water tanks,
 - hydrophore pumps and pressure tank,
 - hot water system,
 - watermakers.

7.2. Plumbing

- The fill system shall be suited for gravity filling only.
- The two fill lines, and the pressure regulated shore connection line, shall each be fitted, with a closing valve at their connection to the fresh water transfer/distribution manifold.
- The system shall be fitted with draining valves at strategic locations.
- All lines to outside consumers and in areas susceptible to freezing in cold climates, shall be insulated and fitted with readily accessible local drain-/isolating valves.
- All piping for hot and cold water out of Polypropylene. PP.
- All piping pressure tested before filling the system.

7.3. Freshwater Tanks

- There shall be four freshwater tanks, total capacity 15,000 lt. Pressure tested at 0.5 bar.
- Each tank can be filled via one filling pipe.
- The tank is connected by a cross over DN-50.
- Manholes, sufficient in size and number, to perform proper tank cleaning will be fitted.
- The tank to have a vent line, leading to a plenum box as high as possible to the ships centre line and from there to a trapped drain.
- The vent line to be protected against incoming seawater.
- Filling and vent pipes out of polypropylene (PP).
- Filling stations on deck will have stainless steel, "Water" engraved screw on caps,
- Water tanks fitted with level indicator to gauge on the synoptic panel. They will be calibrated.

7.4. Hydrophore Pumps

- There will be two Sta-Rite model PLE 115 VAC, 1 HP, hydrophore pumps. A quiet operation will be assured.
- Two pressure accumulator tanks of about 140 l.(air chamber/diaphragm type), working/ test pressure 4/6 bar, will be mounted to keep the system pressurised.
- On the tanks there will be a connection for each hydrophore pump and a three-way valve connection to the consumers system or the other tank.
- Each pump to have its own pressure switch set with a 0.3 bar difference for low and high-pressure cut-offs.

7.5. Hot Water System

- The system to be fitted with two hot water boilers, 320 l, 6Kw. each, connected serial, make Rheem B15V-52D or equal.
- The boilers will be supplied with cold water via an inlet combination.
- The hot water is supplied to the consumers via a ring line.
- The ring line to have a Danfoss or equal 120 VAC, 0.4 kW, circulation pump.
- The system will have necessary devices, for example: thermometers, thermostats, bail-dry safety, pressure relief valves, expansion accumulator, non return valves etc.

7.6. Watermakers

- Two 'Watermakers' brand watermakers or equal, capacity 8,000 litres/day, will be installed.
- The noise level of the watermaker will be a point of consideration.
- The systems shall draw seawater from a dedicated through-hull fitting which shall be located deep enough below the waterline to exclude the possibility of drawing air or running dry under all conditions.
- The system shall include all plumbing and components for cleaning the system.
- A permanent flushing line from the fresh water pressure system shall be fitted.
- Brine and reject product shall be discharged overboard via a dedicated skin fitting with SDNR valve fitted above the waterline.
- The plumbing of the watermaker and choice of the filters to manufacturer's recommendations.
- All seawater pipes to be CuNiFer 90/10. All fresh water pipes in the engine room and extending about 1.5 meter in the accommodation areas, to be CuNiFer 70/30.
- After passing through the re-hardening filter the product water shall be plumbed into the fresh water transfer/distribution manifold.

7.7. Freshwater Treatment System

- Prior to being distributed to the consumers, the water shall pass through a freshwater treatment system, suitable for a fresh water flow of 4 m³ per hour.
- The system shall consist of:
 - A 5 micron cartridge filter which will remove all suspended solids in the water flow larger than 5 micron in size.
 - An activated carbon filter to adsorb a very wide range of unwanted tastes and odours in the water. It will in addition de-chlorinate the water.
 - An Aquafine[®] model MP-2-SL ultra violet sterilisation unit, to provide at least 99.9% bacterial reduction across the water treatment unit.
 - A Polar[®] Magnet anti scaling unit, to reduce to great extent the calcium scale build-up on water heaters, pipe work, shower nozzles etc.

7.8. Deck Wash Outlets

- A proprietary mixer-controlled deck shower is to be mounted in a small deck locker on the aft deck.
- At least eleven fresh water hose connections, allowing the efficient washing down of the yacht.

8. Pneumatic Systems

8.1. General

The system can be divided into the following main units:

- low pressure air system,
- air compressor high pressure (for scuba diving).

8.2. Low Pressure Air System

- The low pressure air system can be divided into two systems:
 - the horn,
 - air outlet to inflate the dinghy.
- The horn:
 - One small 24 Vdc powered air compressor for the horn is to be supplied with the horn by the same supplier.

- The supply line to the horn has to have a sufficient diameter and a solenoid valve close to the horn.
- Horn to be Kahlenberg or equal.
- Working air:
 - SIP Workshop compressor 420/150, 3HP (240 Vac, 2.2 kW 15 Amps) to be fitted in the aft lazarette. Operating pressure = 10.2 CFM at 283 Litres/min.
 - The supply line will be running from the compressor to an air intake above the weather deck.
 - A snap-on connection of 1/2" in the lazarette.
 - Supply line, diameter 1/2", thread 1/2" BSP, stainless steel.

8.3. High Pressure: Diving Air-Compressor

- A Bauer compressor "Capitano", driven by a 220 VAC motor, to be installed in the sport room.
- The suction filter of the compressor will be kept free from exhausts of engines, fuel fumes etc.
- The compressor will have an automatic stop controlled by a pressure switch and a manual start/stop button.
- The start/stop control panel for the compressor will be located near the unit.
- The system will have a mechanical safety pressure relief valve.
- The diving compressor will have an automatic water/sludge drain, the function of which can be controlled near the filling station.
- Special attention will be paid to the heat ventilation of the compressor.
- A filling station (water cooling) for diving bottles will be provided in the aft lazarette for at least four scuba tanks. The scuba tanks in an upright position during filling to prevent damage. The filling station will have a pressure gauge.
- All piping from HP-compressor to the filling station made from stainless steel.
- Working pressure 300 atm.

9. Hydraulic Systems

9.1. General

- The hydraulic system will be divided into individual electro-hydraulic power packs for each unit using hydraulics. These units will be supplied by the manufacturer of the equipment in question, namely :
 - The stabilisers

- The steering system
- The tender crane
- The tender hatch covers
- The transom door
- The sport room shell door
- Aft passerelle

9.2. Hydraulic piping

- All piping to be top quality seamless high-pressure piping.
- Best quality high pressure hoses shall connect all equipment items to the hydraulic piping.
- Diameters will be in strict accordance with manufacturer's recommendations.
- Where pipes run through the deck, stainless steel cup and cone fittings will be used. Where piping runs through a watertight bulkhead, noise isolating bulkhead fittings will be used.
- Piping will be mounted on rubber supported brackets to isolate ships construction from vibrations in the hydraulic system.
- Piping to be installed in an early stage to allow piping to be fitted in long lengths and with bends already welded.

SECTION 10 – HVAC & REEFER SYSTEMS

1. Ventilation Systems

1.1. General

- Particular care will be given to natural and forced ventilation throughout the vessel.
- It is understood that there is always minimum space for ventilation ducting, fans etc., therefore the Builder shall be required to have his air conditioning/ventilation subcontractor complete the principle design of his system in time to allow the Architect to arrange and dimension the frames and girders of the steel and aluminium structures, while taking into consideration the requirements for ducting.
- The design of the ventilation systems will give due consideration to low noise levels and to ensuring privacy.
- Ventilation to sanitary spaces shall be limited to one inlet for the entire toilet room while the WC and shower/bath trunk shall have constant extraction flow while being used.

1.2. Fans and Ducts

- All main fans 24 V DC make Woods, Salor or equivalent. Smaller fans 24 V DC for accommodation ventilation etc.
- All fans to be installed on rubber mountings and connected to solid ducting by means of flexible tubing.
- The ducts to be as short as possible, have good corrosion resistance and drains at suitable places.
- Where necessary the ducts to be sound isolated.
- Special attention to be given to the air supply of compartments with larger extraction fans to avoid under-pressure.
- The air intake/outlets on deck to be determined.
- ventilation openings on deck will have adequate water traps and mosquito nets,
- openings on deck can be closed in case of excessive green water

1.3. Ventilation Fans

Supply air:

- Two 2-speed axial flow ventilators of sufficient capacity to provide combustion air for the main engines and generators and for adequate engine room ventilation, shall be installed in the engine room air intake ducts.
- One centrifugal fan serving the bow thruster compartment.
- One centrifugal fan serving the stabilizer compartments.
- One centrifugal fan serving the aft peak, with air flow directed past the shore power converter unit.
- The air handlers.
- One centrifugal fan serving the clothes dryers.
- One fan serving the leisure equipment stowage area.

Exhaust air:

- Two 2-speed centrifugal flow ventilators balanced to the intake fans and the consumption of combustion air.
- A to be determined number of centrifugal fans for withdrawing air from the sanitary spaces, the laundry room and the space between the tank tops and the cabin deck sole.
- One centrifugal fan serving the main galley, connected to a stainless steel exhaust canopy.
- One centrifugal fan for the crew mess.
- One or more centrifugal ventilators for the dining room, the main saloon and the lounge.
- One centrifugal fan for discharge of air from the clothes dryers.
- A minimum fresh air rate of 18 m³/h. per person will be the target value for each occupied cabin.
- Additional ventilation capacities may be based on the following minimum air changes per hour:
 - sanitary spaces 10,
 - galley 8,
 - stores 8,
 - Lazarette 8

1.4. Exhaust of Fan Hood and Dryer

- The galley, dryer and toilet exhausts will not pass air to any intake duct of the accommodation.
- The ventilation duct for the dryer is sloped and has a drain to the sump tank.
- Fumes from the galley to be extracted by means of a speed adjustable fan in a suitable fan hood (see also Chapter VII.14, 'Domestic Appliance Systems') with manual fire-shut-valve in the duct.

- Sufficient air to be supplied to ensure there is no more than a very slight under-pressure in this area. The fan hood to have flame resistant filters.
- Fan hood vents through deck fitting consisting of flush mounted, removable cowl, fitted with water trap.
- Dryer vents through deck fitting consisting of flush mounted, removable cowl, fitted with water trap.

1.5. Mechanical Ventilation : Machinery Compartments

- Engine room to be ventilated by two intake fans, Hartzell 39-24-WK3, and two extractor fans, Hartzell 39-24-WK3.
- The de-misting system for the engine room is to be designed by Delta T Systems of Fort Lauderdale, Florida.
- The quantity of supply and extracted air will meet the requirements of combustion air quantity and heat reduction necessary for the equipment installed.
- Detailed air flow calculation to be made by the Engineers.
- The incoming air to be ducted to low areas in the engine room. The extractor fans aspirate the hot air at ceiling height.
- Particular attention to be given to intake ducts louvers and water traps to lower the noise level to a minimum. To achieve this, it may be necessary to make baffles in the ducting and to keep airspeed in the louvers under 6 m/sec.
- The fans to have emergency stop switches outside the engine room.
- The ducts to be provided with fire shut off valves.
- The controls shall be installed in the Emergency Controls panel.
- The intake air is taken through the opening on the superstructure.
- The exhaust air vents will exit aft of the Lazarette above the weather deck and via a water trap.

1.6. Mechanical ventilation : Accommodation

- The accommodation ventilation system is based on fans that are fitted in each bathroom and the chart room.

1.7. Natural Ventilation

- The forepeak and Lazarette will have natural ventilation to deck, provided through flush mounted, removable cowls.



- Deck lockers to have a possibility for natural ventilation.
- Particular attention has to be given to assure good natural ventilation in the owner's and guest's accommodation and crew quarters.
- Care will be taken to provide adequate ventilation between decks and ceilings and in the bilge to avoid moisture built up by condensation.
- Cabin doors to have ventilation slots, top and bottom, if doors are not louvered.

2. Air Conditioning

2.1. General

- The Builder's air conditioning supplier will be responsible to the shipyard for balancing of system and checking of duct, heater and cooler sizes.
- He will furnish all diagrams and sizes for refrigerating piping as well as electrical and control circuits.
- All of the foregoing will be subject to final approval of the Supervisor.
- The suppliers will furnish a one-year guarantee of all equipment.

- Copies of the Builder's air conditioning supplier's guarantees and warranties shall be furnished to the Owner and his Architect and shall be approved by the Architect.
- In warm climates, the air conditioning system shall be designed to provide mean internal conditions of +68°F/+20°C and a relative humidity of 50% under the following ambient conditions:
 - Outside air temperature max. +100°F/+38°C
 - Outside air relative humidity max. 95%
 - Sea water temperature max. +90°F/+32%
- The mean temperature of +68°F/+20°C shall be controllable from each individual accommodation space within a range of 6°C: down to 57°F/14°C and up to 79°F/ 26°C.
- In cold climates, the heating system shall be designed to provide internal conditions of +75°F/+24°C and a relative humidity of 50% under the following ambient conditions:
 - Outside air temperature min. +14°F/-10°C
 - Sea water temperature min. +28°F/-2°C

- Where electronic controls might be used on this equipment, the Builder will incorporate an appropriate crystal time base adapter into the individual circuit.
- Seawater and circulating pumps, power distribution panels, switches, grills, frames, drain fittings, hose adapters, relays, etc., shall be installed as directed by the Builder's manufacturer and with the approval of the Supervisor.
- Other design criteria shall be:
 - The noise levels may never exceed 40 dB(a).
 - The maximum air speeds shall be:
 - mechanical ventilation 22.0ft./6.7 meters/second
 - natural ventilation 10.8ft./3.3 meters/second
 - air conditioning system 16.4ft./5.0 meters/second
 - The minimum fresh air rate shall be 883ft³/25m³/hour per person for each occupied room.
 - Nine air changes per hour shall be the minimum norm for all accommodation areas.
 - The air exchange rate for each separate accommodation space shall be adjustable, in order to permit adjustment of the system to the requirements of each individual space.
 - From the main saloon, the dining area, the lounge, the crew mess, the galley and the sanitary spaces, air shall be continuously withdrawn and discharged.
 - The air conditioning and ventilation systems shall be pressure regulated in order to maintain an internal balance on board.

2.2. Compressors

- The compressor units shall be specified by the air-conditioning subcontractor

2.3. Pumps

- Salt water pump to be bronze body and impeller, complete with stainless steel shaft and ceramic seals, and with strainer and self-primer pot.
- Circulating pump using a 0.75 HP motor for chilled water loop.
- There will be a pre-charged expansion tank.
- All pumps and materials to be as supplied or approved by manufacturer.

2.4. Fan Coils

- Make up air as necessary shall be supplied through trapped louvers.
- Fancoil units shall be installed in all cabins and spaces that may be normally occupied for periods exceeding 20 minutes. This includes the ECR, sport room and laundry room but not the engine room, generator room, reefer rooms, BT engine room, or Lazarette.
 - Crew quarters
 - Galley
 - Saloons
 - Guest rooms port
 - Guest rooms starboard
 - Owner's Cabin

2.5. Additional Items

- Multi-speed + off switches for all fancoils.
- All other supply and return air grilles shall match surrounding colour and material in the joinery.
- Maintenance and installation instructions, Operators Manual, pipe flow diagram and internal electrical diagrams will be supplied.

3. Reefer System

System will be centralised – details to be completed

SECTION 11 - ELECTRICAL SYSTEMS

1. Concept

The system will in principal be in designed in a simple to understand format and be fabricated from well known components that have proven themselves in the marine environment.

The overall concept has been deigned by DMD.

All the electrical services will be powered through a common and fool proof split bus bar distribution panel.

The entire system will receive 230/400 VAC - 50Hz 3 phase power from 3 main gensets and a stable shore power supply. Because the vessel has a composite hull, the power will have a 4 wire 3 phase with neutral.

The ship will be, as far as practical, 400V AC, 50Hz, 3 phase. If an item can only be supplied using a DC voltage, then it will have a locally placed transformer/converter.

It has been observed that on a typical yacht of this size, the maximum electrical loading is expected to be around 150 kW. This maximum loading is believed to be only necessary for about 5% of the total running time.

Typical electrical loading is expected to be below 80 kW for 70% of the running time.

The result then is that the typical overall electrical load will never be capable of correctly loading a 150kW genset. Therefore a 3 genset system with less power will be used.

With this 3 genset system it is expected that the generators will see a correct loading somewhere between 70% to 95% of the running time

2. Engineering

The electrical installation will be designed according to MCA code and to the regulations of Class

Ambient temperature: 45^o C



AC Voltage:

400 V, 3 AC / 3 wire, grounded system (TN-C – NET)

230 V AC, grounded system (TN-C – NET)

Frequency: 50 Hz

DC Voltage:

24 V DC insulated system, with earth leakage control (IT – NET)

As far as possible following component suppliers will be used:

Molded case circuit breaker from Schneider Electric or similar

Power Management System from Deif or Cre-Technology or similar

All details in this specification (quantity, capacity and name of suppliers, outgoings etc.) will be adjusted during the final engineering phase. The list of consumers and electrical load analysis below are offered as basic electrical engineering.

Short circuit analysis will be carried out so as to coordinate dimensioning and fitting of circuit protective devices and determination of selectivity.

The final engineering calculations will be completed by a qualified electrical engineer. The system will then be thoroughly checked by another qualified electrical engineer.

Finally, during the entire construction of the vessel there will be in attendance a qualified expatriate electrical engineer. This person may be calculating engineer or the checking engineer or another qualified person.

3. Installation

The Builder will be responsible for the installation of all the parts listed below. The Builder must install all third party equipment as per the manufactures explicit instructions.

The Builder will be responsible for all the tests noted below and any others required by Class and must rectify any defects found.

All work to be completed in accordance with best yacht construction practices and to the satisfaction of the CS. The quality of workmanship throughout shall be of the best yacht quality and to the satisfaction of the Client.

4. Wiring Schematics - Diagrams

The builder shall provide detailed wiring diagrams for each deck of the vessel. All wires and their corresponding labelling are to be shown on as-built wiring diagrams.

5. Labelling & Wire Coding

Generally, all equipment shall be marked in order to ensure correct use.

For essential equipment, all conductor ends for internal and external connections shall be marked for identification corresponding to the appropriate as-built diagram. All other wires are to be tagged at each end and identified on an as-built wiring diagrams.

All switch gear, breakers and fuse gear for each circuit shall be labelled. If a switchboard contains two or more distribution systems with different voltages, the voltage for each system shall be indicated. Labels shall be engraved stainless steel and permanently attached.

Name plates for operations and indications will be lettered in English.

6. Cables & Trays

6.1. Installation

Great care shall be taken when running cables and wires to minimize the possibilities of chafing. Wires are to make smooth turns and not be drawn tight against corners or hard points. All wires are to be laid no more than three deep in the trays.

There shall be rubber insulation installed wherever a wire runs across an edge or passes through a fitting. Wires running through wood studs shall have rubber insulation installed in the holes. All cables that pass through decks and watertight bulkheads shall be enclosed in approved watertight stuffing tubes.

Where wires are terminated, an allowance shall be made to allow for future trimming of the wires. Where wire is inserted in a wire block from below, the wire shall have a loop arranged to provide positive pressure on the connections.

A minimum of three spare wires shall be run to each compartment and have corresponding breakers in the sub panels. In addition to these, there shall be four spare wires run from the bridge to the engine room and six spares from the bridge to the mast.

6.2. Types

All cables will be supplied by on one-way drums, uncut.

- Unscreened ship cable – for 230V, for power, control and lighting, flame retardant insulation, conductor maximum operating temperature 85°C, standard IEC92-353, standard IEC332-3/A, BV rules
- Screened ship cable, for power, control and lighting, flame retardant insulation, conductor maximum operating temperature 85°C, standard IEC92-353, standard IEC332-3/A, BV rules must have an overall watertight and oil resistant outer sheath
- Twisted pair ship cable, with collective screen, flame retardant insulation, conductor maximum operating temperature 85°C, standard IEC92-353, standard IEC332-3/A, BV rules
- Twisted pair, fire resistant ship cable, with collective screen, flame retardant insulation, conductor maximum operating temperature 85°C, standard IEC60331, standard IEC92353, standard IEC332-3/A, BV rules
- Screened, fire resistant ship cable, with collective screen, flame retardant insulation, conductor maximum operating temperature 85°C, standard IEC60331, standard IEC92350, standard IEC332-3/A, BV rules
- Flexible cable, flame retardant insulation, conductor maximum operating temperature 85°C, standard IEC92-350, standard IEC332-3/A, BV rules
- CAT 7 cables – this cable type will be supplied by Imtech
- Special cables will be supplied by the supplier of the respective equipment. (e.g. engine wiring, electronic interconnection)

6.3. Trays & Pipes

Cable trays, cable pipes, flat iron, angle iron, screws, etc. will be from SY

7. Generators

7.1. Generating Set Basic Description

3 marine diesel generating main sets, located in the generator room. Each set is identical and produces 89kW prime power at 1500 rpm. Power is 3 phase 400 volt with neutral in a delta configuration.



A fourth diesel generating emergency set, located in the emergency generator room. The set produces 45kW prime power at 1500 rpm. Power is 3 phase 400 volt with neutral in a delta configuration. The 3 main gensets will operate at 230/400 VAC - 50Hz 3 phase, delta configuration, and will all be identical and of equal capacity. It is expected that they will be approximately 65-70 kW each.

Genset engines will be John Deere, supplier of the gensets may be Kohler, Kilopak or Northern Lights or equivalent.

The genset operating scenario would be as follows - Each day, 1 set is selected as the constant running genset, (CRS) a second set is selected as the standby genset, (SBS) ready to come on-line automatically as the load increases above a predetermined level. The third set would remain off-line and be available as a back-up set (BUS) allowing any required maintenance to be carried out on this unit, and of course, be available should any serious failure of one of the other two sets occur. Any genset designated as the BUS cannot start automatically.

In any case, should the CRS fail, then SBS will start and assume the load. An alarm will be given to notify the engineer to activate the BUS to assume the role as CRS.

The above power transfer operations will be handled by a Power Management System (PMS) as described below.

All sets are to be supplied with the following -

- Set up for heat exchanger cooling
- Fitted with catalytic converters after the turbocharger
- Fitted with mechanically connected oil pressure and water temp gauges mounted on the engine
- Crankcase breather filtration with feed-back to engine intake
- Fitted with protection for front end pulleys/belts
- Engine mounted fuel filters fitted with 2 micron filter cartridges
- 24 volt starting and control with isolated negative
- Sets mounted on a rigid steel framework
- Equipped with local manual start/stop override
- All engine parameters available for remote monitoring by a standard signal system such as CANbus or other.
- Engines to be EPA Tier II or better
- Colour RAL 9003 signal white

7.2. Main Generating Set Details

Engine Technical Data

- Type Marine light fuel diesel engine
- Make John Deere



- Model 6068TFM76
- Compliancy TIER II
- Prime power 119 hp (89 kW)
- @ RPM 1500
- Stby power 110%
- Stby power duration 1 hour in every 12
- Number of cylinders 6
- Cylinder arrangement in-line
- Cycle 4-stroke

Cooling system

- Fresh water Heat Exchanger cooling
- Raw water pump

Governor and Fuel System

- Electronic speed governor to ISO8528 G3
- Fuel pump
- Fuel filters
- Fuel inlet connection
- Fuel return connection
- Fuel shutoff valve - 24 Volt - energise to run

Intake and Exhaust System

- Turbocharger with insulation cover
- Water cooled exhaust manifold
- Dry exhaust outlet
- Flexible exhaust bellows
- Oxidation catalytic converter **

Lubricating System

- Oil pump - gear driven
- Spin on full flow lubricating oil filter
- Integral lubrication oil cooler
- Oil filter bypass
- Closed engine breather system

Primary Starting

- Auxiliary start relay
- Starter system 24volt electric starting motor
- Insulated return DC supply

Wiring, Switches and Senders

- LOP switch
- HWT switch
- Overspeed switch

Alternator Technical Data



sencora

- Make Leroy Somer*
- Model LS 43.2-S25
- Power output 89KWe / 111KVA
- Voltage 400 volt 3 phase, 50hz
- Stby power 110%
- Stby power duration 1 hour in every 12
- Peak power 150% for 30 seconds ^^
- @ RPM 1500

^^ after reaching stable temperature

*Stamford, Meccalte, or Marelli may be substituted.

Features

- Brushless
- Self-exciting
- Self-regulating
- Synchronous
- Air cooled.
- 1 bearing with SAE housing
- Automatic Voltage Regulator giving regulation within 1%
- Drip proof and screen protected to IP 23
- Class F insulation with Class F temperature rise
- Anti-condensation heater

Generating Set Technical Data

- The engine / alternator will be close coupled
- The genset be mounted onto a steel base frame
- Via 4 anti-vibration mounts.
- A d-SMART control panel will be mounted on the generating set.
- The standard functions on the d-SMART Marine control panel are

Shutdowns

- Low oil pressure shutdown
- High engine temperature shutdown
- Emergency stop shutdown
- Over-speed shutdown
- Under-speed shutdown

Multiple Start Failure Alarms

- Low coolant level
- Low lube oil pressure
- High engine temperature

Digital Displays

- Lube oil pressure
- Water temperature
- Hour run clock
- RPM
- Mode of operation



- Status of engine / generator
- Alarm list
- Event timer

Control Features

- Local Start/Stop
- Local Emergency Stop
- Access Switch / local – remote start
- Local alarm siren and terminals for remote siren
- Terminals for Remote Start/Stop
- Terminals for Remote Emergency Stop

Other Features

- A speed pick-up for over-speed protection; this sensor shall monitor engine speed and initiate an over-speed shutdown to protect the engine.
- A spare digital input to be available
- A spare digital output a to be available
- A spare analogue output to be available
- Fully CANbus capable, which enables the use of CanBus/J1939 enabled engines management systems for monitoring purposes.
- RS232/RS485 port to be available
- This system must be expandable for additional binary inputs/outputs, analogue inputs/output, remote indication panel, or remote controller.
- The generating set will be painted RAL 9003 white
- Quantity 1 x Operators / Maintenance / Spare Parts manual c/w wiring diagrams will be supplied with each set

Testing

Genset to be fully tested at 25%, 50%, 75% 100% and 110 % load and all alarm and shutdown systems to be functionally checked.

** Oxidation Catalytic Converter

Gas flow per engine 110% Load: 21.12 m³/min

Gas temp: 459 °C max. 700 °C

Guaranteed Reduction

CO: 60%

HC: 40%

Diesel Odour: 75%

PM: 10-15%

Catalyst diameter: 235mm

Catalyst depth: 90mm 1 layer

Catalyst volume: 3.8 litres

Pressure Drop: 0.6kPa

Space Velocity: 184 000 h⁻¹

Cell density: 200cpsi

Substrate: metal

Catalysts are of metal substrate. 200 cpsi.

The above is to be supplied within a Stainless Steel 316 housing with cones and flanges.

7.3. Emergency Generating Set Details

There will be one emergency alternator of 35 kW. This alternator will be connected to its own switch panel. It will be able to feed the main panel, but only by manual connection. The alternator is driven by the bow thruster engine via a manual operated electromagnetic clutch that is controlled from the emergency generator switch panel.

Full details of the engine will be found in the bow thruster section.

Engine Technical Data

- Type Marine light fuel diesel engine
 - Make Steyr
 - Model MO236K42
 - Compliancy TIER II
 - Prime power 230 hp (170 kW)**
 - @ RPM 4200**
 - Number of cylinders 6
 - Cylinder arrangement in-line
 - Cycle 4-stroke
- ** Engine has dual function – Bow thruster prime power and emergency genset. When in genset mode engine runs at 1500 rpm

Alternator Technical Data

- Make Leroy Somer*
- Model LS 43.2-S25
- Power output 36KWe / 45KVA
- Voltage 400 volt 3 phase, 50hz
- Stby power 110%
- Stby power duration 1 hour in every 12
- Peak power 150% for 30 seconds ^^
- @ RPM 1500

^^ after reaching stable temperature

*Stamford, Meccalte, or Marelli may be substituted.

Features

- Brushless
- Self-exciting
- Self-regulating
- Synchronous
- Air cooled.

- 2 bearing with pulley drive
- Automatic Voltage Regulator giving regulation within 1%
- Drip proof and screen protected to IP 23
- Class F insulation with Class F temperature rise
- Anti-condensation heater

Generating Set Technical Data

- The engine / alternator will be belt coupled
- The alternator will be mounted onto a steel base frame
- Via 4 anti-vibration mounts.

8. Shore Power

8.1. Shore Power Converter

An ASEA, Atlas, ABB, Magnus or Exendis shore power converter shall be fitted.

This converter will be capable of

- Delivering a full 90 kW of stabilized 400 VAC 3 phase current at 50Hz to ships main panel.
- Able to accept both European and American shore supplies or voltages from 100V to 400V and frequencies of 45 to 65 Hz
- Able to automatically phase match the 2 shore supply cables.

The converter consists of:

- Rectifier unit, designed as B12C bridge connection for supplying the power inverter
- Power inverter in IGBT technology with pulse-width modulation.
- Digital control unit with microprocessor for open-loop control, closed-loop control and self-diagnosis of rectifier and power inverter.
- Block diagram in the devices front cover with the following indications via LED :
- Display of status information
- Alarm signals via LED, additionally via acknowledgeable buzzer
- Alphanumeric display of several measured values such as mains voltage, output voltage, output current and load in % via menu-assisted text display.
- Alphanumeric display with storage of all alarm and status displays.

Specifications of the Converter:

- Output power: 100 kVA (277 to 528 V) 50 kVA (170 to 276 V)

- Power factor: 0,8
- Output voltage: 3 x 400 / 230 V, 3 phase + neutral ($\pm 5\%$ adjustable)
- Tolerance of output voltage: $\pm 1\%$ static, $\pm 5\%$ dynamic at load step 0-100-0 %
- Output frequency: 50 Hz $\pm 0,01\%$ Recovery time: 20 ms Short circuit behaviour: short-circuit proofed
- Harmonic distortion: $< 3\%$ at linear load Operation: permanent service Input voltage: 170 to 528 V, 3-phase
- (in steps switched) Paralleling: -converter to converter permanent - converter to generator temporary Overload: 200 % for 100 ms 150 % for 1 minutes
- 125 % for 10 minutes Phase asymmetry : 100 % Efficiency: $> 92\%$ at full load
- Heat losses: 4,8 kW at full load Input frequency: 47 to 63 Hz Radio interference level: acc. to EN 50091 class "A"
- Class of protection: IP 23 Ambient temperature: 0°C to 45°C Relative humidity: class "F" acc. to DIN 40050
- Cooling: with temperature controlled ventilators. Shade of colour: RAL-2003, 80 % gloss
- Cubicles: free-standing sheet steel cubicles, with vibration mounts and anti condensation heater
- Dimensions (w x h x d): 1000 x 2170 x 800 mm Weight, approx. : 1230 kg Data interfaces : RS 232 for data exchange,
- RS 484 for remote panel Vibration-and shock solidity: acc. to BV

8.2. Shore Power Cables

There shall be 2 shore power cables, 1 each of 25m and 50m.

The main or primary 25m cable will be a 3 core 125 ampacity cable located in a bin under the port side aft stairway.

The secondary 50m cable will be a 3 core 63 ampacity cable located under the terrace deck in the Lazarette.

Both cables will exit from a WT locker located in the port transom bulwark. Both cables will be electrically driven (in & out) by a CM8 Cablemaster device. Both cables will be hard wired to the ship.

In the case that both of these cables are used (example – connected to 2 less powerful dock outlets) there will be a switch on the converter to allow the secondary supply to be phase matched with the primary.

9. PMS – Power Management System



The Power Management System is a PLC based system of devices used for the control and the protection of alternators and the diesel engines. It is also capable of managing and controlling the entire 400/230 VAC mains system of the ship. There will be 1 PMS unit per power source. The maker will be Deif or Cre-Technology

9.1. PMS Management Functions

- As the PMS sees the load increasing it will select certain non-essential consumers and signal them to temporarily shed their load (take them off-line) (e.g. hot water boilers, refrigeration compressors etc.), in two steps in case of overload during periods of temporary peak loadings caused by start up currents from large electric motors for example.
- If it still sees a load increase, then at a predetermined level it will signal the SBS to start.
- When the load decreases it will signal the SBS to stop at a predetermined level and time delay.
- The PMS will be capable of stopping certain loads that are known as non-immediate-demand power users,
- The PMS will control a sequential time delay system connected to heavy equipment that have a high amperage loads from motor starts, this way coincidental high load starts are avoided.
- Synchronizing of the alternators to the busbar by way of manual or automatic modes.
- Automatic speed adaptation of the diesel engine to the busbar frequency
- Automatic load sharing
- Load free disconnection of the alternator circuit breaker
- Load dependent start/stop of diesel generators
- Able to detect the imminent overloading of one supply (any shore power or any generator) and signal the start of standby power to complement the load.
- Able to detect the imminent collapse of one supply (shore power or generator) and to start a standby main genset to assume the load.
- Ability for pre-programming a load value and a time delay to control the level at which a standby genset is started.
- Able to signal certain equipment to reduce or stop loading on the system.
- Able to delay the start of equipment that has high amperage start up currents if it detects another high start load that is coincident.
- Able to detect the presence of shore power and stop running genset, if shore power supply is adequate for the load.
- Ability to monitor and control all functions from a control station in engineers control room
- Ability to send all monitoring and alarm information in an acceptable format to the pilothouse monitoring system

9.2. PMS Protection Functions

- Short-circuit protection
- Overload protection by over current recording in three steps
- Reverse power protection
- Over current protection
- Under-and over voltage monitoring and protection
- Under-and over frequency monitoring and protection
- Readings of data :
 - working hours of generators
 - kWh counter (dual counter)
 - kVar counter
 - power factor meter

10. Main Electrical Switchboard

10.1. General

The main electrical switchboard (MSB) will be located on the aft bulkhead of the ECR. It will consist of 6 separate panels.

It will be IMGe's standard "dead-front" design. It will be drip proof and fire proof, deck mounted steel enclosure. All sides and the canopy of the switchboard will be covered with steel sheets. The panels are separated from each other and from the consumer panels by full height bulkheads.

The front side will be equipped with doors with front opening access that lock open.

The main switchboard will be designed for arrangement in the engine control room and must be accessible from the front. The main switchboard is deck mounted and designed for wall standing. Cables will be inserted from below.

A non-conducting safety handrail shall be fitted on the front. A non – conducting mat or grating shall be provided on deck in front of the switchboard.

24VDC interior lighting shall be installed and activated when the doors are opened.

The power supplies will feed a common bus bar that can be mechanically split by a tie breaker in case of emergency. Actual configuration and loading on each side of the split to be determined.

The buss bars shall be of copper and suitably sized. All wiring shall be installed with approved type terminals and have numbered per the wiring diagrams.



Dimension of Switchboard:

- Length: approx. 3000 mm
- Depth: 620 mm
- Height: approx. 2100mm with foundation
- Protection: IP 22
- Colour: RAL 9003

The switchboard panels will be equipped with all the switches and motorized breakers for transfer of power between the 4 main supplies (3 gensets and the shore power converter) and the 400/230VAC services.

They will have all the necessary control lamps and instruments required for ship operation.

Complete voltage, amperage, frequency, kilowatt, kilowatt-hour, kVA and kVAR metering shall be included for each power source. Ground-fault meters shall also be included for the buss.

Incorporated in the MSB will be the PMS units.

All elements to be operable from the front side.

10.2. Layout

The basic switchboard design consists of 6 panels and shall provide for divisions into sub-sections of the generating section, the load distribution section and the shore power section. The 24VDC section shall be a separate unit.

- Panel 1 Consumer 400VAC
- Panel 2 Main Generator 1
- Panel 3 Main Generator 2
- Panel 4 Main Generator 3
- Panel 5 Consumer 400VAC
- Panel 6 Consumer 24VDC

10.3. Load Transfer

Load transfer from diesel generator to diesel generator or shore power is possible and is affected without interruption via the corresponding motorizes circuit breaker, a continuous parallel operation between diesel generators is possible. The generators are designed for manual and automatic synchronizing for parallel operation.

10.4. Switching Mode

The following generator circuits can be connected during normal operations by a control switch

Sea Service

- 1 main generator feeds the busbars,
- 1 main generator on immediate standby to assist,
- 1 diesel generator off-line

Manoeuvring Service

- 2 main generators feed the busbars,
- 1 diesel generator off-line

Harbour

- Shore converter feeds the busbars,
- 1 main generator on immediate standby to assist,
- 2 diesel generators off-line

10.5. Generator Panels

Measuring instruments, control indicating lights, generator circuit breaker and all necessary switches are arranged in each generator panel. The main 400V switchboard bus bar system consists of two sections which are realized by a bus-tie coupler.

The following control gears are provided for each generator panel:

- 1 generator breaker motorized drive (power operated with emergency hand lever) plug in type
- 1 electronic generator protection and power management system
- 1 "Governor motor control" swivel rotary switch
- 1 Generator breaker "Manual" push button with cover
- 1 Swivel rotary switch for "Automatic ON/OFF" (ON-function with automatic synchronizing Off-function with automatic load reduction)
- 1 Generator "STAND BY"/"OFF" swivel rotary switch
- 1 Generator space heater "ON/OFF" swivel rotary switch (The generator space heater to come in automatically by means of aux. contacts on generator circuit breaker.)

The following instruments (analogue type) will be fitted, the instruments will be square shaped, size 96 x 96 mm with flat frames and tinted glass. Nominal values will be marked in red.

- 1 voltmeter with change-over switch
- 1 frequency meter
- 1 ammeter with change-over switch
- 1 KW-meter
- 1 running hour meter included in PMS System

The actual status will be indicated by the following coloured lights:

- 1 generator switch "ON/SYNCHRONIZING WORKING" -green (when synchronizing working indication light flickering)

- 1 generator switch "OFF" -white
- 1 generator "HEATING ON" -white
- 2 not synchronous -clear
- 1 generator switch tripped -red
- 1 stand by activation (only in DG Panels) -blue

Following additional parts will be installed in the diesel generator 2 panel:

- 1 rotary synchronoscope
- 1 double voltmeter
- 1 double frequency meter
- 1 common selector switch
- 1 indication and "Reset" -push button
- 1 "Non-essential Consumer Cut-out"

10.6. Consumer Panels 400VAC

The consumer panels are located to the left and right hand side of the generator panels. The panels contain the molded case circuit breakers or miniature circuit breakers for feeding the outgoing consumers and distribution panels. All molded case circuit breakers are manual operated. All molded case circuit breakers are fixed type. Breakers are as follows :

400VAC Consumers

- 23 pcs molded case circuit breaker up to 100 A
- 15 pcs miniature circuit breaker up to 63 A

Shore Connection

- 1 pc molded case circuit breaker up to 160 A – 1 pc green light
- 1 pc ampere meter

Transition to the Emergency 35 kW Switchboard

- 1 pc molded case circuit breaker 100 A
- 2 pcs indication lights

11. Emergency Switchboard

11.1. Layout

The emergency switchboard serves to monitor and protect the 35 KW emergency generator and to distribute electrical energy to emergency services. The switchboard will be of IMGe's standard "deadfront" design. All sides and the canopy of the switchboard will be covered with steel sheets. Cables will be inserted from below.

The emergency switchboard panel is wall mounted. All elements to be operated for shipboard service are operable from the front side

The front side will be equipped with doors with front opening access that lock open.

24VDC interior lighting shall be installed and activated when the doors are opened.

It will be equipped with the necessary switches, control lamps and instruments required for emergency operation.

The emergency switchboard will be designed for arrangement in the crew quarters.

Dimensions of switchboard

- Length approx. 600 mm
- Depth 400 mm
- Height 1.000 mm without foundation
- Protection: IP 22
- Switchboard colour: RAL 9003

11.2. Switching Mode

Normally, the emergency switchboard is fed via the transfer line from the main switchboard. In case of blackout, the transfer switch in the emergency switchboard will disconnect and the automatic emergency diesel starting gear will start the emergency diesel. The generator switch will be connected to the emergency bus-bar provided that the power supply has not been previously taken over by a pre-selected main generator. After restoration of the main network the emergency generator switch will be disconnected, the transfer switch will be connected on. The emergency diesel will be stopped automatically.

11.3. Generator Panel

Measuring instruments, control indicating lights, generator circuit breaker and all necessary switches are arranged in the generator panel.

The following control gears are provided:

- 1 pc generator breaker motorized drive (with emergency hand lever) plug in type
- 1 generator protection with diesel start/stop automatic,
- 1 "Governor motor control" swivel rotary switch
- 1 Generator breaker "Manual ON/OFF" swivel rotary switch with cover
- 1 Swivel rotary switch for "Automatic ON/OFF" (ON-function with automatic synchronizing Off-function with automatic load reduction)
- 1 Generator space heater "ON/OFF" swivel rotary switch (The generator space heater to come in automatically by means of aux. contacts on generator circuit breaker.)

The actual status will be indicated by the following coloured lights:

- 1 generator breaker "On" -green
- 1 generator breaker "Off" -white
- 1 generator "Heating On" -white
- 1 generator breaker "Tripped" -red
- 1 Sea Mode -white

The following instruments (analogue type) will be fitted. The instruments will be square shaped, size 96 x 96 mm with flat frames and tinted glass. Nominal values will be marked in red.

- 1 voltmeter with change-over switch
- 1 frequency meter
- 1 ammeter with change-over switch
- 1 kW-meter
- 1 running hour meter

11.4. Consumer Panel 400VAC

The consumer panel is located to the right hand side of the generator panel. The panel contains the miniature circuit breakers for feeding the emergency consumers. All circuit breakers are fixed mounted.

- 15 pcs miniature circuit breaker up to max. 63 A
- 1 Transfer switch to MSB
- "Transition ON/OFF" swivel rotary switch
- 1 Indication Light "Transition ON" -green
- 1 Indication Light voltage from MSB -white
- 1 transfer circuit breaker 100 A

12. Motor Starter Distributions

Starter devices with air-break contactors or motor protection switches or variable frequency drives will be used on heavy consumers in order to reduce the voltage drop effect of electric motor starting current peaks, Frequency drivers will be installed to "ramp-up" the electrical current required by the respective machinery.

Heavy consumers to be protected are as follows :

- Anchor windlasses
- Capstans

- Tender crane
- Engine room blowers and extractors
- Fire and bilge pump
- HVAC compressors, sea and chiller pumps
- Stabilizer pumps
- Steering pumps

All switching devices will be laid out for direct-online starting unless otherwise mentioned. Switch cabinets will be of drip-water proof design. Each starting device with air break-contactors will comprise the following components:

- molded case circuit breaker (if not incorporated in the Main Switchboard or Power Distribution)
- air-break contactor
- thermal overload relay
- "ON" and "OFF" push button
- running light
- Auxiliary contacts, control fuses, terminals, current transformers etc.
- Colour of panels: RAL 9003

Individual Starters

- 5 Single Motor Starters up to 3,0 kW
- 5 Single Motor Starters up to 7,5 kW

Starters will be put together in groups as far as practicable. If needed the following starters will be delivered by the suppliers of the equipment

- HVAC compressors, sea and chiller pumps
- Stabilizer pumps
- Steering pumps

13. Sub Distribution Panels

Three-pole power consumers as well as one- pole consumers not connected to the main switchboard will be fed from the distribution panels.

Generally the electrical distribution will be arranged so that each space has its own distribution panels. Power to each these sub-panels will originate from a clearly marked main disconnection switch and a "power on" lamp circuit breaker on the MSB consumer panels.

Outgoing circuits are protected by miniature circuit breaker. The distribution panels are of drip-water proof design for mounting on

bulkheads. Cable inlet from beneath by means of cable glands. Colour of all panels RAL 9003

Location of and contents of the 400/230 V Power Sub-Distribution Panels

No.	Area Covered	Located	Breaker Qty		
			10A	32A	63A
			1 Pole	3 Pole	
1	Lazarette	Lazarette	6	2	2
	Terrace		2	2	
	Under Side Stairs		2	2	2
2	Owners Cabin	Owners Office Locker	6	2	
	Owners Bathroom		6	4	
	Owners Office		6	2	1
3	Sports Room	ECR	4	2	15
4	Guest Cabin Port	Guest Cabin Corridor Locker	4	2	
	Guest Cabin Stbd		4	2	
	Guest Cabin VIP		4	2	
	Guest Cabin Corridor		4	2	1
5	Galley	Galley	10	4	4
6	Laundry	Laundry	6	4	1
	Reefer Room		3	2	3
7	Stewardess Cabin	Crew Corridor under stairs	2		
	Engineers Cabin		2		
	Port Cabin		2		
	Stbd Cabin		2		
	Crew Corridor		2	1	
	Lower Crew Mess		2	1	
8	Windlass Deck	Crew Mess	4	2	2
	Emergency Gen/BT Room		2	3	1
	Fore peak		2	1	
9	Main Deck Exterior	Eng Room Entrance	8	1	
10	Salon	Pantry under stairs	8	1	
	Pantry		6	2	

	Upper Crew Mess		2		
11	Wheelhouse	Wheelhouse	12	4	2
	Wings / Tech Space		2	2	
12	Skylounge	Skylounge port air shaft	6	2	
	Sundeck		2		

14. 24VDC Power Systems

14.1. General

A 24VDC system will also be fitted for engine starting, emergency lighting, alarm systems and navigation items. Each battery bank will have its own dedicated charging source (no charge dividers will be used). Provision will not be made for any battery paralleling but battery diversion switching will be fitted. (Using batteries normally dedicated for a task to be temporarily used for another in case of problems).

14.2. Circuits

The following 24VDC circuits will be established

- Main engine starting
- Generator starting
- Bow thruster / emergency generator starting
- 24 VDC Service items
- Emergency lighting
- Radios

All circuits will be independent of one another, with their own switchboard and charging system.

14.3. Batteries

Batteries banks shall be made up from either 2V or 12V standard gel maintenance free type batteries.

All batteries shall be secured and placed in epoxy or polypropylene battery boxes with covers and ventilation where required.

Battery banks will be installed as per the following:

- 2 sets (310 Ah each) for main engine starting
- 3 sets (170 Ah each) for main generator starting
- 1 sets (170 Ah) for Bow thruster / emergency generator starting
- 1 set (600 Ah) for 24 VDC Service

- 1 set (600 Ah) for emergency lighting & electronics
- 1 set (400 Ah) for Radios

The sets of batteries for the main engines and 2 of the sets for the main generators shall have a facility to cross connecting in case of emergency.

14.4. Chargers

The builder shall furnish and install the following battery chargers as manufactured by Dolphin / Reya 24000 series. The chargers shall have heat and over charge sensors.

- 1 x 100 Ah with 2 supplies for main engine batteries
- 1 x 80 Ah with 3 supplies for main generator batteries
- 1 x 100 Ah with 1 supply for 24 VDC Service main generator batteries
- 1 x 50 Ah with 1 supply for Bow thruster / emergency generator batteries
- 1 x 50 Ah with 1 supply for Radios batteries

Chargers will be located in a secure place near their respective batteries. Remote Control panels for all the chargers will be located in the ECR as well as all battery voltage monitoring.

- Charger specific details :
- physical ventilation
- electronic-magnetic, automatic control with current limiter
- Supply voltage 400 V, 50 Hz, 3-phase
- Rated output voltage 27 VDC
- Rated current
- Output circuit breaker: amperage as required

14.5. Switch Panels

Only the service and emergency batteries shall be connected to the 24V panels in the ECR and the wheelhouse.

15. Lighting

15.1. General

Complete lighting of the Yacht will be guaranteed to ensure good visibility in all work, service and accommodation areas and on deck.

Lighting in general will be designed for maximum efficiency and longevity. Therefore wherever possible lights will LED type. Fluorescent lights will

also be used. Halogen and xenon lighting in special areas. No incandescent light will be used.

Power to all lighting, except emergency lighting will be supplied from the 230VAC mains.

15.2. Navigation And Signalling Lights

15.2.1. Navigation Lights

Nav lights will comply with COLREGS 72, and any subsequent amendments and the installation shall be approved by flag state. The navigation lights will be duplex and have dual power lines. The light circuit will be composed as follows :

- 1pc 112.5° red 2NM duplex sidelight PS
- 1pc 112.5° green 2NM duplex sidelight SB
- 1pc 225 ° white 5NM duplex fwd. masthead light
- 1pc 225 ° white 5NM duplex main masthead light
- 1pc 135° white 2NM duplex stern light
- 1pc 360° white 2NM duplex anchor light fwd.
- 1pc 360° white 2NM duplex anchor light aft
- 4 pcs 180° red simplex N.U.C. lights installed on the main mast.
- 2 pcs 180° white simplex lights
- 1 pc/set Suez light(s) [minimum 1 pc red light aft, existing NUC lights to be used for Suez regulations if possible]

The navigation light circuit will have a control panel complete with a synoptic readout. It will be predisposed for the change-over from one light to other in case of failure of any main navigation light.

An automatic acoustic and visual alarm signal will indicate the failure of any single light.

15.2.2. Navigation Operating Lights

All navigation instruments in the wheelhouse will be equipped with dimmers.

In the wheelhouse there will be an independent circuit switch with blue dimmable light bulbs for night navigation. This circuit will be in the wheelhouse over the chart table and extend to the upper crews mess and the crew stairway and corridor.

Two or three blue bulbs on this circuit shall be provided in the deck of all these spaces.

15.2.3. Signalling Lights

- 1 pc Search light, remote controlled, type Francis Voyager VH330, 250W halogen
- 1 pc Daylight signalling lamp inclusive battery and charger
- Cable and socket or connection box for Suez search light (search light not included) to be foreseen.

15.3. Emergency Lighting

An emergency lighting circuit, supplied from the 24V DC emergency battery bank and the emergency generator, will be provide lighting in all accommodation spaces, corridors and staircases. Also in the galley, laundry, and engine rooms.

There will be at least one light next to the access door of the space and in large spaces 2 or 3 lights.

In the engine spaces there will one emergency light in each fluorescent fixture.

At the liferaft stowage and liferaft embarkation areas and the fore deck rescue boat launching area forward there will be sufficient high-powered remote controlled flood-lights. Specifically :

- Sun deck flood lights illuminating the liferafts port and stbd
- Aft transom platform floods for raft embarkation
- Fore deck floods on the fore mast for rescue boat launching
- Fore deck crane floods for rescue boat launching

All floods will be Hella Marine type 6142 - IP67 Xenon

15.4. Technical Space Lighting

Lighting in technical spaces will generally be fluorescent operating on 230 VAC.

- | | |
|-----------------------------------------|---|
| ○ Forepeak | 2 |
| ○ Chain lockers (2) | 2 |
| ○ BT/EG room | 2 |
| ○ Galley | 6 |
| ○ Laundry | 4 |
| ○ Reefer room | 3 |
| ○ Cold store | 1 |
| ○ Freezer room | 1 |
| ○ Under guest staircase technical space | 1 |
| ○ Generator room | 5 |
| ○ Engine room | 8 |
| ○ ECR | 3 |
| ○ Engine room entrance & staircase | 2 |

○ Shaft tunnel port (3)	3
○ Shaft tunnel stbd (3)	3
○ Lazarette – aft peak	4
○ Port aft staircase locker	1
○ Stbd aft staircase locker	1
○ Windlass deck	2
○ Port fore bridge locker	1
○ Stbd fore bridge locker	1
○ Under wheelhouse technical space	4
○ Port side deck locker	1

Engineering space lighting will be Aqua Signal type 1044 / B024 - IP67 2 x 18/20W or equal with fluorescent tubes 230 V and with 24 V LED for emergency lighting

In refrigerated areas, and wherever high-humidity is present, watertight light fixtures will be installed.

15.5. Deck Lighting

All deck lighting will be LED type and supplied from a 230 VAC circuit. The lighting will be a combination of overhead spots and foot lamps. Sizes, number and positions TBD.

On exposed decks and wherever high-humidity is present, watertight light fixtures will be installed. ISPS Lighting and Anti Paparazzi Lighting are not included.

Lighting for passerelle, and ladders will be included by the manufacturer.

15.6. Decorative Exterior Illumination

All decorative lighting be LED type and supplied from a 230 VAC circuit. The lighting will be a combination of rope lighting inside the bulwark handrail, up-floods illuminating the mast, and backlighting of the name boards. On exposed decks and wherever high-humidity is present, watertight light fixtures will be installed.

15.7. Guest & Crew Accommodation Lighting

All accommodation will be LED type and supplied from a 230 VAC inverter/battery system. This will avoid light flickering due to generator/shore power loads and blackout due to temporary power failures. The batteries must be capable of maintaining 15 minutes of lighting.

The type, number and position of these lights as well as all sockets will be the task of the lighting designer.

15.8. Switches & Sockets



Waterproof CEE sockets for 230V and 400V for all technical spaces shall be provided. Sizes, number and positions TBD.

SECTION 12 - NAVCOM SYSTEMS **(Navigation & Communication)**

1 Design Criteria

The equipment is designed in accordance with the classification society and the requirements of flag state approval. (presumably UK)

The equipment shall also fulfil the following rules and regulations valid at the date of offer:

SOLAS 1974 and 1988 with amendments 2000, 2001 and 2002
IEC 60945

The equipment shall also comply with the following criteria:

Operation Area: A1+A2+A3

Max. operational Ambient Temperature

Portable: 55°C

Protected: 55°C

Exposed (above deck): 55°C

Min. operational Ambient Temperature

Portable: -20°C

Protected: -15°C

Exposed (above deck): -25°C

Voltage:

400V 3-phase (Steering Gear)

230 V 1-phase (Radio-communication/Navigation)

24 V DC

Frequency: 50 Hz

2 Navigation Systems

2.1 Imtech SeaGuide Navigation System

Consisting of:

- 2x ECDIS with 19" Multi-functional-displays, dual redundant
- 2x Basic Software MfD
- 1x Navionics (private vector charts) World folio set with one year license
- 2x UPS
- 1x X-Band 6' CAT2 Radar incl. 19" Screen
- 1x X-Band Scanner Unit
- 1x S-Band 12' CAT2 Radar incl. 19" Screen
- 1x S-Band Scanner Unit
- Radar power supply



- Chart planning station (Location: chart-table), with 19" display, keyboard, trackball and computer

2.2 Compass System

Consisting of:

- 1x Gyro compass Navigat X Mk1 Mod.10
- 1x Heading management system Navitwin IV
- 1x Console repeater compass
- 1x Magnetic compass Jupiter with Fluxgate

2.3 2 DGPS System

Consisting of:

- 1x Leica MX500 (or similar)
- 1x Installation kit
- NMEA distribution

2.4 Autopilot NAVIPILOT 4000

Consisting of:

- 1x Control and display unit
- 1x Steering control unit
- 2x Isolation proportional interface board for connection to an analogue controlled steering gear

2.5 Speed log System Naviknot 600SE FNF II-Yacht

Consisting of:

- 1x Master Indicator for bridge
- 1x Electronic unit 1x Preamplifier
- 1x Naviknot Antenna
- 1x FNF II Yacht Sensor with 20m cable (for fibreglass hulls)

2.6 Wind instrumentation

Consisting of:

- 1x Wind speed and direction Ultrasonic sensor
- 1x True wind calculation processor
- 1x analogue Display for Wind direction (144mmx144mm)
- 4x Display's (about 5.7")
 - -interactive via touch screen
 - -each display can display up to 8 external selectable data and also the wind data
- 1x NMEA concentrator 8 to 1 (for up to 8 external NMEA inputs e.g. Speed, Depth, Heading, GPS Lat/Lon, etc.)

Note:

The

1x analogue and the 4x about 5.7" Displays will be delivered in a frame for mounting into a ceiling console.

2.7 AIS System

ACR NautiCast X-Pack DS

Consisting of:

- 1x Display and electronic unit
- 1x Combined GPS/VHF- antenna with splitter cable
- 1x Nav-Data NMEA-Buffer

2.8 Navigational Echo Sounder

Consisting of:

- 1x FE 700 Master Indicator for bridge area
- 1x Electronic unit
- 1x Sensor with 15m cable

Note: Sensor mounting may need separate class approval. Installation and delivery of the transducer flange is shipyards responsibility.

2.9 Colour Video Sounder (Black Box Version)

Consisting of:

- 1x FCV 1200 BB Control Panel (to be mounted in WHC)
- 1x FCV 1200 BB Electronic unit (connected to WHC Monitor)
- 1 x Sensor with 15m cable (for mounting in fore part of the vessel)
- 1 x Sensor with 15m cable (for mounting in aft part of the vessel)

Note:

3 External Communications

3.1 GMDSS Station

Consisting of:

- 2x Sailor RT5022 VHF DSC system
- 1x VHF remote control unit CU 5000
- 4x Sailor VHF GMDSS portable SP3520
- 1x SSB Transceiver MF-HF system Sailor 5000, 150W
- 2x Inmarsat-C Sailor TT-3000EB with message terminal and printer
- 2x SART transponder Sailor
- 1x EPIRB with automatic release and programming (with integrated GPS)
- 1set Navtex Furuno NX 700A

3.2 Satellite Communication

Consisting of:

- 1x Sailor Fleet Broadband 500
- 1x Sailor Iridium Satellite Phone
- 1x Seatel VSAT 4009 Set (Ku-Band)
- 1x TT3000SSA (Inmarsat-C SSAS System) Including:
 - Interface Box for connection of:
 - 2x Alarm + 1x Test Button
 - 20m Antenna cable
- 1x TT 3000LRIT (Inmarsat-C LRIT System) Including:
 - Interface Box for connection of PC (e.g. for re-programming)
 - 20m Antenna cable

4 Internal Communications

4.1 Telephone System

Consisting of:

- 1x Panasonic PABX KX-TDE100
- 1x Power Supply incl. UPS
- 19x KX-DT333 digital phone 1x KX-DT321 digital phone
- 1x Patch panel
- 1x Flash bell for noisy area
- 4x DECT Antenna
- 3x DECT Mobile Telephone

4.2 Steward Call System

Consisting of:

- 3x Remote Control Panel including visual and acoustic call indication
- 7x Radio button

4.3 Talk-Back, Public Address and General Alarm System

with General Alarm transmission in the accommodation area comprising the following functions, (acc. to the ship General layout)

consisting of:

Talk-Back-System

- 1 set Control unit with built-in microphone- loudspeaker (with gooseneck or hand microphone),
- 10 lines
 - 4 lines for talk-back facilities
 - 6 lines for PA facilities (e.g. outside area, crew,

guest/owner, all)

- 1 set Hand-microphone and Loudspeaker for each bridge wing
- 4 sets Talk back substations ECR console, Fore and Aft decks, Engine Room

Public Address & General Alarm-System (according to SOLAS 97/IMO)

- 1 set PA/GA – Main Cabinet for connection to PABX including built-in central unit for talk-back system
- 1 set General alarm signal generator for bridge console approximately 56 sets Ceiling-, wall mounted-, Horn- etc. Loudspeaker for Cabins, Bathrooms, Passageways, Outside areas, Working areas, etc.

5 Navigation Control Panels

5.1 Wheelhouse Panels

Construction :

Self supporting two (2) or three (3) layer massive aluminium structure. Designed to fit into the wheelhouse arrangement and design details from the cabinet maker. All the operational equipment will be as far as possible integrated in the panels.

Internal Wiring :

with flexible cable, one or multi-core of suitable diameter

Dimensions:

Approximately 1,5 m² Shape: aluminium structure with overlay foil.

5.2 Wing panels Port and Stbd

○ **Construction :**

Self supporting brushed stainless steel structure. No visible screws. The design and position of the wing panels to fit into structure. The wing panel equipment will be as far as possible integrated in the wing panels.

○ **Internal Wiring :**

with flexible cable, one or multi-core of suitable diameter

○ **Dimensions:**

Approximately 250x400mm² with symmetric layout for Port and Stbd

5.3 Wheelhouse Screens



- **Make :**
Hatteland 19 inch Series II Flange (touch screen) Size: TFT LCD 19 inch Resolution: 1280 x 1024 (XGA) Input: DVI, RGB, S-Video, Comp Video Brightness: 450 cd/m2 Contrast: 600:1 Surface: Hard Coated Anti-Glare Glass Viewing Angle: 89 (up/down/left/right) Mounting: Bracket Power: 24V
- **Construction :**
Mounting of the screens covered with aluminium made frames on central post with industrial hinging head with breaks. Central post with Ø48mm
- **Internal Wiring :**
Cable routing inside of the post.
- **Dimensions:**
Screen frames for five to seven (7) 19" monitors.
- **Quantity :**
Minimum of 5, maximum of 7. The number of screens is depending on the quantity of monitors within of the ordered systems and options.

6 Options

6.1 UMTS / GSM System

Consisting of: Quad-Band Modem for use within the range of transmission for GSM/UMTS Antenna

6.2 Passenger Information system

Consisting of:

- Industrial computer with chart system
- NMEA multiplexer for navigational interfacing

6.3 Tender Tracking system

Consisting of:

- Display of tender/jet ski position on navigation screen within the range of VHF-Signal
- VHF encrypted communication signal
- Transmission of panic button signal from tender
- Equipment for two tender and two jet skis

6.4 Dynamic Positioning System DP-0



Manual position control and automatic heading control under specified maximum environmental conditions.

Consisting of:

- 1x Joystick System with
 - -Bridge Display
 - -Sensors
 - -Interfaces for bow thruster, engine control and e.g. RPM

Note: The DP-0 System includes conning display and an approved high speed auto pilot. With the DP-0 option the position 2.4 Autopilot above is not required and for this reason not included in the scope of supply.

6.5 Sonar System

Consisting of:

- FS-3DT forward looking sonar system
- 60kHz Transducer module
- UPS
- NMEA interfaces

6.6 Thermal Image Camera Thermo Vision Voyager II

Consisting of:

- Voyager Camera
- Bulkhead Box
- Joystick Control Unit

6.7 NAVIGAT 2100 Fibre Optic Gyro

Consisting of:

- Fibre-Optic Gyrocompass and Attitude Reference System NAVIGAT 2100
- Control and display unit

Note: with this system the **NAVIGAT X MK1** (see Item 2.2 Compass System) is not required

6.8 Water/ Air Temperature

This is an add on to Wind System

Consisting of:

- 1 x Air Temperature Sensor
- 1 x Water Temperature Sensor
- 1 x Interface to Wind System (see Item 2.6 / Wind Instrumentation)

Note: With this option the Temp. Data can also be displayed on the weather displays.

6.9 Aft Terrace Platform Monitor

(This is an add on to Wind System

Consisting of:

- 1 x DB 15" MFD colour display
 - Sunlight resistant
 - Tamper proof
 - Unbreakable glass front 1 x Interfaced to Wind System (see Item 2.6 / Wind Instrumentation)

Note: With this option all Data within the Wind System can be displayed also on this monitor.

6.10 IRIDIUM System

Consisting of:

- Iridium Open Port Antenna incl. 50m cable
- Iridium Open Port electronic unit
- Three separate phone lines and high-speed always-on data line
- Data: 9.6 – 128 kbps (configurable) with per-MB pricing for airtime

Note: with this system the **Sailor IRIDIUM System** (see Item 3.2 Satellite Communication) is not required

SECTION 13 - AVE **(Audio Visual Entertainment)**

Entertainment System

1. General

1.1 Operation/ Maintenance

The concept described in this document results in easy operation of all related equipment. Also easy maintainability and reliability are main issues. Spare parts have to be available all around the world as far as possible. The man-machine interface will be easy understandable and unique around all zones and cabins.

1.2 Network

A rack with all central A/V components (consisting of central network switch, all three servers, TV distribution, and all other central components) will be located below deck in a special electronics compartment. All equipment in this area are to be mounted in an industrial standard 19" rack.

1.2 Cabling

There will be one or two cables type CAT 5e or CAT 7 with 16 wires to each location from central switch. Eight wires will be used for entertainment purpose, the last eight wires are available for a computer network system, local network sockets for office computers or wireless access points.

The network sockets for LAN-access are located in guest cabins, VIP cabins, owner office, crew mess one and two and wheelhouse (each cabin/office/WH 1xLAN socket).

The principle of the system is based on the network technology. Antenna cables are only required if in some locations access to Sky, Galaxy or similar is required. Also all cameras and security door locks are connected by network cable.

In order to be prepared for future requirements, the following connections between wheelhouse and central rack are foreseen: 1 x 16 wires LWL + 1 x 16 wires Cat. 5e-7 + 1 x 24 wires serial.

In addition, the following analogue cable connections are

required:

- at TV antenna to central rack
- Wireless antenna to sun deck rack.

1.3 Server

Three identical servers are to be used:

- Server 1: central video and music data base for audio and video on demand.
- Server 2: all business, ship inventory, documentation and security data.
- Server 3: TV streaming server.

All hard disk drives in each server will be duplicated and protected against hard disk crash failures by a RAID system.

In case anywhere in the world a server breaks down, it must be possible for the on-board engineer to replace defect components and restart the related server within ten minutes, without losing function or data and having a huge IT knowledge. Upon arrival in the next harbour a replacement device or a new spare drive has to be available. It is not necessary that a technician of the supplying company does the replacement, because only mechanical work has to be done.

1.4 Communication

For high speed data communication a VSAT antenna should be installed, in the same size as the Sat TV antenna. This might be the combination Seatel 4004 and 4009.

As most harbours provide the service of a local hot spot, mounting of a W-LAN bridge and antenna is foreseen. This allows owner, guests and captain to access a free high speed internet access, IP TV and VOIP. For terrestrial TV reception an optional DVB-T antenna can be installed.

1.5 TV Sets

As far as possible, all digital free-to-air channels (DVB-S) are centrally fed into the network and are thus available in all locations. The following rule applies: Each receiver can distribute six to eight channels. Switching between PAL and NTSC signals is not necessary, because all signals are digital. In this concept in total 40 to 60 channels are foreseen within the distribution.



An antenna distribution and the related cabling is no longer required.

In order to receive special analogue (encrypted) signals there are two ways of the implementation:

- One receiver will be fixed tuned to one program. This data stream will be distributed into the system.
- Selected locations get proprietary receivers and are thus in the position to gain access to the complete program set of this special supplier. In this case, an additional antenna cable is required for this location.

Digital input for Passenger Information System from the bridge system (view of actual position on the map etc.) are to be integrated in the TV-System.

1.6 Video & Music on Demand

For each location a set-top box will be foreseen, it is a small local controller computer. This unit is connected via one network cable with the central equipment. All further cabling is only internal within the room / music zone. From each location/room the user has access to all TV channels, pictures and music stored on the central server, independent from all other locations. The basic concept allows storing 1000 hours of high definition movies and 1000 hours of music. Increase of capacity is possible at any time by adding or exchanging hard disk drives.

Each user has internet access via the set-top box or may have the possibility of VOIP telephone capability. For internet access we recommend to use a wireless keyboard with internal pointing device. The TV screen is used to view internet pages.

Via the planned system the following features can be implemented additionally:

- View of digital pictures
- Playing of private videos
- View of the actual sea chart including position of the ship (passenger information system)
- View from the mast camera

1.7 Remote Control

The remote controls will be as easy to handle as possible. Each guest will be able to operate it without special training within five minutes. We will locate identical remote controls in each

room providing the following functions:

- On -off
- Volume control up -down
- Left-right-top-bottom (for selection on the screen of music title, video, TV channel, photo, camera)
- Special button for internet access

All required sub functions are fully automatic. The remote control (IR version) only has to be pointed to the TV screen.

This system will be perfect for different guests, e.g. if the yacht is also used in the charter business. Also the possibility of control with sophisticated remote controls (e.g. Creston or IPod) is to be implemented.

1.8 Cameras

Each engine room will be equipped with one or more CCTV camera. Outside areas will be supervised with day-night cameras. Even thermo imaging cameras can be implemented as an option. The camera can be programmed to provide the special features, like recording, motion detection etc. Storage of camera pictures will be done on the video server, no additional equipment is required.

Cameras can in principle be controlled from each location. In fact, the access to camera control can be limited to owner and captain. Camera pictures can be routed to each TV screen. Connection of cameras requires one network cable only to each camera position. If high speed data access is available on the ship, and the appropriate access rights have been set, camera pictures can be accessed from all around the world. Selection of type and make of cameras can be done later in the project.

The following camera positions are foreseen:

- Engine room: 3 cameras PTZ, day and night
- Aft. platform: 1 camera fixed, day and night
- Aft. Deck 1 camera fixed, day and night
- Main deck: 4 cameras fixed, day and night
- Mast: 1 camera PTZ, day and night

Remark: PTZ is pan/tilt/zoom

The camera system will be protected against AC power failure by the central UPS within the power distribution system or via the UPS of the IP system.

1.9.1 Wings

Each Stbd and PS wing has a waterproof touch screen monitor for CCTV.

- Stbd wing 1 x camera aft + 1 x camera PS or one camera stand alone
- PS wing 1 x camera aft + 1 x camera Stbd or one camera stand alone

1.9 Access Control System

All doors from outside to the interior ought to be equipped with a touchless (transponder) reader without keypad. In addition, step sensors can optionally implemented into certain areas of the deck. Precise adjustment of these sensors in order to prevent the system to react on false alarms e.g. by birds, cats or other small animals.

1.10 Wireless-LAN

For those areas that need Wi-Fi access, a set of W-LAN access points will be installed. In order to prevent unauthorized access, e.g. in a harbour, the Wi-Fi system can be easily deactivated.

1.11 Music Only

There will be some areas that will only have a music installation, e.g. outside areas or pantry. These areas will have access to the central music data base via a separate music control. All of these areas and locations can be combined to perform a „party mode“.

1.12 Local Sources

Each room and location equipped with a set top box, can be additionally equipped with a local DVD, CD Blue-ray disk player or -for music only -iPod docking station or an MP3 music player input.

1.13 Set-top Boxes

The implemented set-top boxes have to be of very compact size, fanless windows based PCs. Beside the main objective, to direct video, music, camera and TV channels from the central rack to each location and its power amplifier and local screen, these units also can be used -if required for normal office applications. Of

course in this case the standard remote control has to be completed by a remote wireless keyboard and mouse for full PC functionality. As these additional functions can be arranged at any time, an early agreement on the question, e.g. at which location the CCTV cameras will be supervised is not necessary. This task allocation can be done later in the project. As every set-top box can in principle provide all available functions, it is only a matter of allowing or denying access to this specific function(s).

1.14 Screens

In those rooms and locations that are supposed to be equipped with video, camera or TV services, normal monitors will be used to display the pictures or videos. In principle all off the shelf monitors can be used, as long as they are stable enough to withstand the specific environment on a ship. Precise type and make selection can be done at a later stage of the project, because model life time can be less than six months, and flat screen technology is enhancing permanently. Therefore, also the proposed screen sizes contained in the following paragraphs describing the cabin equipment, are examples only. All of them provide at least full HD capability,

2. Entertainment Equipment

All used speakers can, at customer's choice, either be delivered for mounting into the ceiling, into the wall or even invisible. All outside speakers are waterproof versions. Wherever possible, all black box equipment like power amplifiers and set-top boxes are mounted in an invisible way. Remote control is done via infrared or via RF.

All functions will be controlled by one unique remote control unit. Selection of TV channel, audio-on-demand and video-on-demand source will be done via the TV screen.

2.1 Main Deck

Crew 1 (music only)

- 1 x stereo-in-One speaker, ceiling, round
- 1 x music controller, amplifier
- 1 x local IPod/ MP3 player input
- x ear phone connector

Crew 2 (music only)

- 1 x stereo-in-One speaker, ceiling, round
- 1 x music controller, amplifier
- 1 x local IPod/ MP3 player input
- x ear phone connector

Crew 3 (music only)

- 1 x stereo-in-One speaker, ceiling, round
- 1 x music controller, amplifier
- 1 x local IPod/ MP3 player input
- x ear phone connector

Crew 4 (music only)

- 1 x stereo-in-One speaker, ceiling, round
- 1 x music controller, amplifier
- 1 x local IPod/ MP3 player input
- x ear phone connector

Captain's Cabin

- 1 x 20-22" LCD-TV at the end of the bed at STBD
- 1 x stereo-in-One speaker, ceiling, round, or alternatively two speakers
- 1 x set-top box with local CD/DVD/Blue-ray player
- 1 x local IPod/ MP3 player input

Crew Mess 1

- 40-50" LCD-TV to be used for TV
- 24-27" LCD for CCTV only
- x stereo ceiling speakers
- 1 x ear phone connector
- 1 x set-top box with local CD/DVD/ or Blue-ray player
- 1 x local IPod/ MP3 player input
- 1x wireless keyboard and mouse for CCTV control

Crew Mess 2

- 40-50" LCD-TV to be used for TV
- 24-27" LCD for CCTV only
- x stereo ceiling speakers
- 1 x ear phone connector
- 1 x set-top box with local CD/DVD or Blue-ray player
- 1 x local IPod/ MP3 player input
- 1x wireless keyboard and mouse for CCTV control

Galley (music only)

- 1 x music controller, amplifier
- 1 x stereo in one ceiling speaker, round

Guest 1

- 32-40" LCD TV behind spy mirror glass In order to provide good viewing from both bed positions, it is proposed to place the screen behind a special mirror on top of a side board. If the TV is off, there is a normal mirror only.
- x ceiling speaker



- 1 x set-top box with local CD/DVD or Blue-ray player
- 1 x local IPod/ MP3 player input

Guest 1 Bath Room (music only)

- 1 x music controller, amplifier
- 1 x stereo in one speaker, round

Guest 2

- 32-40" LCD TV behind spy mirror glass In order to provide good viewing from both bed positions, it is proposed to place the screen behind a special mirror on top of a side board. If the TV is off, there is a normal mirror only.
- x ceiling speaker
- 1 x set-top box with local CD/DVD or Blue-ray player
- 1 x local IPod/ MP3 player input

Guest 2 Bath Room (music only)

- 1 x music controller, amplifier
- 1 x stereo in one speaker, round

VIP 1

- 32-40" LCD TV behind spy mirror glass In order to provide good viewing from both bed positions, it is proposed to place the screen behind a special mirror on top of a side board. If the TV is off, there is a normal mirror only.
- x ceiling speaker
- 1 x set-top box with local CD/DVD or Blue-ray player
- 1 x local IPod/ MP3 player input

VIP 1 Bath Room (music only)

- 1 x music controller, amplifier
- 1 x stereo in one speaker, round

VIP 2

- 32-40" LCD TV behind spy mirror glass In order to provide good viewing from both bed positions, it is proposed to place the screen behind a special mirror on top of a side board. If the TV is off, there is a normal mirror only.
- x ceiling speaker
- 1 x set-top box with local CD/DVD or Blue-ray player
- 1 x local IPod/ MP3 player input

VIP 2 Bath Room (music only)

- 1 x music controller, amplifier
- 1 x stereo in one speaker, round

Engine Control Room Area (CCTV only)

- 1 x 22" LCD will be installed into the electric distribution panel
- 1 x set-top box with local DVD player
- 1 x keyboard mouse or Trackball

Sports Room

- 40-63" LCD or plasma screen
- 2-4 stereo speakers
- 1 x set-top box with local CD/DVD or Blue-ray player
- 1 x local iPod/ MP3 player input

Office

- 1 x 22" LCD-TV
- 1 x stereo in one speaker, ceiling, round or alternatively two speakers
- 1 x set-top box with local CD/DVD or Blue-ray Player
- 1 x ear phone connector

Owner's Bath Room (music only)

- 1 x music controller, amplifier
- x stereo in one speaker, ceiling mounting, round
- Party mode is possible with Owners State Room and terrace

Owner's Stateroom

- 1 x 37-40" LCD TV mounted on a TV lifting system, located at the foot end of the bed. The lift allows turning the TV be 180 in order to allow viewing from terrace area.
- x stereo speaker, ceiling
- 1 x set-top box with local CD/DVD/Blue-ray player
- 1 x local iPod/ MP3 player input
- 1 x local music control unit (in order to allow control of music with TV lift down)
- Party mode is possible with Owners Bath and Terrace

Owner's Terrace (music only)

- 1 x music controller, amplifier
- 4 waterproof speakers within the coaming
- Party mode is possible with Owners Bath and Stateroom

2.2 Bridge Deck

Wheelhouse:

- One of the existing bridge screens can be used as TV or video screen
- x stereo in one speaker



- 1 x set-top box with local CD/DVD or Blue-ray player
- Option: music selection via a separate remote control with integrated display

Pantry: (music only)

- 1 x music controller, amplifier
- 1 x stereo in one speaker, ceiling, round
- Party mode is possible with Saloon and Aft outdoor area

Dining: (music only)

- 1 x music controller, amplifier
- 4 x stereo speakers

Saloon:

- 50-70 " LCD TV, eventually made with foldable ceiling mounting lift (optional)
- 4 x stereo speaker
- 1 x set-top box with local CD/DVD or Blue-ray player
- 1 x local IPod/ MP3 player input
- 1 x local music control unit (in order to allow control of music with TV lift down)
- 1 x local karaoke / gaming input (e.g. playstation, Xbox etc.)
- Party mode is possible with Pantry and Aft outdoor area

Aft Deck Outside: (music only)

- 1 x music controller, amplifier
- 4-6 waterproof speakers stereo
- Party mode is possible with Saloon and Pantry

2.3 Sun Deck

Sky Lounge Indoor:

- 50-70" LCD
- 4 stereo speakers
- 1 x subwoofer
- 1 x set-top box with local CD/DVD or Blue-ray player
- 1 x local IPod/ MP3 player input
- 1 x local music control
- 1 x local karaoke / gaming input (e.g. playstation, Xbox etc.)
- Party mode is possible with Sky lounge outdoor

Sky Lounge Outdoor: (music only)

- 1 x music controller, amplifier
- 4 x waterproof speakers
- Party mode is possible with Sky lounge indoor



3. Party Mode

Depending on the final decision on system layout and configuration, a „party mode“ can be implemented. Only one command may start or terminate this mode.

SECTION 14 – AMS (Alarm Monitoring & Security)

1. ECR-Console

1.1. General Details

- Shape: tilted console top plates with additional top unit Accessibility from front only. The console will be delivered including shock mounts
- Construction - self supporting steel construction, straight line type
- Dimensions:
 - Length: approximately 2.600 mm
 - Height: front 900 mm rear 1.400 mm
 - Depth: approx. 1.100 mm
- Material sheet-steel t = 2 resp. t = 3 mm
- Surface protection painted
- as per interface list
- Foundation supply IMTECH 100 x 65 x 7 mm
- Access - by means of portable doors, secured by turnbuckles at the bottom part of the console and hinged top/front plates, where practical
- Internal wiring - with flexible cable, one or multi-core of suitable diameter
- Cable conduits - are supplied in sufficient quantities and sizes for internal wiring as well as for ship's cable
- Drawings - Dimensional as well as general arrangement drawings with parts list and internal wiring/connecting diagrams with cable designation acc. to yard information are part of this offer. Connecting diagrams and dimensional drawings of components which are not supplied by IMTECH must be supplied to us latest 12 weeks before delivery date of the console.

- Standard equipment
 - internal illumination with switch
 - service socket
 - handrail

1.2. Components Supplied By Other Companies

All these components are professionally installed and will be wired to a main terminal board. This equipment must be supplied to us latest 8 weeks before delivery date of consoles free of charge. The

ECR-console will be fitted with the following equipment:

- Main Engine Remote Control Yard supply
- Main Engine Alarm and Slow Down Panel Yard supply
- Main Engine Safety System Panel Yard supply
- Emergency Engine Order Telegraph Yard supply
- ME Indicating Instruments IMTECH
- 1 pc Graphic Operator Stations IMTECH
- 1 pc Alarm & Journal Printer
- UPS 230V, 50Hz for GOS and Printer IMTECH
- Extension Alarm Panel (Engineer Call and Duty) IMTECH
- ER Fire Alarm Panel IMTECH
- Log Repeater
- Relay Unit for Alarm Columns IMTECH
- Pump Running / Stop and Auto Start Indication Panel
 - (Steering System) Yard Supply
- Alarm Panel with Alarm Lights and Push Buttons for system Test and Acknowledge (Steering System) Yard Supply
- Rudder Angle Indicator Yard Supply
- Dead Man Panel IMTECH

Auxiliary Equipment:

- Fuses,
- Terminals
- Distr. 24 V (10 pcs min. circ. breaker)
- Distr. 230 V (10 pcs min. circ. breaker) IMTECH

2. Monitoring System

The builder shall supply and install one monitoring system panel that shall enunciate critical ship conditions. The panel shall be installed in the pilothouse. An additional audible and visual alarm from the pilothouse shall be installed in the captain's stateroom and crew lounge with reset

Each panel shall be made of aluminium and engraved with the profile of the vessel and general arrangements of each deck of the vessel
Panels shall show the locations of each bilge alarm, smoke/fire detector, navigation light, bilge pump and fire pump.

The panels shall monitor the following systems:

- Bilge alarms
- Smoke and fire detectors
- Navigation lighting
- Bilge pumps
- Fire pumps

Each of the above systems shall have its own individual fault circuit to detect individual component failure. An LED indication shall show the



status of each item monitored. Upon activation of any item, the LED will illuminate. Upon failure of any component, the LED will flash. Each system shall have colour coded LED lights as follows:

- Bilge alarms – BLUE
- Smoke & fire detectors – RED
- Navigation lighting – GREEN
- Bilge pumps – YELLOW
- Fire pumps – YELLOW

The monitoring system shall also activate an audible alarm that shall sound at each panel location upon failure of navigation lighting, activation of bilge alarms, security system and smoke/fire detectors. In addition to the above, the smoke/fire detectors shall also activate the vessel's general alarm. The smoke/fire detectors shall be installed in each of the following areas:

- Crew Cabin
- Crew lounge
- Laundry
- Guest staterooms
- Guest bathrooms
- Guest foyer/stairs
- Engine room
- Master stateroom
- Master bathroom
- Master stateroom closets
- Main galley
- Forward lounge
- Main deck entry area
- Salon
- Pilothouse
- Captain's stateroom
- Engineer's cabin
- Electrical room

3. Fire Detection System

Maker / Salwico Cargo FDS Central Units types as described below or equal.

Individually adapted

Salwico Cargo is modular-based analogue addressable Fire Detection System fully SOLAS compliant. The modularity makes it possible to configure a system that matches your needs in the most cost optimized way.

Quick and easy to install



The cabinet's compact design and location of the control panel from the cabinet greatly simplify installation. And as always, Consilium is ready to offer you the benefit of full support if necessary wherever your location.

User-friendly

The control panel is designed for simple and intuitive control. Variable levels of lighting and different colours help to maintain the user's focus, and the auto-adjustable backlight ensures optimal visibility whatever the light conditions. In the event of a system failure, a USB port located in the front of the panel allows the user to generate status reports and to get rapid support from our experts.

Maximum safety

Every module is independent, allowing component replacements without affecting the rest of the detection system. Other safety features are built-in redundancy, optimal distributed system design and a control panel interface giving maximum support in case of an alarm or an emergency situation.

Superior reliability

Powerful loop system using FSK (Frequency Shift Keying) as a communication method together with the Evolution range of detectors that makes your installation immune against interferences and ensures its long life. The extremely sensitive and reliable detectors of the Evolution range make sure unwanted alarms are kept to the absolute minimum while increasing the systems over all level of performance.

Future-proof

Modularity allows you to easily meet future demands. Simply upgrade, add or replace modules to achieve the system functionality you require

- Salwico Cargo FDS, 3 loops Includes:
- -Control Panel 4,3
- -Loop M X, Loop Module
- -I/O M 700, Output Module 8 * 700 mA Outputs.
- -Relay M8, Relay Module 8 Programmable Relay Outputs
- -Change Over M
- -Charger M,
- -PSU M AC/DC 120W (5A)

- -Lead Gel batteries 24V/2AH (2x12V/2Ah) (2pcs needed)
- All above in a wall mounted cabinet 440x570x180 for up to 5
- loops
- **Flame detectors:** 3
 - N11121+
 - NS-AUV
 - Analogue Addressable UV-Flame 46916+ Detector with IP55 base
- **Manual call points:**
 - N11301
 - NS-ACP
 - Addressable Manual Call Point 16
 - N11305
 - NS-ACP/IP55
 - Addressable Manual Call Point, IP55 6
- **Short Circuit Isolators:**
 - N11891
 - NS-SCI
 - Addressable Short Circuit Isolator, IP55 2
- **Alarm devices:**
 - N1541
 - BE-24
 - Flash light, red, 24VDC, dry space. 1
 - N1546
 - FLASH/NI
 - Sounder & beacon, 32 tones, IP65 5
- **Gas Detection System**
 - Carbon Monoxide Sensors 6

4. Navigation And Signal Light Panel

Incorporated in the monitoring system

5. Engine Room Luminous Call System

1 x Indication Unit



Dimensions: 144 x 260 mm (W x H) with 7 pcs. Illuminated fields, siren, horns and terminal strip Location: ECR Console

1 x Control Unit

Power supply: 230V AC from emergency switchboard and main switchboard. The activation of the lighting fields are made via potential free contacts from the corresponding systems.

1 x Light Signal Columns

Visible from 3 sides for engine room area according to IMO regulations. consists of following fields:

- General alarm
- CO2-alarm
- Engine fire alarm
- Engine alarm
- Telephone call
- Telegraph call alarm
- Dead man alarm additional mounted are:
- Rotating light red
- Rotating light white / green
- Rotating light orange
- Siren for GENERAL ALARM / CO² ALARM
- Siren for the other above mentioned alarms

6. COLD STORE ALARM SYSTEM

consisting of: -

- 2 x push button with control lamps
- 1 x signal horn with alarm light
- 1 x relay box
- 1 x galley unit with reset push button, buzzer and indication lamps.
- 1 x potential free contact to AMS
- The power supply should be 24 V DC.

7. Safety Panel For Wheelhouse

Only Fire Alarm Panel will be installed in the wheelhouse

SECTION 15 – DECK EQUIPMENT

1. Anchoring System

1.1. General

- Two anchors will be self-stowing and self-launching, located on the forward end of the main deck above the anchor locker.
- Anchor winches will meet the speed and pull strength requirements of Classification Society.
- Both anchors shall be identical and meet BV weight requirements for the primary anchor.
- Controls for the anchor winch are mounted adjacent to winch by means of 2 wander leads.
- The wandering leads shall be permanently wired to a terminal strip in a watertight junction box, which shall be installed out of sight.
- Provisions shall be provided for unobtrusive secure stowage of the control box and its cable when not being used.
- Stainless steel recessed plates with stainless steel protection strips, shall be fitted on either side of the bow projecting down to the water line to allow each anchor to be set and weighed without damage to the vessel paint work.
- The anchor winches and ancillary equipment shall be mounted onto a drip tray arrangement of painted composite.

1.2. Chain Lockers

- The chain lockers floors are to be as close to the waterline as possible to provide maximum drop.
- Chain to be self-stowing for the whole of its length.
- Chain lockers to have permanent drain to bilge fitted with valve at lowest point (aft).
- Inside the chain lockers, a chain plate will be fitted at the centreline at top aft side to secure the anchor chains.
- Chain lockers to be accessible from crew quarters for maintenance

1.3. Anchor Windlasses

- Anchor windlasses to be electric with capstan, gypsy and band brake with 45° hand wheel.
- All winch components and ancillary equipment to be polished stainless steel.
- Gearbox and electric motor components to be coated with a minimum of two coats of white (RAL9003 or equal) polyurethane enamel over zinc primer.
- Make Maxwell VWC 11000 Hydraulic or Muir VCR 11000 vertical
- Gypsy kit for diameter 19.5 mm chain galvanised.
- Electric remote control.

1.4. Hawse Pipes

- Anchors stowed partly recessed in hull and to have stainless steel hawse pipes.
- Hawse pipes provided with sea water connection for anchor wash-down.
- Stainless steel protection plates to be fitted against hull around the anchors
- Two steel anchor stoppers to be mounted on base-plate on main deck.
- The side walls shall be strong enough to take full snatch load of the boat tacking at anchor under extreme conditions.
- At the top opening of the hawse pipe there shall be a wildcat type chain roller with flattened cheeks onto/into which the shackles will lie flat to prevent undue stress to the chain links.
- The rollers shall provide a clean lead of the chain onto the stoppers.

1.5. Anchors

- 2 x 280 kg galvanised steel anchors "Pool-N" high holding power

1.6. Anchor Chains

- 2 x 110 m 20.5 mm diameter galvanized stud-linked hi-tensile chain, to be located in chain locker.
- The bitter ends of the chains shall be securely fixed to an adequately reinforced and readily accessible fitting in the forepeak.
- A safe quick release mechanism shall complete the installation

1.7. Chain Stoppers - Devil's Claws

- Two stainless steel anchor stoppers to be mounted on base-plate on main deck.
- The stoppers will be a clamp-style chain lock.
- They will be set at the correct height to cause no horizontal or vertical deflection of the chain when locked.
- Two polished stainless steel devil's claws, one for each chain, shall be permanently fitted at the foredeck.
- Tensioning by means of a bottle screw mechanism with a removable ratchet.

2. Mooring System

2.1. Capstans

- Two Maxwell or Muir VC-3500 Hydraulic vertical capstans will be installed on the terrace deck.
- Proper reinforcement will be strong enough to take the weight of the boat under dynamic snatch loadings in any direction.
- Capstan operation shall be through watertight footswitches (one each for each capstan).
- All capstan components and ancillary equipment to be polished stainless steel.
- Gearbox and hydraulic motor components to be coated with a minimum of two coats of white (RAL9003 or equal) polyurethane enamel over zinc primer.

2.2. Mooring Bollards and Fairleads

- Eight double polished stainless steel bollards, two each on port and starboard on the foredeck and two each on port and starboard on the aft deck, on raised base plates bolted to the main deck structure.
- The top of the polished stainless steel base plates shall be about 5 mm higher than the surrounding teak deck.
- The internal shape of the fairleads shall be sufficiently rounded to prevent undue wear of the mooring lines.

- Additionally, there shall be a large polished stainless steel cleat vertically welded to the fairleads amidships both on port and on starboard.
- Bollards will be installed adjacent to fairleads but at an angle which permits the warp to enter the cleat at an angle, not parallel, to the cleat.
- Bollards to be properly supported under deck for spread of load.
- Fairleads shall be fabricated & highly polished 316 Stainless steel and set fair into the bulwark.
- Fairleads shall be strong enough to take the weight of the boat under dynamic snatch loadings in any direction and of a size to allow an eye splice to go through.
- Additionally, at the stern two polished stainless steel mooring line fairleads, with rollers, to be properly located in relation to the capstans in order to provide a proper lead of the mooring lines onto the capstans in stern-to mooring situations.

2.3. Misc. Mooring Equipment

- Eight mooring lines of 40 m each. 3 x 8 strand, 30 mm square braid Polyester.
- Three mooring lines of 10 m each, 3 x 8 strand, 30 mm square braid Polyester with stainless thimble/eye splice and a 2m loop of 14mm galvanised chain.
- One 150m sea towing rope of adequate diameter.
- Canvas fender hoods and canvas fender topside protection mats are specified in Chapter XVI. 'Upholstery'.
- Eight pneumatic fenders, approx. 1000 x 600 mm, each with lines, adjustable leather-covered fender hooks and two fender covers (20 total).
- Three fender-boards, each with lines and adjustable leather covered fender hooks.
- The Builder shall supply one set of removable Mooring Products[®] mooring whips with two sets of flush sockets, one set at the bathing platform and one set each on starboard for mooring the tender next to the accommodation ladder.

3. Gangways & Ladders

3.1. Stern Gangway

- A 6-meter long electric/hydraulic passerelle (minimum width 800 mm), in the same style as the accommodation ladder, exiting through a flush door in the transom.
- The gangway shall have swivelling (130⁰) and tilting capabilities, a “doorbell” and in the underside a recessed track for fitting the shore power cable support rollers.
- The hydraulic power should be taken from the standalone hydraulic power pack system supplied by the gangway manufacturer.

3.2. Accommodation Ladder

- A removable carbon fibre accommodation ladder with self-levelling teak steps (minimum width 600 mm), will have fittings both port and stbd at the bulwark doors near amidships.

3.3. Swimming ladder

- The swimming ladder shall extend approximately one meter down into the water and have comfortable 800 mm wide teak steps.
- Deployment in flush sockets set into the fold down transom bathing platform.

4. Tender Crane & Tenders

4.1. General - Crane

- A 9 ton/m fully rotate able fore deck mounted crane type KS FC09 will be supplied to facilitate the launching of both tenders (maximum loading – 2 tons each) over both sides of the hull
- The hydraulic power should be taken from the standalone hydraulic power pack system supplied by the gangway manufacturer.

4.2. General - Tenders

- The builder will supply 2 custom built tenders.
- Each tender will be fitted with Steyr inboard Z drive propulsion systems – 256 hp each.
- 1 tender will be fitted out for utility purposes and water skiing. The other will be styled as a launch.

- The builder shall fabricate GRP support cradles for the yacht's tenders. These cradles shall be bolted to flush stainless steel deck-fittings and shall be easily removable.
- Cradles to be painted in the yacht's colour and fitted with attachment points for holding-down straps and canvass cover.
- Additional flush stainless steel screw-eyes shall be installed in the deck to hold down the tenders during passage-making.

5. Tender Hatches

5.1. General

- Hatches will be custom built by KS and the shipyard and KS Engineering
- They will operate on the lift and slide principle
- Power for the hydraulic mechanism will be supplied by the crane unit
- Controls will be located at the bridge wing panels

6. Sport Room Shell Door

6.1. General

- The door will be custom built by KS and the shipyard and KS Engineering
- It will operate on the swing down principle
- Power for the hydraulic mechanism will be supplied a standalone hydraulic power pack system supplied by KSE.
- Controls will be located at next to the door in the sport room.

7. Transom Shell Door

7.1. General

7.2. General

- The door will be custom built by KS and the shipyard and KS Engineering

- It will operate on the swing down principle
- Power for the hydraulic mechanism will be supplied a standalone hydraulic power pack system supplied by KSE.
- Controls will be located at next to the door on the aft transom.
- Inside the shell door will be enclosed the swim ladder mentioned above. The ladder will exit from the side of the door.

8. Salon Sliding Doors

8.1. General

- The doors will be custom built by Opacmare, Bofor or equal.
- They will operate on the sliding balanced principle.
- They will be manually operated as far as opening is concerned. Sealing will be by compressed air / electric system.
- The three door are :
- Owners cabin aft door
- Main salon aft door
- Skylounge aft door
- All three will be built from square section PPST.
- All doors will be made up of 4 panes
- The two lower doors, only the two central panes will slide behind the two outer panes.
- The upper door all 4 panes will slide to the side and disappear into the structure
- The Owners door will have an air sealing mechanism

SECTION 16 – DECK FITTINGS

1. General

- All hardware used will be of the highest quality, specifically suitable for use in the marine environment. And be of common general look.
- Deck castings, fittings and capstans to be stainless steel.
- All deck gear to be bedded with 3M 5200 or equivalent.
- All high-load deck gear bedded on teak shall have a high-density insert to the deck replacing the teak.
- Where stainless steel bolts are in contact with anodised aluminium, there shall be applied a 3M anti-corrosion isolating compound (yellow paste).
- All places shall be adequately drained.
- Equipment shall be installed recessed and flush.
- No unnecessary or unwanted eye catching features.
- All stainless steel items to be installed shall be high gloss polished.
- Between all metal items, fitted onto the hull or superstructure, a thin UV-proof nylon layer shall be fitted in order to prevent electrolytic corrosion.
- Helicoil™ type threaded inserts and Tef-Gel™ corrosion inhibiting compound shall be used for bolts into the metal structures or components.
- Concealed hinges and flush, recessed or removable handles and locks shall be used whenever possible.

2. Doors

- All entrance doors to be from Freeman Marine, PCM or equal, each equipped with a central dogging down mechanism using the continuous chain system and adjustable hinges. Both in the open and closed positions all doors, shall be held firmly in place. No rattling shall be allowed.
- For normal use all entrance doors are to open and close lightly, using normal hardware. Additionally, there will be facilities for dogging down to insure water- and weather tightness in accordance with BV requirements.
- For day-to-day use all doors to accommodation areas shall open and close lightly using normal marine quality hardware.
- Unless specifically noted otherwise, all doors and hatches shall be completely flush with the surrounding surface. In the closed position, except for the sliding side doors on the side decks.
- All superstructure doors on the main deck will be sliding type and have coamings of 150mm.
- Engine room access from the port exterior side deck shall have a hinged watertight door with 150 mm high coaming.

- Emergency engine room access from the stbd exterior side deck shall be via the stbd air duct which will have hinged watertight door with 600 mm high coaming.

2.1. Deck Hatches

- All shipyard built hatches will include deep drains and guttering, the lid will bed down on a rubber seal using Rondal-style flush hinges.
- The following flush deck non-wt hatches will be fitted :
 - 1 on foredeck centre for anchor windlass operation
 - 2 on foredeck sides for mooring operation
- The following raised WT hatches will be fitted :
 - 1 on Windlass deck forepeak entrance
 - 1 on Windlass deck for fwd crew entrance
 - 1 on Bridge deck for central crew entrance
 - 2 on terrace deck for lazarette access
- Deck planking pattern will continue over the flush hatches.
- Margins around the hatches.
- Aluminium channel/gutter and hatch frame will be fitted.
- Teak edge of deck and hatch will be protected by stainless steel vertical strip.
- Channel/gutter will drain overboard.
- Hatches will be fitted with heavy duty, stainless steel hinges and locks. Stainless steel to be bead blasted.
- Hinges and locks will be flush mounted.

2.2. Deck Lockers

- Hinged lids and small doors to storage compartments and technical spaces shall be fitted with fully concealed "hook" hinges, gas springs and dogs.
- All storage compartments shall be adequately ventilated, self-draining and fitted with polypropylene gratings.
- Any door, covering an equipment item such as a refrigerator or icemaker, shall be fitted with a door-coupling mechanism.

3. Windows

- Windows to be located and dimensioned in accordance with the designer's General Arrangement Drawings.

- Each window glass shall be glued into a recess, which is moulded in the superstructure sides.
- The recess depth will allow for a flush finish with the superstructure shell and therefore must be designed to a depth equal to the glass thickness and sealing system.
- All glass will be laminated and hardened safety glass
- All glass will be clear glass
- See-through, externally attached white window covers shall be supplied for the wheelhouse.

3.1. Hull Portlights

- Portlights to be located and dimensioned in accordance with the designer's General Arrangement Drawings.
- Each portlight glass shall be glued into a recess, which is moulded in the hull sides.
- The recess depth will allow for a flush finish with the superstructure shell and therefore must be designed to a depth equal to the glass thickness and sealing system.
- All glass will be laminated and hardened safety glass
- All glass will be clear glass
- All ports will be supplied with storm covers in stainless steel hinged from the inside.

4. Stainless Steel Hardware

4.1. Railings

- The railings shall be constructed in 32mm diameter polished stainless steel tubing.
- Top bar shall be split with a hinged gate to access side accommodation ladder, and aft to access the aft passerelle.
- Gate openings shall be minimum 600mm.

4.2. Stanchions

- Stanchions shall be highly polished 80mm dia. tubular 316L stainless steel.
- Stanchions to be located under the upper deck overhang.

4.3. Bell Mast

- On the windlass forward located between the anchor winches, a permanently installed tubular stainless steel structure for installation of the following items:
 - The ship's bell.
 - The intercom station.
 - The low level anchor winch lights.
 - Anchor wash-down valves.
 - Ventilation pipes for the forepeak.
 - Attachment points for "dressed ship" lights and/or flags.
 - Hoisting facilities for the black anchoring ball

4.4. Flag Pole

A 316 L stainless steel flag pole 3m-long of sufficient diameter or profiled shape in a support integral with the aft side of the upper deck coaming railing.

5. Teak Deck

5.1. Type

- Teak decks will be synthetic type as produced by Stazo, Estec, or Tek-Dek.
- All exterior open areas will be covered.
- Other areas included :
 - The sport room deck,
 - The sport room door inner/upper side
 - The transom door inner/upper surface
- Areas not included :
 - Garbage locker
 - Tender bays
 - Windlass deck
- A painted scupper will be left outboard of all decks.

5.2. Installation

- Teak deck planking will be traditionally laid with king-planks, bevelled raised margin plank at the superstructure sides, covering planks around the perimeter and proper detailing around the equipment installed on the deck surfaces.
- Teak deck planking 6 mm x 75 mm.
- King planks 125 mm

- Margin boards 90 – 100 mm
- Deck seams 5 mm filled with black deck sealer except the seam next to the paintwork may be done with white sealant
- Planking glued to deck with Sikaflex or the product recommended by the supplier.
- Deck planking curves parallel to the waterway and is rebated into the king plank.
- Margins will be fitted around capstan bases, hatches or deck structures.
- The planking to run as uninterrupted as possible, minimum length will be 4 meters and maximum 6 meters
- Planking butts to be placed sequentially skipping each adjacent plank. No butts will be positioned close together or clustered.

6. Miscellaneous Items

6.1. Tables

To be defined with owner and interior designer.

6.2. Windscreen Wipers

3 windscreen wipers Hepworth Marine HD 80 NMM, two-speed, 24 VDC with B-140-39 40" wiper blades shall be fitted to the forward windows of the wheelhouse. Equipped with 42" P81-42 heavy duty pantograph arms. Controls shall be located in the wheelhouse.

SECTION 17 – COATINGS

(Paint & Fairing – Interior & Exterior)

1. Coating Quality

The gloss finish of the exterior hull topside and superstructure surfaces as well as all interior finished will be carried out to the Builder's highest current standards. All the products used for painting the yacht will correspond to obtaining a high standard of finish suited for a boat of this calibre.

1.1. General

- The Builder shall be wholly responsible for the painting and fairing in all areas of the yacht and on all third party supplied equipment.
- The Builder will be responsible for ensuring that there is no subsequent print-through due to incomplete post-curing and shall satisfy himself that the hull has been correctly cured prior to applying any paint process.
- Each type of coated surface, as far as is practical shall utilise a complete system from a single supplier, to ensure that the different layered products of the system used are compatible. The mixture of systems is permissible if this is the builders practice and known to be without compatibility problems.
- All paint and filler materials shall be of a best grade yacht quality type, specifically formulated for use in the marine environment
- All colour schemes, styling lines and special features will be discussed with and approved by the Owner. Various colours, colour schemes and other combinations will be submitted for the Buyer's approval.
- The agreed paint supplier and paint cycle specification can be revised at any time according to the latest experience of the builder and any eventual modification will be agreed in advance with the owner.
- The builder shall be able to commence any coating system as soon as any of the substructure fabrication has been completed.

1.2. Manufacturers Recommendations

- Up to date specifications shall be obtained from the chosen coating suppliers and provided (as completely as possible) as part of the builders final specification.

- The Builder shall consult closely with the coating manufacturer and arrange for inspections by a representative of the manufacturer.
- The manufacturer's instructions will be strictly followed with regard to the stowage of all the material, the preparation of the surfaces and the application of the system.

1.3. Preparation and Application

- During the application and drying of the final finishes, the paint system, whether being applied by brush, roller or spray shall be carried out while no other activity is taking place in the vicinity which may cause undue dust.
- All aluminium parts used for the construction of the Yacht will be degreased, washed and dried before applying the primer.
- All steel parts used in construction sand-swept and/or ground and/or brushed to remove any oxidisation before applying primer.

1.4. Control Of Conditions

- The coating work will be performed under conditions such that it presents a superior finish, having the absolute minimum of dust inclusion, orange peeling, pin holing, craters, fish eyes, paint runs, gloss dullness, free of print through, and sanding scratches.
- Paint manufacturer's specifications are to be strictly observed and monitored at all times. Particular attention will be paid to the :
 - climatic conditions,
 - mixing ratios,
 - dry-film thickness
 - over coating times
- A detailed quality control survey will be monitored daily by a builder technician. This will include recording :
 - temperature,
 - dew point,
 - humidity
 - batch number of all paint cycle products.

2. Coating Systems - Interior

2.1. General

- All surfaces listed below that are to be painted are to be thoroughly cleaned degreased and coated with a coating as listed below.
- Colour will be white throughout and be RAL 9003.

2.2. Surfaces & Equipment to be Painted

- Surfaces that shall be painted :
- All bare composite structures that are not covered with a more or less permanent lining of insulation. Surfaces behind these linings will not be painted unless they are made from a material that will corrode, such as ordinary steel. All pipes, pipe hangers, ducts, cable trays and similar items shall be considered as an integral part of the "Surface behind the linings" and be treated correspondingly
- All normally visible insulation components
- All normally visible non-insulation lining components
- All mechanical and electrical equipment.
- The interior of all lockers and storage spaces.

2.3. Method of Painting

- Normally most areas and equipment will be sprayed.
- The followings surfaces on all machinery and equipment throughout the vessel shall be carefully masked and protected against overspray during painting :
 - All lighting fixture glass lenses
 - Label plates
 - Gauge faces
 - Glass hardware
 - Fuel & water hoses, hose clamps
 - Flexible rubber/plastic piping connections
 - Cables/wiring harnesses and hangars
 - Electrical terminal points and connections
 - Plastic and rubber electrical protective boots
 - Stainless bolts
 - Instrument dial faces.
 - Any surface intended to be an electrical isolation unit, e.g. solenoid covers.
- After painting, the masking and any extraneous paint/varnish shall be removed, and all painted units protected against damage by the use of blankets, plastic sheeting or plywood.

- The sharp edges or corners of frames, stiffeners etc. may be hand brushed with primer and topcoat prior to spray painting.
- Bilge and small areas will have coatings applied by brush and roller.

2.4. Details Technical Spaces Above Lower Deck

- This includes all engine rooms and machinery rooms.
- The bare hull, perimeter bulkheads, bilges, deck heads, and all insulation surfaces and all machinery and equipment will be painted with a two part epoxy or LPU based paint.
- Paintwork in the vicinity of high temperature piping or parts of machinery, where temperature is in excess of 60 degrees C. shall be painted with heat resisting paint in the recommended manner.

2.5. Details Technical Spaces Below Deck

- This includes all bilges, below lower deck and engine rooms deck plates.
- The bare hull shell, perimeter bulkheads, girders, and floors, bilges, deckheads will be painted white gelcoat.
- all insulation surfaces and all machinery and equipment will be painted with a two part epoxy or LPU based paint.

2.6. Details Technical Spaces Piping

- Pipes which are to be galvanised, if any, shall first be completely fitted in place using untreated steel pipes of the appropriate quality, after which the fabricated pipe sections are to be removed, grit-blasted, galvanised and reinstalled, prior to the application of the final coat of paint to the surrounding area.
- All visible pipes not withstanding their material shall be coated. However some stainless piping will be left uncoated and instead polished.
- All pipes will be marked with periodic stripes of coloured paint to indicate their content as per the international recognized colour code
- All valves and valve handles shall be white epoxy painted prior to final installation and. Valve handles to be painted to match content with same colour code as corresponding pipes.

3. Tanks



3.1. General

- Generally the coating of all composite double bottom tanks is not required for reasons of longevity, as the structural epoxy is impervious to all liquids found on a motor yacht. However some will be coated for other reasons.

3.2. Fresh Water Tanks

- Two coats of food safe white epoxy gelcoat
- Type TBD

3.3. Fuel and Lubrication Oil Tanks

- One coat of fuel resistant white epoxy gelcoat
- Type TBD

3.4. Waste Tanks

- One coat of fuel resistant white epoxy gelcoat
- Type TBD

3.5. Interior Woodwork

- All wood surfaces, bulkheads, hull lining, corridors, furniture, tables, and all visible details will be carefully finished to reflect the high standard of construction pertaining to this class of yacht. Where applicable, rubbing down and polishing will receive particular attention
- Generally the type of coatings will be decided once the interior design has been completed.
- All paints and varnishes will be two part LPU or epoxy systems
- Floors where necessary to be treated with 6 coats of 2 component polyurethane clear semi-gloss varnish.

4. Coating Systems - Exterior

4.1. Exterior Colour

- Hull is to be painted a shade of white.
- Superstructure to be painted a shade of white.

- **As an option** the hull only may be painted any shade of colour up to and including dark blue.

4.2. Coating Suppliers

- The Builder will use Sicomin as the main exterior coating system for the hull topsides and superstructure.
- The Builder will use Nautique or Veneziana as the main exterior anti-fouling coating system for the underwater areas of the hull.
- The following other paint & fairing systems suppliers can be considered and used as an option - Awlgrip, Sikken's International, Alexseal, Boero, or DuPont.
- The antifouling will be TBT free, and comply with the latest Anti-pollution requirements.

4.3. Under Water Area System

The underwater area to a distance of 0.30 m above DWL to be painted as per the manufacturer's specifications, and should include as a guide the following coats :

- sand entire surface
- one coating primer paint
- one coating light epoxy filler to remove worst deformities
- sand entire surface
- one coating barrier paint
- one coating primer paint
- two coatings anti-fouling paint

4.4. Topside & Superstructure System

Note – this is a general guide – final system may change

- Sand entire surface
- one coating primer paint
- successive coatings of heavy epoxy filler and sanding
- successive coatings light epoxy filler and sanding
- two coatings build up primer
- one coating with intermediate/linking paint (if applicable)
- two coatings of sprayed undercoat
- one or two coatings sprayed topcoat
- one or two coatings of sprayed clear coat

4.5. Deck Surfaces

- Any deck surfaces that will be painted will have a non-skid surface. The following surfaces shall be coated with non-skid (antiskid) paint:

- Tender bays
- Windlass deck
- Area on skylounge roof just below mast
- Other areas may be decided later in collaboration with the owner.

4.6. Boot-topping & Hull Trim

- The boot-topping (waterline) will be painted with two monochromatic bands to a standard dimension and colour as per owner's choice. The same painting cycle as for the topsides will be applied.
- Other hull trim lines can be applied as an option.

4.7. Names, Logos & Lettering

- The yacht's name, hailing port and logo can be painted, but the builder will normally supply a PPST backlit raised lettering for the yacht's name and hailing port.
- The builders logo will be applied to the superstructure in PPST
- Regulatory load line, draft marks and freeboard marks shall be applied in PPST
- As an option the owners logo can be applied
- There will be various locations for these items :
 - Name on transom
 - Hailing port on transom
 - Name on superstructure side forward on both sides
 - Builders logo superstructure side aft on both sides
 - Load line marks amidships both sides near DWL
 - Draft marks on both sides of bow and stern
- The tenders, life rings, and similar items shall be appropriately marked in vinyl lettering with the yacht's name, hailing port, call sign or otherwise.

4.8. Exterior Woodwork

In keeping with the low maintenance requirements of the vessel concept, there will be very little or non exterior wood work.

In case that there is some wooden item that requires a decorative coating (e.g. – table top) the following sequence will be carried out :

- sanding
- one priming coat (50/50 dilution)
- one priming coat (70/30 dilution)
- sanding

- a minimum of eight coats of transparent marine varnish with sanding as required. The first 2 coats will be applied as soon as practicable after installation.
- light sanding
- two coats of UV resistant clear coat

5. Exterior Hull / Superstructure Finish Standard.

5.1. Coating Guarantee

The builder shall provide an paint warranty that guarantees the whole paint systems for a period of one year, from the date of delivery, and shall include the complete exterior coating system of the hull and superstructure.

This guarantee to cover defects in excess of 5% to the bottom and topsides and in excess of 3% to the superstructure, excluding any and all mechanical damage caused after delivery.

5.2. Coating Reference Sample

The builder shall prepare a horizontal and a vertical reference plate or plates intended to serve as a model for the acceptance of the Yacht's finished surfaces.

The plates shall be made of the same material intended to be used for the construction of the Yacht and subsequently primed, filled, sanded and painted to the same standards and procedures intended to be used for the project. The size must be such as to allow for a proper comparison.

5.3. General

In order to eliminate the subjectivity associated with visual assessment of the standard of surface finish of exterior painted surfaces, the builder has adopted the following procedure to provide an objective and repeatable evaluation of surface finish.

The finish of painted surfaces subject to such analysis, namely the topsides and the superstructure, shall be presented to the Buyer's representative for acceptance based on the following procedure.

The two most conspicuous aspects of surface finish, the brilliance (the "Gloss") and orange peel or haze effect (the "Look") will be measured with appropriate instrumentation, as detailed below, and results will be compared with the established Builders Standards for both parameters. :

- Inclusions – usually dust
- Gloss – a measure of the shininess of the surface
- Look – a measure of the level of orange peel effect

In the event of disagreement over final finishes, the following guidelines shall be used.

5.4. Inclusions

In case of dust inclusions no larger than 500 micron, high/low visibility areas need to be defined. This will be done in advance of contract using a dwg of the vessel to mark these areas.

Acceptable limits are :

- high visibility areas – a maximum of 10 particles per square decimetre.
- low visibility areas – a maximum of 20 particles per square decimetre.

5.5. Gloss & Look Measurement Positions

- After a period of 20 days following the last application of top coat, both Gloss and Look readings will be taken in the following positions:
- Topsides: Starting from a position 1.5m below the cap rail on the port transom corner, 3 readings will be taken in the same general area at horizontal intervals of 3m (+/- 0.3m), until returning to the port transom corner. This "circuit" will be repeated at vertical intervals of 1.5m below the previous circuit until the waterline is reached.
- Superstructure: Due to the complexity of shape and surfaces, a drawing representing a density of reading positions similar to that of the topsides will be presented prior to effecting measurements of Gloss and Look.

5.6. Gloss Measurement and Acceptance

The Gloss of subject surface finishes will be measured with a professional Gloss meter (in accordance with procedures detailed in ASTM D 532, ISO 2813, DIN 67 530) set for an angle of incidence of 60° (+/-2° as per instrument manual), in the respective positions detailed in ii) above.

- Main Standard ISO 2813
- Horizontal surfaces < 87 % at 50° average
 - Vertical surfaces < 90 % at 40° average

 - The average of the entire sample of Gloss reading values, respectively for the topsides and superstructure, will be recorded as the respective reference values for future comparison.
 - Resulting average Gloss values of less than 90 gloss (with a margin of error of -2 gloss) for either surface, measured as detailed above, will be considered as unacceptable.

5.7. Look Measurement and Acceptance

An image shall be measured using a wave scan device. The readings established as a result of such a measurements shall be compared with the relevant readings from the reference Plate.

- In order to simulate the visual evaluation of orange peel or haze effect, an appropriate laser emitting instrument, known as the "Wave-scan plus", will be used to optically scan the resulting wavy, light-dark patterns on the surface.
- The average of each group of 3 readings per position, measured as detailed above, shall be plotted on a graph as per Fig. 1. The elliptical confine marked on the graph represents the current highest standards obtained by the builder. The cylindrical confine marked "C" represents a higher standard than the ellipse.
- In the event that at least 20% of the plotted averages fall in the areas marked "A" and/or "B", the respective surface finish shall be considered unacceptable.

5.8. Guarantee Terms for Topside and Superstructure Paint Cycle.

The terms of guarantee for the paint cycle applied to the exterior surfaces of the topsides and superstructure shall be subject to the conditions as described below.

5.8.1. Defect Determination Process

The relevant paintwork shall be deemed to require rectification in the event that the coating presents any of the following defects:

- pitting
- blistering

- rust spots
- flaking
- in the event that a white-coloured LPU topcoat, a reduction in gloss of more than 15% compared to the relevant reference Gloss Value measured in accordance with Annex I prior to delivery,
- in the event that a white-coloured Acrylic topcoat is applied, a reduction in Gloss of more than 25% compared to the relevant reference Gloss value measured in accordance with Annex I prior to delivery,
- in the event that a dark-coloured LPU topcoat is applied, a reduction in gloss of more than 30% compared to the relevant reference Gloss Value measured in accordance with Annex I prior to delivery
- in the event that a dark-coloured Acrylic topcoat is applied, a reduction in gloss of more than 50% compared to the relevant reference Gloss Value measured in accordance with Annex I prior to delivery
- a change in the topcoat colour, relative to adjacent surfaces, of more than 8 Cielab units (DIN 6174) for a white-coloured finish
- a change in the topcoat colour, relative to adjacent surfaces, of more than 10 Cielab units (DIN 6174) for a dark-coloured or different finish.
- Note - The measurement of gloss and colour readings will only be undertaken on flat surfaces but, any such positions that present mechanical damage, fender rubbing marks, docking line abrasion and any abrasion due to inappropriate surface washing shall be excluded from measurement.

5.8.2.Extent of Rectification

- The extent of such rectification called for shall be as follows:
- to carry out local repairs to defective areas in the event that the extent of the defect does not cover more than 3% (for white-coloured topcoats), or 5% (for dark-coloured topcoats), of the total relevant coated area (topside or superstructure), or
- to repair the relevant continuous section of the coated area (topside or superstructure) making full use of suitable adjacent structural or natural interruptions (i.e. the bow) to "mask-off" the area of repair, in the event that the extent of the defect exceeds 3% (for white-coloured topcoats), or 5% (for dark-coloured topcoats), of the total relevant coated area (topside or superstructure).

SECTION 18 – SAFETY SYSTEMS

1. Fire Fighting Systems

1.1. General

The fire fighting is divided into these categories :

- The sea water pumping, fire hoses and nozzles classic system
- The engine room gas smothering fire system
- Portable fire extinguishers
- A water fog type system - optional

1.2. Sea Water Fire Extinguishing System

- The pumping part of this system is described in the Bilge Section
- On board will be four hoses of suitable length provided with jet nozzles. These hoses will be stored on reels or in special brackets.
- 8 hydrants will be strategically located.
 - One on windlass deck
 - One in garbage locker
 - One by port pantry entrance door
 - One by port engine room entrance door
 - One under the stairs in the guest accommodation
 - One in port side locker under steps up to aft deck
 - One in sport room
 - One on port side coaming of upper deck
- The hydrants will be located about 250 mm above the deck surface, there shall be moulded-in recesses into which the valves for the fire and salt-water deck-wash systems are to be installed if they are not in enclosed lockers.

1.3. Engine Room Gas Fire Extinguishing System

- In the engine room there will be a modified Halon automatic NAF III one-shot fire extinguishing system.
- The system is self-operated with sensors in engine room.

- One nozzle shall be located over each main engine and each generator set.
- Fans and fuel pumps stop when system activated.
- Fire flaps will close the engine room air ducts automatically or manually.
- For safety, the automatic system can be immobilised when a person is working in the pump/engine room.

1.4. Portable Fire Extinguishers

- In the accommodation, a fire extinguisher will be located on suitable places to MCA recommendations, as follows:
 - portable dry chemical 5lb. (9 in total):
 - galley 2
 - crew mess 1
 - guests cabins 1 in each
 - nav area 1
 - owner's cabin 1
 - portable dry chemical 10 lb (3 in total):
 - saloons 1
 - deck house 1
 - lazarette 1
- One fire blanket and one CO2 fire extinguisher to be installed in the galley.
- A central fire/smoke alarm system to be installed throughout the vessel with the control panel in the navigation station. See AMS section

2. Lifesaving Systems

2.1. General

- The Yacht will be supplied with all the equipment required by the BV and MCA
- A plan will be prepared showing the position and quantity of safety equipment on board.

2.2. Liferings

Round self-draining recesses shall be moulded in the superstructure sides for flush installation of liferings:

- one each on port and starboard aft on the main deck
- one each on port and starboard on the bridge deck adjacent to the wheelhouse entrance.
- These recesses shall also include space for the man-overboard-lights.

2.3. Life Vests and Harnesses

20 solid core life vests, with radar and light reflectors, will be supplied with the vessel in accordance with MCA.

A whistle, dye marker and stroboscopic light will be delivered for each life vest.

3 harnesses will be supplied for crew when working on deck in difficult circumstances

2.4. Liferafts

- 4 twenty (16)-man inflatable life-rafts, suitable for oceanic use, SOLAS Type A will be supplied.
- The inflatable life-rafts will be recessed in the upper deck coamings

2.5. Flares

The following equipment is to be supplied with the yacht in accordance with MCA :

- Twelve red parachute flares
- Six white parachute flares
- Four red hand flares
- Four white hand flares
- Three orange smoke day signals.

2.6. First Aid Kit

A first aid kit, suitable for a world-wide cruising motor yacht of this size, according to SOLAS and MCA is to be supplied and intalled. This the Owner's Supply

3. Miscellaneous Safety Items

3.1. Fog Horn

- One chrome plated Kahlenberg® figure 553 Quintuplex Chimetone™ marine air horn system, complete with:
- a model M-411 automatic Fog Signal Timer, 110 Volt AC, suitable for bulkhead mounting and to be coded in accordance with International and Inland Navigation Rules Commandant Instruction M16672.2B
- a model M-300 whistle light with clear fresnel lens and 100 Watt light bulb
- a model M-463A "Automatic & At Will" whistle switch suitable for flush mounting in the wheelhouse
- two model M113A flush mount push buttons for installation in the wing stations
- one model plain steel air receiver, complete with all ancillary equipment to include air strainer/moisture trap, drain valves, safety valve, check valve, pressure gauges, etc.

3.2. Searchlights

Two ACR RCL-600 search lights with remote in wheelhouse and wing stations shall be fitted.