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Massimiliano Panessa
Yacht & Small Craft Surveyor

Report nr.	22072PP
Date of inspections:	21/06/2022
Where inspected::	Marina San Giorgio boatyard
	S. Giorgio di Nogaro, Italy
Customer:	Mr. Christoph Schmid
	Grossplatestrasse 20, Pfaffhausen – Switzerland
Kind of survey:	Pre purchase

Inspection report
Auxiliary Engine Sailing Yacht named:

Britta

Cavriago, 27/06/22

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1. Assignment

According with the instructions received from Christoph Schmid, on 21/06/2022we attend to inspect the above mentioned pleasure craft in Marina San Giorgio, in order to ascertain the condition of hull, machinery and equipment.

1.1 Performed Inspections

Component	Performed Inspections	
Underwater Body	☒Dry-docked inspected ☒Visual inspection ☒Tap Test ☒Moisture test ☐Infrared Thermography ☐Ultrasonic test	☐Not inspected
Topsides	☒Inspected ☐Infrared Thermography	☐Not inspected
Deck	☒Inspected ☐Infrared Thermography	☐Not inspected
Masts and rigging	☒Inspected at deck level ☐Inspected aloft	☐Not inspected
Sails	☒Inspected ☐Furled ☒Unfurled on rigging ☐Laid out ashore	☐Not inspected
Structures	☒Inspected	☐Not inspected
Furnitures	☒Inspected	☐Not inspected
Engine	☒Inspected ☒Operated at a sea ☐Infrared Thermography	☐Not inspected ☐Not operated
Electrical system	☒Inspected ☒Tested ☐Infrared Thermography ☒Batteries conductance test	☐Not inspected ☐Not tested
Plumbing	☒Inspected ☒Tested	☐Not inspected ☐Not tested

Component	Performed Inspections	
Galley gas system	☒Inspected ☐Operated	☐Not present ☐Not inspected ☒Not operated
Navigation equipment	☒Inspected ☐Tested ashore ☐Tested at mooring ☒Tested at sea	☐Not inspected ☐Not tested

Table 1.1

1.2 Equipment used

For instrument and measurements details see Appendix.

Tap test	• Wooden hammer • Phenolic head hammer • Pin hammer • Spike handle • Spike
Moisture Meter	• Tramex: ◦ Composite materials (not suitable for carbon fibre): conductance type sensor, scaled 0 through 100, a dry laminate should mark 0 to 50, moderately wet marks 51 to 70 (warning threshold); readings of 71 (alarm threshold) and over indicate a wet laminate. ◦ Wood: pin-type probe, percentage scale. • Protimeter Aquant: Radio-frequency type sensor, scaled 0 through 999, a dry laminate should mark 0 to 169, moderately wet marks 170 to 199 (warning threshold); readings of 200 (alarm threshold) and over indicate a wet laminate
Thermal Imaging Camera	• Trotec AV080C, 160×120 pixels, FOV 28°x21°, IFOV 3mrad, NETD <80mK • Testo 882, 320×240 pixels, FOV 32°x23°, IFOV 1,7mrad, NETD <50mK (in SuperResolution mode: 640×480 pixels, IFOV 1,1mrad)
Ultrasonic	• Flaw detector Mitech MFD620C • 25mm/0,5MHz Olympus delay-line probe (composites) • 10mm/5MHz Olympus dual-crystal probe (metal)
Electrical testers	• Autool BT660, printer • Ring RBAG700, printer

	• Current clamp Trotec BE44, measuring both AC and DC current flow • Mastech MS5908C circuit analyser
Other equipment	• Litmus paper, measures pH of liquids – valuable in osmosis detection • Environmental Thermo-hygrometer Trotec BT21 • Digital multimeter fitted with Ag/AgCl probe for galvanic current evaluation • Extech EC170 salinity gauge permit to tell fresh from salt or brackish water in bilges, when taste is not advisable

Table 1.2

1.3 Attending to the inspections

The following people have attended to the survey operations:

1) Yacht Surveyor Massimiliano Panessa, supervisor;
2) Yacht Surveyor Marco De Simone, undersigned;
3) Mr. Christoph Schmid as a prospective buyer;
4) Mr. Robert-Emanuel Leitenberger, owner, with three companions.

1.4 Definitions

Throughout the report the following terms could be used:

Term	Referred to the craft	Referred to components
EXCELLENT, VERY GOOD	The craft is new or like new, with relevant renewals and replacements of material	The component is new or like new
GOOD	The craft has been maintained in accordance with the rules of good owner; ordinary maintenance is to be considered.	The component has been maintained in accordance with the rules of good owner; ordinary maintenance is to be considered.
FAIR	The craft is presented in the worst conditions of what one should expect from a boat of her age, in addition to routine maintenance, more substantial work is needed.	The component is presented in the worst conditions of what one should expect from a boat of her age, in addition to routine maintenance, more substantial work is needed.

Term	Referred to the craft	Referred to components
POOR	The craft needs urgent and important works, both cosmetic and structural, is in precarious conditions and can not take the sea	The component needs urgent and important works, both cosmetic and structural, is in precarious conditions and can not take the sea. It is likely to be replaced
BAD, VERY BAD	The craft is devoid of any value; cannot be considered usable as a nautical device	The component is devoid of any value, and it is not usable
NEGATIVE FINDINGS	Referred to Thermal Imaging: absence of an exception or a thermal pattern that can be explained by artifacts from construction details or environmental conditions such as shadows and reflections. Referred to any other inspection: absence of an exception.	

Table 1.3

The surveyed craft could be graded with an evaluation according to surveyor's experience. Such evaluation is expressed in hundredths, and could be considered as follows (ref. Table 1.3):

- 96 to 100: Excellent
- 86 to 95: Good
- 71 to 85: Fair
- 51 to 70: Poor
- Up to 50: Very bad

In green the recommendation in order to keep the craft in good state of use

In red the works to be considered essential for safety purpose, and so that the craft complies to regulations in force.

Eventual suggestions should not be considered compulsory nor recommended, but are given to the customer in order to consider further improvements to the craft. Such suggestions are reported in blue.

1.5 Reference standards

RINA rules for pleasure craft construction (before CE-RCD)
EU – Recreational Craft Directive (relevant harmonised standards)
ISO 10824 – Infrared Thermography
Standard for Infrared Inspection of Recreational Yachts & Small Craft Constructed of Fiberglass Reinforced Plastic and Composite Materials – Infraspection Institute
IEC EN 60947 – Low voltage equipment
ABYC Standard E-2 – Cathodic Protection

Italian pleasure navigation code and relevant actuation rules

Table 1.4

1.6 Disclaimer

Only those items specifically discussed in this report were actually examined. Very limited access was available to the hull internal surfaces and the bilges. No fixed linings were removed.

During the haul out, the vessel was supported by metal cradle giving good access to the outer hull except for the bearing points.

I have not inspected woodwork, metalwork, GRP or other parts of the structure which are unexposed, covered, or inaccessible and are consequently unable to report that any such part of the structure, including the hull exterior where coating remains, is free from defect.

The report, therefore, implies no guarantee or safeguard against latent defects, subsequent defects or defects not discovered at the time of survey in such areas of the vessel which were not accessible to the surveyor, externally due to the presence of coatings, or internally due to the presence of such coatings or to the installation of linings, panels and internal structures which are not readily removable. This reservation also applies to reporting of structural condition in way of lockers which are not accessible or found to contain stores, equipment or other gear which prevent ready access.

No machinery was operated (except as stated) or opened up for inspection and nothing in this report should be taken or is implied to indicate the condition of internal mechanical or electrical components. It is recommended that an engineer's and/or electrician's report is obtained in respect of such items, if necessary, following operating trials.

No samples of the vessel’s insulation were removed and sent to a laboratory for testing. For those yachts that have been built before Asbestos was banned, it is strongly recommended to get the vessel insulation tested in order to confirm that no such material has been used.

The information contained in this report, concerning sizes, ratings, capacities, speeds, etc, was ascertained from maker's plates, logs, documents, plans and certificates on board together with statements of the Owner's representative.

None of the information was ascertained by measurement or calculation and, although all the information contained is believed to be correct, the accuracy thereof is in no way guaranteed.

Further, no determination of stability characteristics or inherent structural integrity has been made and no opinion is expressed with respect thereto.

This report carries no warranty regarding ownership or any warranty regarding outstanding mortgage, charge or other debt there may be on the vessel.

Whilst all due care and diligence has been exercised in the collection of data for, and of the preparation of this report, the surveyor purports to provide an advisory service only, based on the opinion and experience of the individual consultant responsible for its compilation. The surveyor issues such advice in good faith and without prejudice nor guarantee. Anyone wishing to rely on such opinion should first satisfy themselves as to its accuracy and feasibility. The surveyor shall not be liable for any loss (including indirect and consequential loss), damage, delay, loss of market, costs, expenses of whatsoever nature or kind and however sustained or occasioned.

This report has been prepared specifically for the addressed customer and is for his use only.

1.7 Copyrights

The present report is ownership of Yacht Surveyor Massimiliano Panessa. Copies in whole or in part should not be released to, or consulted by, other parties without the express prior written permission of the surveyor.

2. Craft description

2.1 Technical specifications

Name:	Britta		
Builder:	Hallberg-Rassy		
Model:	Hallberg-Rassy 42E (Enderlein)		
Year built:	1983		
Flag:	Austria		
Registration number:	K-05436		
Length:	12,93	m	
Beam:	3,78	m	
Draft:	2,05	m	
Displacement:	11,5	t	
Hull nr:	42-76		
Engine(s):	Volvo Penta D2-55		
Type and fuel:	Inboard diesel		
Power:	41kW	@3000	RPM
Serial number:	51039764108		

Table 2.1

2.2 Documents sighted

Document	Details	
Seebrief	Expiring 16/01/2027	☐Original ☒Copy ☐Not sighted
Certificate of Hull Construction	Lloyd's Register nr GOT366004, issued 01/06/1983	☐Original ☒Copy ☐Not sighted
Radio License		☐Original ☐Copy ☒Not sighted
Owner's handbook		☐Original ☐Copy ☒Not sighted

Table 2.2

2.3 Construction

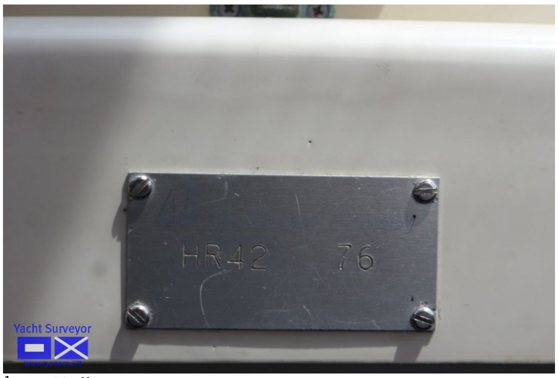
Hull	This single-skin glass reinforced plastic hull moulding incorporated a round chine, straight raked bow and a transom stern. Structures are wooden floors and foam stringers moulded to hull shell. A cast iron ballast keel was encapsulated in deep bilge moulding. Orthophthalic polyester resin is used for moulding. The precise layup of the mouldings was not ascertained. The unbalanced skeg hung rudder is fibreglass made as two clam shell mouldings over the bronze stock with welded tangs extending into the blade.
Deck	The deck is of composite construction, mainly sandwiched with PVC core, incorporating the cockpit, coach roof and side deck area, with teak layer on deck and cockpit.
Mast(s) and spars	Deck stepped, silver anodised aluminium in-furling masts, main with two spreaders and single spreader mizzen, masthead rigging; silver anodised aluminium booms and spinnaker poles. Conventional continuous rigging with double D1 – lower shrouds on both masts.
Engine	The vessel is powered by a Volvo Penta D255 naturally aspirated inboard diesel, 4 cylinder-in-line, displacement 2200cc, indirect injection, coupled to a Volvo Penta MS25A-A gear box, reduction ratio 2,23:1 forward and rear, serial number 20276917.

Table 2.3

2.4 Identification

The craft has been identified by her hull number engraved on a metal plate affixed to companionway beam; a Lloyd Register plate was riveted into the cockpit.

Engine serial number was located on engine; gearbox serial number was marked on a metal plate riveted to gear box top.



1. *Hull nr.*


3. *Engine S/N*

2. *Lloyd's Register Plate*

2.5 Survey conditions

Survey started at 09:20.

The conditions on the day were misty and overcast. Environmental data at 10:00 were as follows.

- Air Temperature: 28°C
- Hull Surface Temperature: 26°C
- Relative Humidity: 52%
- Wind: calm

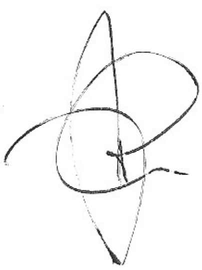
Condition were suitable for moisture test, not suitable for thermal imaging.

The vessel was then launched at 12:45 for sea trail and delivery to her berth. Survey ended at 15:30.

The vessel was inspected ashore, supported by a boat cradle with four posts, one iron stand forward and three keel wooden blocks. Prior to commencing the survey, the cradle was checked and found to be secure. Access was generally good except in way of the shores.

The masts were stepped in place with the standing and running rigging attached.

The sails were not laid out for inspection.



The engine, tanks, rudder, stern gear, and all normally installed equipment were in place. This restricted access to the internal surfaces of the hull and deck thereby preventing detailed examination in these areas.

The rudder and propeller shaft were inspected in situ and not un-shipped. Areas hidden from view cannot be commented upon.

The electrical system was examined visually without in depth or specialised testing and by switch testing only. The electronic equipment was tested, but not fully assessed.

The tanks and pipe work were examined visually only. No opening up was carried out and the tanks were not fill tested, pressure tested or tested for contamination.

Seacocks were not removed and no hose testing except heave test was carried out.

The following was covered within the scope of this survey and any areas or items not specifically mentioned were not examined. Any equipment tests are superficial and restricted to the limitations of the general survey on the day. The vessel and her equipment have not been checked for faulty elements of design or compliance with any rules or statutory regulations.

3. Survey findings

3.1 Underwater body and appendages

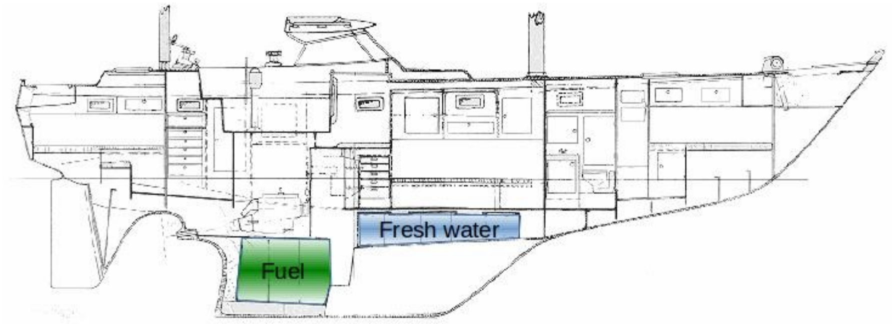
a) Antifouling	The vessel has been presented with a new red antifouling coating that presents itself in good condition, well adhering and not flaking;.
b) Visual inspection	The hull below waterline was sighted from a distance along the port and starboard sides of the canoe body and seen to be fair. There were undue distortions in way of forward cradle stands which pushed the hull inward slightly deflecting the hull surface; this may have induced some of the cracks to floorboard frame, detailed elsewhere, but no permanent damage noted to hull shell or framing; no indications of repair or areas of concern visible. I inspected the entire hull without finding any osmotic blistering except for a single small osmotic blister on the rudder, to be treated locally, removing interested layers and replace with new epoxy filler. The boat received an anti osmotic blister treatment in the past. RECOMMENDED: Treat the osmotic blister on the rudder
c) Tap test	I carefully sounded the hull with a wooden hammer and a spike at closely spaced intervals to test the external surface of the laminate for voids, degradation and areas of inconsistency. I noted that all soundings were consistent throughout the hull below waterline area except for a little area on half aft on port side where was noted a different sound frequency that do not shows any indication internally, but was rather related to a building characteristic. From what could be ascertained, the external surface of the hull moulding was in satisfactory structural condition.
d) Moisture test	Performed all over the hull, reported readings almost everywhere below instrument warning. Highest readings were found on the skeg and on the rudder. From such readings the hull can be considered dry. At the dedicated paragraph at the end of the report are visible the gathered data.
e) Keel-hull join	The cast iron ballast was encapsulated within the hull moulding and no join is visible either from outside and inside the hull; no indication of ballast defects noted at a visual inspection.

f) Keel

The external cast iron ballast moulding was in serviceable condition, showing slight visible indication of damage caused by grounding with no visible cracks but for a small one on fore port side with water leaking. The area must be restored to avoid further water infiltration.

The aft part of keel moulding hosts the fuel tanks as showed in the diagram below. The draining plug present in this kind of boat on the lower part of the keel was closed by a fibreglass layer

Fresh water tanks are located above ballast, also showed in the diagram.



RECOMMENDED: Locally fix the crack on forward lower corner of keel moulding.

g) Rudder

The rudder and steering mechanism were visually inspected, hammer sounded and moisture readings taken. There were a few cracks on the rudder in way of bronze fittings and a vertical one along the junction between rudder shells.

Where steel rudder stock goes through the rudder a delamination area was detected; to avoid further infiltration into the rudder this should be restored removing the area and replace it with new fibreglass.

The rudder was physically tested to port and starboard under the weight of the surveyor and showed a slight play, still acceptable.

The stainless steel rudder stock result in good condition with no indication of damage.

Steering wires were visually inspected where accessible and found to be secure with no slack nor signs of significant wear noted to the cables.

The rudder stock pass through the hull by a bronze rudder tube with greaser in fair condition, showing oxidation. The stock is accessed from aft cabin. The emergency tiller is under starboard locker. The emergency steering was not be tested in service but appeared to be in good functional order. The wind vane secured to the transom could be used as an emergency steering system.

Rudder stock fastenings to the quadrant were visually inspected and hammer sounded and found to be secure. Over deflection of the rudder was prevented by substantial rubber stops, which were bolted to the hull to the port and starboard side of the quadrant. Rust and an indication of previous leakage noticed from bolts to starboard quadrant stop, to be monitored. During sea trial no effective water leaked from that stop, but it could take time to start so it is recommended to check and fix the stop.

The auto pilot was driven by an electric actuator and a pair of dedicated cables acting on a separated quadrant above the main one; it was noted to be in good working order although not tested at sea.

RECOMMENDED: Repair the delamination and the vertical crack on the junction of rudder shells.

Replace the sealant of the starboard rudder stop bolts.

h) **Propeller shaft**

The stainless steel shaft is in serviceable condition where visible, showing no corrosion, though corrosion is likely to occur within the stern tube and bearing and could not be assessed without unshipping the shaft.

The shaft tube is moulded in keel casing and not supported by bracket. Watertightness is provided by a Volvo Penta shaft seal, in good condition.

i) **Cutlass bearing**

The ∅30mm shaft runs through a rubber cutlass bearing, with a clearance of 0,35mm, as gathered by the table aside the clearance is well within tolerance, thus in good condition.

TABELLA 'Z' - *Table 'Z'*

RIFERIMENTO SOSTITUZIONE BOCCOLA *Reference Substitution Bearing*

TOLLERANZA CLEARENCE *Clearence Tollerance*		SOSTITUZIONE *Replaced*
mm	A mm	mm
20-25	+0.1 +0.25	+0.55
30-40	+0.1 +0.3	+0.75
45-80	+0.15 +0.4	+1.2
85-105	+0.2 +0.45	+1.9
110-125	+0.25 +0.5	+2.5
130-165	+0.3 +0.6	+3
170-205	+0.35 +0.7	+3.8

j) **Propeller**

There was a three bladed fixed bronze propeller. This was visually inspected and hammer tested and found to ring true. The blades were partly covered in antifouling, and no indication of corrosion or cavitation noted.

k) **Cathodic protection**

Affixed to the propeller there was a hub type zinc anode which is eroded.

RECOMMENDED: Replace propeller anode

a) **Bow-thruster**

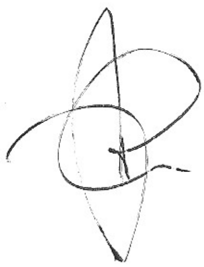
An electric bow-thruster was securely fitted inside the glass fibre tunnel at the bow. The single propeller was secured to the bow-thruster drive and found to be in satisfactory order. The internal connection of the bow-thruster tunnel was tested with a surveyor's hammer and found to be secure to the hull moulding. Entrances of bow-thruster tunnel are shielded by two steel bars secured to hull moulding.

The bow-thruster motor could be operated by a pair of foot switches fitted adjacent to the helm position. This was tested at sea and found to be operational. The bow-thruster motor was seen to be in satisfactory external order with slight powder deposit, likely coming from the motor brushes.

l) **Skin fittings and seacocks**

No skin fittings or valves were dismantled as part of this survey but the following routine tests were carried out:

- Examination from outside and inside the boat.



- All thru-hull fittings scraped back to examine their colour for visual dezincification (where zinc has leached out leaving a weak copper structure).
- All valves open and closed to their full extent where possible.
- Fittings aggressively tested inside the boat for security in the hull.
- Hose clips inspected and hoses aggressively tested for security.
- All hoses and inboard fittings checked for condition and security where accessible.

Whilst these checks have been carried out, it is not possible to guarantee complete water tightness to these items and upon launching they should be checked for any seepage in accordance with good boatyard practice.

(1) Forward Heads inlet: A metal thru-hull fitting ball valve showing slight corrosion, to be replaced after the next season, a second stainless hoseclips must be added

(2) Galley sink outlet: A thru-hull fitting with composite ball valve in good condition.

(3) Cockpit drain: A metal thru-hull fitting ball valve in good condition.

(4) Bilge pump outlet: A thru-hull fitting with composite ball valve made by Truedesign in good condition.

(5) Black Water outlet: A thru-hull fitting with composite ball valve made by Truedesign in good condition.

(6) Aft Heads Basin outlet: A metal thru-hull fitting ball valve in fair condition with slight oxidation.

(7) Deck Drain: A thru-hull fitting with composite ball valve made by Truedesign in good condition.

(8) Forward Heads Basin outlet: A metal thru-hull fitting ball valve in poor condition showing oxidation and dezincification, to be replaced after next season.

(9) Black Water outlet: A thru-hull fitting with composite ball valve made by Truedesign in good condition.

(10) Cockpit drain: A metal thru-hull fitting with gate valve in good condition

(11) Engine cooling intake: A thru-hull fitting with composite ball valve made by Truedesign in good condition.

(12) Aft Heads inlet: A metal thru-hull fitting ball valve in good condition, a second stainless hose clips must be added.

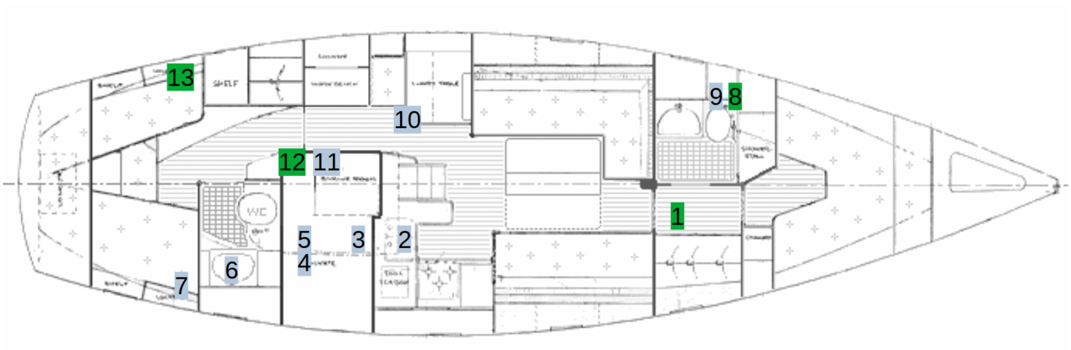
(13) Deck drain: A metal thru-hull fitting with gate valve in fair condition, blocked, to be serviced.

The skin fittings/valves/tailpipes on this vessel are yellow metal or composite. Their condition should be monitored and valves operated frequently. If any deterioration, corrosion or leakage is noted the fitting should be replaced.

According to EN ISO 9093-1 standard, metal hull fittings should be corrosion resistant as per following definition:

“**CORROSION-RESISTANT**: Material used for a fitting which, within a service time of five years, does not display any defect that will impair tightness, strength or function.”

This way the five-year time bar should be taken as recommended replacement interval.



1. *Diagram 3.1.a – Skin fittings identification*

RECOMMENDED: Replace the forward heads inlet and washbasin drain seacocks at the end of next season.

Add a second hose clip to the Aft heads inlet seacock.

Service the deck drain seacock (number 13).

Replace metal thru-hull fittings at a five year interval.

3.2 Topsides, deck and superstructure

a. Topsides

The topsides are constructed of single skin GRP laminate with white coloured gel coat finish. There is a painted blue boot top stripe. It is slightly damaged in a few places. There is a single cove line stripe in blue paint along porthole lines, in fair condition and locally damaged.

The hull is fair without any distinct distortion visible from the bonded in internal structures such as the chain plate ring frame.

Five opening portholes are fitted to each topside, and with acrylic panes. Portholes aluminium frames appears in good condition although slightly crazed.

On the transom a stainless steel bathing ladder was permanently fitted to the hull, working correctly under surveyor's weight. Also a Windpilot Pacific Plus wind vane was secured to transom, in apparent good condition but not tested at sea.

Several holes were still present on the transom where a previous equipment was fastened, to be closed.

RECOMMENDED: Close the open holes on the transom.

b. Hull to deck joint

The hull to deck seam is achieved by the hull moulding having a moulded inward facing flange at the bulwarks. The deck moulding is then landed onto this flange with sealant and through fastened by the screws which secure the toe rail in place. The external joint is covered by the teak toe rail, and the bulwark is filled with micro-balloons added resin. This joint is thus not visible. The joint is then laminated over internally, where accessible, examination did not reveal any signs of movement or leakage in the seam where it was visible.

c. Deck

The deck is constructed from solid and PVC cored GRP laminates. The deck laminate was not moisture tested by the teak presence.

At the bows there is an anchor locker which has a hinging GRP lid. The anchor locker drains through two skin fittings on both topsides. On aft deck there is a shallow locker with also a GRP lid. All was found in serviceable condition.

d. Teak decking

Teak laid decking is screwed to deck in way of side decks, aft and fore deck coachroof top; it has suffered normal wear and tear and result consumed till screw level in many areas of the teak. The caulking was diffusely decayed, locally detached from the seam groove and to be restored. Notwithstanding it is reportedly the vessel's age it is not yet end of life, and still could last a few years before replacement.

RECOMMENDED: Schedule to replace the teak on next future.

Restore the teak deck caulking.

e. Cockpit

The centre cockpit was of moulded GRP and integral with the decks and cabin moulding. The cockpit gave way to the main accommodation companionway.

Cockpit teak seating was in matching condition to deck teak.

The cockpit sole was found to be firm under the weight of the surveyor. It was teak laid as well, with decking in serviceable condition.

There was a sign of crazing to port forward probably due to a fallen tool, a cosmetic issue.

The light alloy wheel pedestal was bolted to the cockpit mould with stainless steal grab rails built around which were found securely affixed. The pedestal showed slight peeling, though no structural faults.

There was a single locker within the starboard cockpit seating. Such locker is deep and provides for general stowage

An aluminium framed dodger with an ecru acrylic spray hood was securely fitted in front of the cockpit. The dodger windowing was found in good condition. The spray hood canvas and external stitching was found to be in satisfactory order where tested at random.

f. Chainplates

Mast shrouds are pinned to through deck chainplates which are welded to stainless steel straps bolted through integral hull frames. These appear well seated and the anchor points in the hull are well constructed and free of movement. There was evidence of leakage through the deck plates to the accommodation from all chainplates, and the sealant should be restored. Moisture readings on the frames in way of chainplates were satisfactory.

Forestay chainplate is a thick stainless steel strap fastened through the stem. This is well secured by seven through bolts and free of evident movement externally. Inspection internally via the chain locker found the fixings to be secure with backing washers and nuts securely in place. Two innerstay chainplates were secured to internal structure and in good standing, with no leaks noted.

The backstay was attached through stainless steel plates which were securely fastened with four through bolts and free of evident movement externally.

RECOMMENDED: Seal all shrouds chainplates.

g. Hatches & Companion-ways

The companionway is closed by a sliding hatch and a washboard. The hatch is in moulded fibreglass with a bonded teak hardwood flange at the after edge as a hand rail. This is in good condition. Washboards are acrylic as well and sound and in good condition.

There were four aluminium framed hatches; all are hinged on the forward edge. This is ideal as it prevents a breaking wave from flooding the accommodation if the hatch is not fully closed. There is also a possibility of the hatch being carried away in a storm.

The forwardmost was on fore deck; this forward hatch provides light to the fore cabin; the acrylic is in good condition. The hatch should be kept closed at sea.

Before the main mast on top of the coachroof there are two rectangular hatches, in good condition with no signs of leakage.

Aft cabin hatch was in good condition, with no leak mark underneath albeit the dinghy stored above could have prevented the leaks.

Prism skylights are fitted on the deck to give more light below decks.

h. Deck gear and fittings

A pair of aluminium T bar sheet tracks is mounted on the side deck. Each carries one stand up sheet block with a nylon sheave for sheeting the genoa and the staysail. These blocks slide on cars and are limited in their movement by stop pins. The cars slide well and are in good functional condition.

A pair of cast alloy mooring cleats is mounted on the bulwark either side at the bows, the starboard side one showing decay of anodisation. There is a second pair on the aft quarters. All are well secured and in good condition. A third pair is placed amidships, though on deck instead of bulwark. No fairleads are present, and stainless steel rubbing strakes have been affixed to the teak toe rail in way of central cleats. All the cast alloy deck fittings are anodised.

i. **Guard and Grab Rails**

The vessel is equipped with a tubular stainless steel pulpit and twin pushpits 25mm in diameter and 60cm high. Tensioned between is 1×19 coated upper and lower stainless steel guardwires with roll swaged end fittings and rigging screws for tensioning. The guardwires are interrupted by a boarding gate on port and starboard quarter. Pulpit and pushpits are in good condition and well secured into the deck.

The guardwires are in bad condition with widespread corrosion and distortion in correspondence to the stanchions. The plastic coating can accelerate anaerobic corrosion in stainless steel and it is recommended to routinely replace guardwires after 10 years. The wires are fully tensioned.

There are five stainless steel stanchions ∅25mm each side socketed into stanchion bases embedded into the bulwarks. There is some movement between the stanchions and the bases abut they are well seated and secure. The second stanchion on port side and the fourth – starting from bow – on starboard side are bent inward, and the other are reasonably straight.

On the coachroof windscreen there is a pair of aluminium handrails. These are sound and in good secure condition.

RECOMMENDED: Replace all guardwires

j. **Winches**

Four Lewmar winches were located on the cockpit coaming, two 55ST for genoa/staysail sheets and two 40 for mainsheet and traveller, and three 40 on mast for halyards. All were in serviceable condition.

k. **Anchor**

Bow anchor: CQR 75lbs (~34kg) was secured to a 10mm galvanised chain via a stainless steel swivel. The anchor has been recently cold-galvanised.

A second Danforth type anchor, weight not obviously marked, was placed on a transom roller, in apparent good condition.

l. **Windlass**

Lofrans' horizontal windlass with gipsy and drum, securely fitted on deck above the anchor locker, in fair condition, tested and working by foot switches.

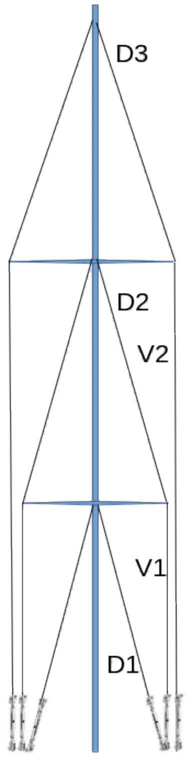
3.3 Mast(s) and rigging

a) **Mast**

The mast is silver anodised masthead rigged spar manufactured by Seldén. The spreaders are straight and the rig is conventional with continuous cap and intermediate shrouds pinned to common chainplates and double lowers. There is a forestay, two inner stays – the foremost one removable, and backstay with hydraulic tensioner on main mast,

The spar is in good condition with the anodising slightly pitted over its length. The mast is deck stepped. Sighting up the masts they were seen to be in column, and well tensioned. There is slightly corrosion at the foot and around riveted stainless steel mast fittings where it might be expected, it is recommended to replace the rivets and monitor the mast foot for corrosion increasing, Climbing steps are riveted all along mast.

> RECOMMENDED: Replace the rivets on the mast.
>
> Monitor the mast foot corrosion.



b) **Mast step**

Fixed cast aluminium, bolted to deck. Where inspection was possible the mast was noted firmly attached to the shoe with no signs of movement, not corrosion noted.

c) **Shrouds**

The lower and cap shrouds are in 1×19 ∅10mm stainless wire and intermediates are in 1×19 ∅8mm stainless wire. All the shrouds at deck level have fork ended open bodied stainless steel rigging screws. All were seen to be in good physical condition and all are seized with split pins. The main mast upper fittings are eye swaged terminations pinned to plate bolted to the mast. There is no evidence of standing rigging replacement. Roll swaged terminals were examined at deck level for signs of broken strands, evidence of corrosion and signs that the wire is drawing out of the swage, and slight corrosion evidence noted to the terminations and along the strands.

Being the rigging still in apparent serviceable condition, its age goes beyond the safe limit of fifteen years for a light Mediterranean summer cruising – or even less in case of more demanding sailing – and thus should be replaced.

> REQUIRED: Replace standing rigging.

d) **Backstay(s)**

The single main backstay is 1×19 10mm stainless wire rope; it is intended to be used as an SSB aerial, thus isolated through ceramic isolators to which the wire is Talurit spliced; the wire is corroded and deformed in way of splices. Tensioner is in serviceable condition.

Running backstays fitted to the mast are to be used in combination with staysail; they are in 1×19 ∅6mm stainless steel wire, swage termination cracked, to be replaced along with the remainder of standing rigging.

REQUIRED: Replace backstay.

e) **Forestays**

Main forestay was not visible, as totally encapsulated inside genoa furler; Fixed and running inner stays were in reasonable condition.

Considering the age of the forestays, those must be replaced as the remainder of the rigging.

REQUIRED: Replace forestays.

f) **Spreaders**

The spreaders are mounted on cast alloy roots which are braced to the mast. These were well seated and secure when vigorously swigged.

g) **Boom & gooseneck**

The silver anodised aluminium boom was securely fitted to the gooseneck. Along the boom there were no visible distortions, however it appear spread of superficial pitting. Corrosion noted in way of riveted fittings; in general, the boom was found to be in serviceable condition.

An inspection of the gooseneck revealed that there was no wear between the boom fitting and mast connection bracket. The black anodised end fittings of the boom were found to be secure and in good order where visible. The sheaves were found to be free running. The boom was supported by an alloy vang showing a deep pitting mark, to be monitored before replacement. The stainless steel fittings on the underside of the boom were seen to be secure; however, slight indications of galvanic action was visible in way of the connections.

RECOMMENDED: Replace the rivets on the boom.

Foresee vang replacement.

h) **Running rigging**

Mainsheet is working through a purchase with blocks, traveller and sheet in serviceable condition.

All of the running rigging is in double braid polyester; they were not inspected along their full length. Genoa sheets are in fair condition.

a) **Downwind sails rigging**

There is an aluminium telescopic spinnaker pole placed at its mast fitting. The pole was in apparent serviceable condition with a detached cap for the outer section, but not fully tested and assessed.

i) **Mast fittings**

The main mast has an aluminium T track on the forward face for a spinnaker pole with car fitted and endless hauling line; upwards, between first and second spreader, there are a 225° steaming light and a deck light, all in serviceable condition.

Mast has got riveted climbing steps.

j) **Masthead equipment**

Masthead was seen from a distance, main supports three VHF aerials, an anemometer and the Windex, a 360° anchor light and a tricolour light which were all seen to be secure from deck level. Lights were not tested.

k) **Electrical connections**

The electrical wiring coming out from the mast go down below by stainless steel gooseneck thru-deck fitting; wiring are in fair condition, and the gooseneck is sound and well secured to the deck.

3.4 Sails

a) **Main**

The mainsail is flaked onto the boom with lazy jacks. The sail was seen to be a faded and softened white Dacron fabric in fair condition, with a few stitching to be serviced and slightly dirty. It is a cross cut sail full battened and is made with three slab reefs and hoisted on sliders.

The blue mainsail cover was noted to be ripped in places and in general fair condition.

RECOMMENDED: Service the mainsail.

Repair the mainsail cover.

b) **Genoa**

The genoa is a tri-radial sail in a Dacron cloth by Segelwerkstatt Stade Sails with a white UV sacrificial strip. The sail was seen to be a new looking, slightly dirty and crisp white fabric.

c) **Furler**

The furling equipment was tested as far as practical and found generally in good working order. The drum was examined and no defects were seen in either the bearings or in the rigging screw attachment.

The aluminium alloy luff extrusion appeared to be straight and with no kinks.

d) **Other sails**

A staysail was packed in its bag and shackled to the removable inner stay. The sail was not opened on board and it looked in fair condition.

3.5 Engine, engine room and fuel system

a) Engine

The engine has been recently replaced and found in good condition.

There was no evidence of engine overheating. The paint coating was in very good condition, but with some minor corrosion and peeling.

The exhaust elbow was inspected and found to be in good condition; the muffler was made as two stainless steel caps connected together by a rubber hose, and leaks noted on both caps, the upper one positively coming form a corroded weld, the lower one – more abundant – not clearly identified.

The engine oil was at the correct level, free of water ingress.

The Volvo Penta reduction drive gearbox was a model MS25A-A, serial number 20276917. The gearbox oil was inspected and found to be clean, free of moisture and at the correct level.

RECOMMENDED: Fix the leaks on the muffler.

b) Leaks

No leaks from the engine cooling water, oil, fuel and exhaust systems were evident, except for the above mentioned exhaust muffler corrosion issue.

c) Engine mounts

The engine was secured to longitudinal glass fibre engine bearers which were seen to be sound. The Volvo Penta resilient mounts were inspected, found to be secure. The mounts were in reasonable order with no apparent defects.

d) Instrument panel

Engine control was via a single lever, giving forward and reverse gears and throttle control, mounted next to the helm on the starboard side of the helm binnacle.

In cockpit there is the engine instrument panel which included the rev meter, start/stop push-buttons and coolant temperature gauge, correctly working.

e) Hour meter

Inside rev meter there was a digital hour meter showing 170,5h.

f) Tanks

There was one structural fuel tank of a reported capacity of 395ℓ in the keel moulding. The visible parts of the fuel tank were generally free of damage. Hoses to the engine, were of suitably marked black rubber.

An additional ~100ℓ stainless steel tank was located under port saloon settee; visible areas of the tank was in good condition. Fuel hoses to this tank were on unsuitable clear plastic type, to be replaced with fuel grade hoses.

No level gauge noted.

REQUIRED: Replace additional tank fuel hoses.

g) Insulation

The insulation material in the engine compartment was of grey acoustic foam covered by aluminium film. This was seen to be in fair condition.

h) Fire fighting system

There is the provision for a fixed fire fighting system in the engine room, with a loose actuating cable connected to a handle fitted to the binnacle; however a dedicated fire extinguisher was not present, and should be replaced; alternatively, a fire port could be cut out and clearly marked to the outside of engine room.

REQUIRED: Replace the fixed fire extinguisher in engine room, or create a fire port.

3.6 Electrical system

3.6.i. *DC System*

a) Voltage: 12V

b) Main switchboard: A main aluminium panel is fitted on port side, aft of the chart table, with thermomagnetic switches and lights, working when tested.

c) Secondary switchboards: Not fitted

d) Batteries:

- Domestic: six flooded batteries with capacity 70Ah/640CCA of in good condition located beneath the aft cabin bed. Engaged via a quarter-turn switch, located in a locker beneath companionway ladder.
- Cranking: two 72Ah/660CCA flooded batteries, in good condition, under starboard cabin bunk. Engaged via a quarter-turn switch, located as above.

All batteries are reported as new.

e) Battery conductance test: Conductance test was done on all service batteries, the two cranking batteries were not tested because of superficial charge presence.

	Voltage	State of Health (residual CCA)	Internal resistance	Comments
Service 1	12,72V	100%	2,84mΩ	Good
Service 2	12,73V	100%	3,38mΩ	Good
Service 3	12,79V	100%	1,79mΩ	Good
Service 4	12,71V	100%	2,73mΩ	Good
Service 5	12,71V	100%	1,71mΩ	Good
Service 6	12,72V	100%	2,63mΩ	Good

f) Battery charging: Batteries are charged by the engine alternator through a Mastervolt 1203MT charge separator; a by-pass was unduly connected to charge separator outputs. When shore power is connected, a 12V/30A Victron Energy, switch mode 3-output battery charger would recharge the batteries.

Three solar panels were located on the deck, wired to a solar charge regulator, were found to be functional; so as there was a single output form the regulator I would assume that only domestic batteries are currently charged by this system.

3.6.ii. *AC System*

a) Voltage: 220V, supplied via a shore power 16A cord and plug, in good condition; a

Waeco 500W inverter was fitted to the system.

a) Residual current circuit breaker	Not fitted. RECOMMENDED: Fit a residual circuit breaker on AC circuit.
b) Main switchboard	Not present. A general main switch is located in a locker behind the DC panel.

3.7 Plumbing system

a) Tank	There is one structural fresh water tank with a reported capacity of 725ℓ on board the vessel. This is located in the central bilge right above the ballast; it could inspected externally without noticing any crack or leak.
b) Pressure pump	Pressurised water is supplied from the tank to a distribution manifold by an electric pressure pump situated in engine room. All powered up and worked satisfactorily delivering cold and hot water to faucets in the heads and galley.
c) Water heater	Isotemp 20 litre hot water calorifier. The calorifier is located in the engine room and a heating coil receives heating water from the engines closed cooling system. There is also a 220VAC/750W immersion heater element. From the calorifier, pressurised hot water is then fed in a distribution manifold. The heater appeared in good standing, tested in heat exchanger mode and found to work.
d) Toilets	The sea toilets are installed in the head compartments on the port side forward and starboard side aft. Forward toilet was an electric system with ceramic bowl and plastic seat and lid. Forward toilet electric pump was tested at sea and found to work. Aft toilet was a Blakes two-handle manual pump toilet with ceramic bowl and plastic seat lid in good standing. Also tested and well working.
e) Washbasins and sinks	The heads were fitted with a moulded gel coat finished washbasin, with hot & cold mixer tap/shower head. The galley sink is stainless steel with also a hot & cold mixer tap, and a dedicated tap fed by a pedal pump located under the sink. All above was founded to be in serviceable condition.
f) Waste water system	Aft toilets drain at sea without holding tank; forward toilet may drain into a dedicated stainless steel black water tank located in the heads compartment locker or at sea, by means of two valves right behind the toilet. Holding tank drains at sea by gravity.
g) Grey water system	Not fitted, washbasins and sink drained at sea by gravity; forward shower tray drains into the bilge.
h) Bilge pumping	The bilge pumps were not fully tested as this would have required a large volume of water to be placed in the bilge. However the electric pump were switched on and found to be in working order. A manual diaphragm bilge pump was located in the side of the cockpit seating, starboard of the helm wheel. The inlet to the manual bilge pump was located in the bilge forward of the engine. An electric submerged bilge pump was also installed on board, located in the bilge sump amidships. The pump was controlled by a floating switch located in the same sump, or manually operated by a switch on the DC electrical panel. The pump powered up when the switch was set to manual. I could not reach the floating switch to manually lift it. A second bilge pump switch is located behind the companionway, but the

second bilge pump was not found.

3.8 Galley gas system

a) Stove	The cooker is a stainless steel three burner cooker with oven. There is a flame failure device on all the burners. The cooker was not tested. Testing gas systems should only be carried out by a certified engineer using certified equipment, and is beyond the scope of this survey.
b) Gas cylinder	A gas cylinder of not specified capacity is located into the anchor locker and drains through the chain locker drain. A spare cylinders was found in the same locker.
c) Piping	Copper gas piping runs from the locker to the galley and was not fully inspected along its length. There is a shut off valve behind the cooker, and the cooker is supplied from a bulkhead fitting via a flexible hose, expired. The flexible hose from the regulator is expired as well.
	REQUIRED: Replace internal and external gas flexible hoses.

3.9 Interiors

3.9.i. *Structures*

a. Bilges

Bilges could be inspected by removing saloon and aft and fore cabin floorboards; they were fairly clean, with no evidence of engine oil spillage or flooding. The internal off-white coloured hull gel coat application was generally in good condition.

b. Frames

Hull structure is made in the traditional way of wooden floors laminated to the hull and longitudinal stringers, likely PVC foam cored.

The exposed surfaces of the floors and stringers were finished in off-white gel-coat. The visible gel-coat surfaces of the internal moulding were in good cosmetic condition. Where accessible, framing was inspected and no evidence of cracking or other damage was noted.

c. Bulkheads

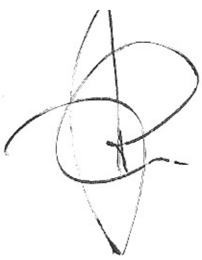
Where accessible, the teak-faced plywood bulkheads were inspected and found to be in good condition with no evidence of moisture ingress, wood rot or delamination.

The bulkheads, semi-bulkheads and locker frames were secured to the hull & deck by GRP cloth tabbing. The integrity of the tabbing was inspected and found to show de-bonding and cracks on the furniture and floorboard framing, with a major crack on a floorboard beam in saloon starboard forward side.

RECOMMENDED: Repair broken and disbonded tabbed floorboard structure.

3.9.ii. *Accommodation*

The main companionway give access to the saloon, with galley on starboard side and chart table and navigation station on port side. Ahead an L-shaped settee with a square opening table is placed to port and a straight couch to starboard; a lifting bunk is placed above each settee. From the saloon a passageway leads to the fore cabin and head and shower compartment. Going aft from the chart table the master stateroom with en-suite heads is accessed. Engine room is accessed through a hatch in the passageway from chart table.



a. Woodwork

The fit out is executed in teak veneered plywoods and solid wood mouldings. The joinery is well executed with solid hardwood framing and edge banding to the cupboard doors with no unfinished edges shown. The interior woodwork was found to be in good condition and free of splits or damage.

The companionway steps are wooden steps mounted onto a substantial wooden locker. The steps are firm and secure.

b. Upholstery

All the saloon and cabin upholstery is plain foam filled cushions of blue Alcantara fabric. This is a good quality material and is diffusely worn and locally repaired. The headlinings are in off white vinyl covered plywood panels in good condition with no signs of sagging normally associated with this form of headlining.

c. Sole boards

The sole boards are in teak veneered plywood. These are well secured by being a good close fit although not all actually fastened down. They were seen to have suffered below wear and tear and well maintained.

3.10 Equipment

3.10.i. *Navigation and communication*

On deck

1. A Sestrel magnetic compass that was supposed to be mounted to the binnacle was reported to be under service;
2. Cetrek Autopilot; nobody was able to make it works, to be checked;
3. Standard Horizon Matrix GW2000 VHF DSC, sighted stowed below decks and not tested;
4. Echo/Log Sea DataNX, working.

Below decks

5. Navtex Nasa Marine; switched on, but did not receive any message while in use.
6. GPS VDO map 7 wi, not tested.
7. GPS Garmin GPS128, working.
8. Simrad Radar, working, but not fully assessed.
9. Sailor RE2100 HF-SSB receiver, not working;
10. Sailor R109 MF-SSB radio transceiver, not working;
11. A brass set of Royal mariner clock and barometer in good cosmetic condition and apparently working.
12. A thermometer located close to the chart table.

RECOMMENDED: Put the compass in place once serviced.

Check the autopilot.

3.10.ii. *Safety*

1. The following fire extinguishers were found on board:

Type and weight	Location	Pressure gauge
5kg ABC-powder	Saloon table	To be serviced
2kg CO_2	Chart table	To be serviced

2. A self-inflatable liferaft is located on coachroof top, to be serviced.
3. There are three CE marked 100N life jackets stored in fore cabin.
4. Safety ladder.

REQUIRED: Service the fire extinguishers.

Service life raft.

3.10.iii. *Other equipment*

1. Rigid dinghy stored on aft deck, not launched.
2. Inflatable Bombard dinghy, sighted deflated and not assessed.
3. Frigoboat fridge in galley; it only works under engine operation and could not be tested.
4. Wooden gangway.
5. Eberspächer D4L heating system, not tested.

4. Sea trial

Weather	Wind:	E2
	Sea state:	calm
	Swell:	Absent
People on board:	7	
Fluid loads:	Unknown	
Max engine speed:	3100rpm	
Max boat speed:	7,3knots	
Observations	Sea trail was conducted in Aussa-Corno river, outside the marina. Engine cold started immediately, with no smoke. Engine ran smoothly, without any evidence of bad working. No relevant vibration were detected. The achieved engine speed was 100 rpm higher then the rated engine speed, likely because an undersized propeller pitch. For what I may ascertain through this sea trial nothing should be carried out.	

5. Found and recommended

This is intended as a check list. Full details must be read and can be found in the body of the report.

5.1 Required

1. Replace standing rigging.
2. Replace backstays.
3. Replace forestay.
4. Replace additional tank fuel hoses.
5. Replace the fixed fire extinguisher in engine room, or create a fire port.
6. Replace internal and external gas flexible hoses.
7. Service the fire extinguishers.
8. Service life raft.

5.2 Recommended

1. Treat the osmotic blister on the rudder
2. Locally fix the crack on forward lower corner of keel moulding.
3. Repair the delamination and the vertical crack on the junction of rudder shells.
4. Replace the sealant of the starboard rudder stop bolts.
5. Replace propeller anode
6. Replace the forward heads inlet and washbasin drain seacocks at the end of next season.
7. Add a second hose clip to the Aft heads inlet seacock
8. Service the deck drain seacock (number 13).
9. Replace metal thru-hull fittings at a five year interval.
10. Close the open holes on the transom.
11. Schedule to replace the teak on next future.
12. Restore the teak deck caulking.
13. Seal all shrouds chainplates.
14. Replace all guardwires.
15. Replace the rivets on the mast.

16. Monitor the mast foot corrosion.
17. Replace the rivets on the boom.
18. Foresee vang replacement.
19. Service the mainsail.
20. Repair the mainsail cover.
21. Fix the leaks on the muffler.
22. Repair broken and disbonded tabbed floorboard structure.

5.3 Suggestions

1. None

6. Conclusion

The craft is a strongly built, good quality piece of craftsmanship; as per her age she suffer the normal wear and tear, but still in pretty good shape. However, the rudder is to be addressed, the standing rigging to be replaced and the teak deck should be replaced in the foreseeable future, and those are the most expensive problem to solve, but, the presence of a new engine is a relevant thing to value. There are also other minor problems to address, therefore, before to proceed with the purchase an amount of the remainder should be taken into account.

At present, and in the condition in which she lays, according to my experience, inspected vessel can be assigned the following technical (See definitions at §1.4)

Assessment: 87/100

The present report is composed by 51 numbered pages. The surveyors took 764 pictures on 21/06/2022.

Cavriago, 27/06/22

Faithfully submitted

Marco De Simone

Small craft surveyor, IIMSstudent

The supervisor

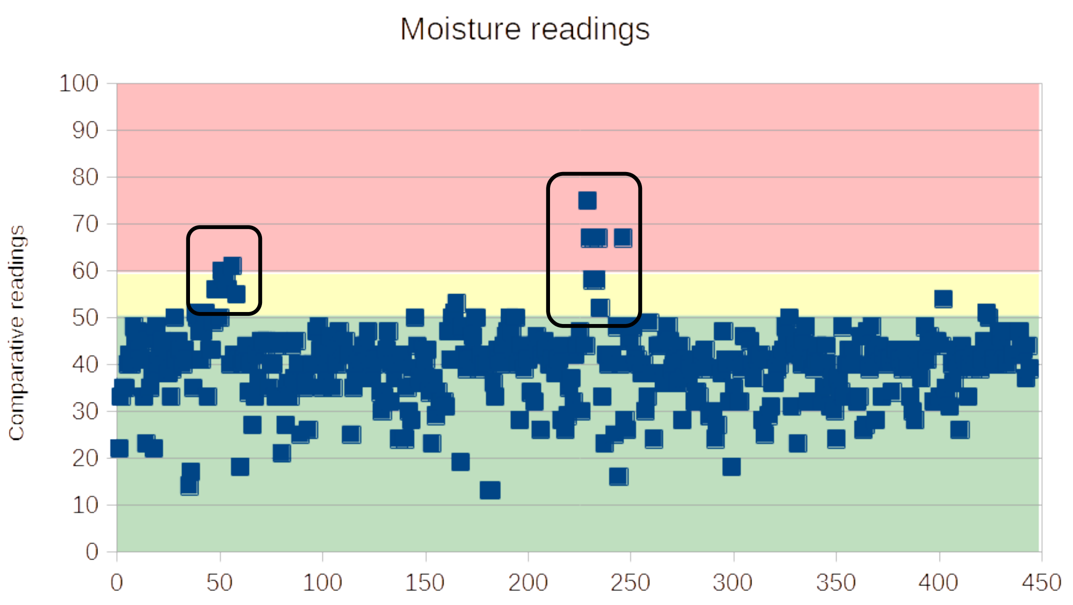
Massimiliano Panessa

Yacht and small craft Surveyor, AssocIIMS, YDSA Affiliate, ABYC Member

MASSIMILIANO PANESSA
N. 425
RUOLO PERITI
LA SPEZIA
Perito Nautico

7. Moisture test

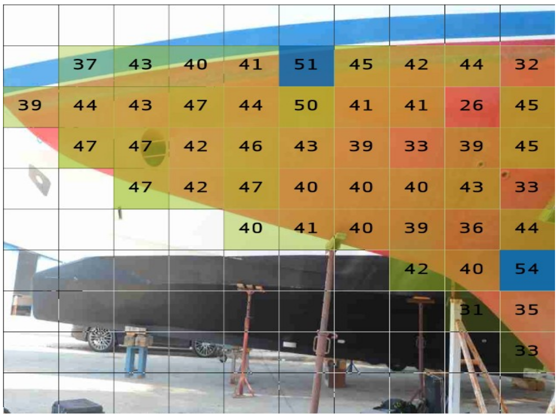
Hallberg-Rassy 42E, BRITTA – Moisture test		
Instrument used: Tramex Skipper 5 Reference scale: 0-100% Warning threshold: 50%		Probe type: Capacitance Instrument acoustic alarm threshold: 50% Alarm threshold: 60%
Environmental data gathered at 10:00 of 21/06/2022: Relative humidity: 53% Air temperature: 28°C		Hull temperature (Ts): 26°C
Nr. readings: 443 Minimum: 13% Maximum: 75%	Average: 40% Standard deviation[1]: 8% Main value gathered are between 32% and 48%	Readings between warning and alarm threshold: 5.9% Readings beyond alarm threshold: 1.6%
Green value are below warning threshold (DRY). *Yellow value are between warning and alarm threshold (ATTENTION).* *Red value are above alarm threshold (WET).*		



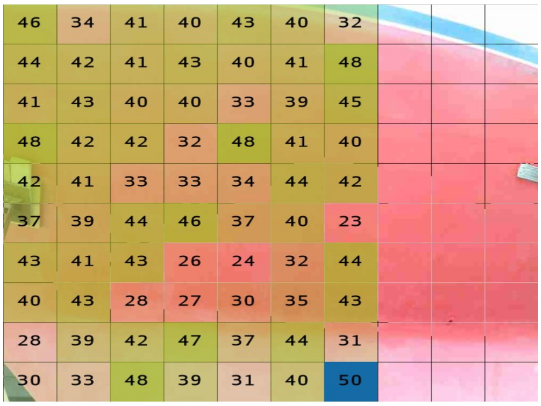
Graphic 1: Highlighted reading were taken in way of rudder and skeg

In a pre-purchase survey all readings below alarm threshold are considered to be acceptable.

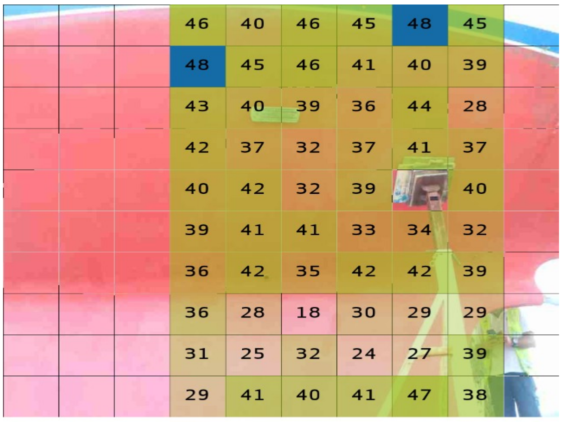
1 Standard deviation: definition from Wikipedia [Standard deviation – Simple English Wikipedia, the free encyclopedia]



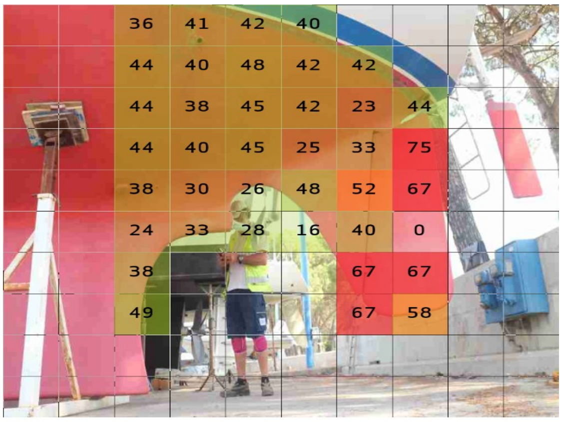
Port bow



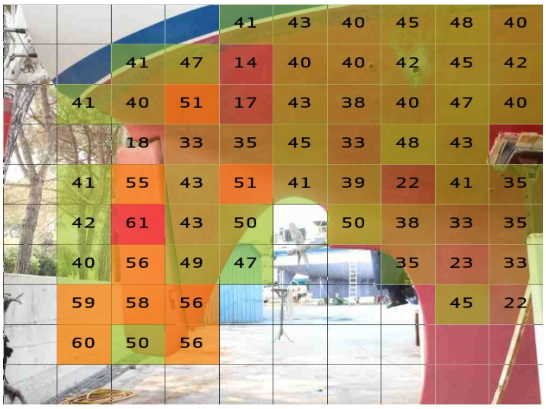
Half port bow



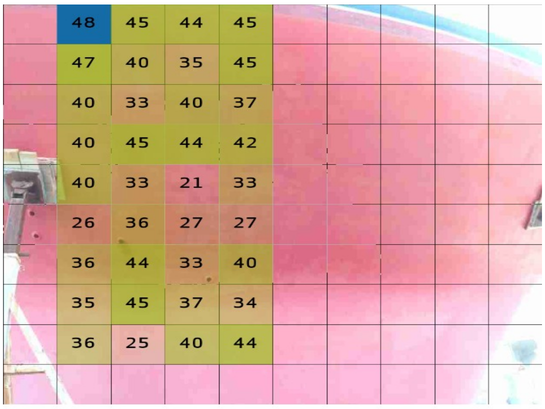
Half aft port



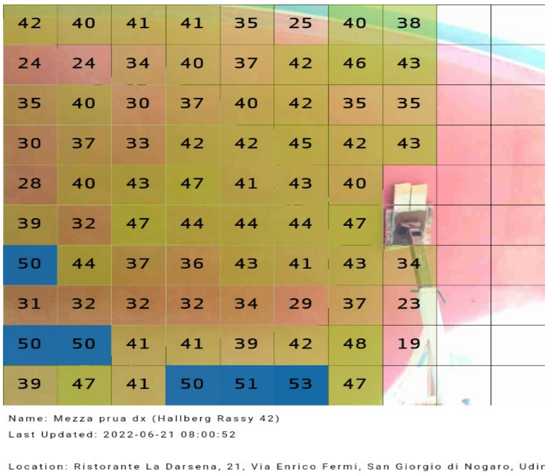
Aft port



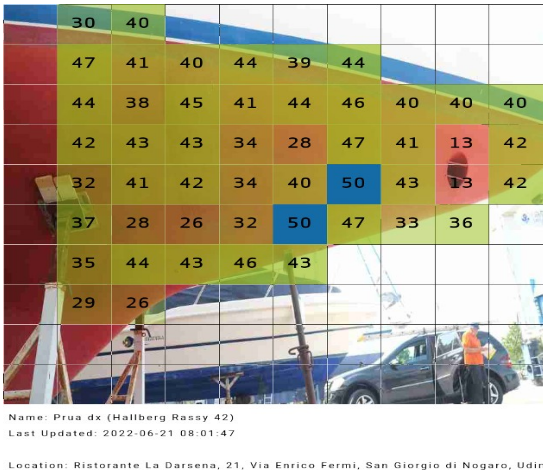
Aft starboard



Half aft starboard



Half Bow starboard



Bow starboard

8. Appendix – Technical notes

8.1 Tap testing

Tap Testing is an old and extremely simple NDT (Non-Destructive Testing) technique, also known as Coin Testing, which involves the knocking of an object's surface with a small hammer or a coin and judging its integrity by the sound that emanates from the object as a result of the nocking. A duller sound would indicate that the impact has been dampened possibly because of the presence of a defect. However when the technique is applied manually it does not provide much data or a record of the response and it naturally begs to question the reliability of the assessment because it is highly dependent on the operator's perception, experience etc.

For yacht surveys, I use the following tap devices:

4. *A wooden hammer: used on fibreglass and composite hulls*

5. *A phenolic head hammer: for other parts than hulls, such as seacocks, engine mounts, fittings. Etc.*

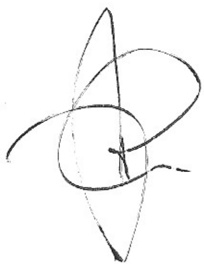
6. *A pin hammer: metal hulls and fittings*

7.

8. *A special mention goes to my favourite tool: a spike with plastic handle. I use both ends, the handle and the probe, to tap the hull and pierce suspect areas, blisters, voids, etc.*
9. *Invaluable on wood.*

8.2 Moisture testing

Moisture is the water absorbed and retained by a solid material; in fibreglass this is due to the intrinsic characteristic of semi-permeability of the resin used for the moulding. In fact polyester resin is highly permeable to water, vinylester much less and epoxy resin almost impermeable (please note: almost). Water intrusion in fibreglass may lead to several issues, first of all degradation of the bonding between resin and glass (or other reinforcement) fibres. The water may find its path to the inner layers of a laminate by mainly two ways: osmosis and wicking.



The first is the well known defect that became a nightmare for all GRP boat owners in the past decades: fundamentally it's generated by pocket of hardener that did not reacted with resin during the cure process. Being the gel coat and resin semi permeable the density difference between hardener (thicker) and water (thinner) generates an "osmotic pressure"; this way the water seek a path to get inside the pocket and dilute the hardener thus to equilibrate the two densities. So the pressure inside the pocket increases, and so does the volume, generating blistering.

Wicking occurs when the end of glass fibres is open to the water, and the water itself start moving along the bonding between glass and resin, just like along a candlewick.

In both cases it's important to know if and how much the water have made its ingress in the laminate, and this is achieved by means of instruments called moisture meters. Those are electronic instruments based on three different principles: there are resistance type, capacitance type and radiowave moisture meters.

Resistance type: the meter sports two probes that should be inserted into the material we are about to measure; between the probes there is a small voltage difference, so the current flows from a probe to the other according with the resistance found in the material: the lower the resistance, the higher the moisture. This kind of meters are used only in wood, and can determine with a good precision the amount in weight of water in percentage of wood weight.

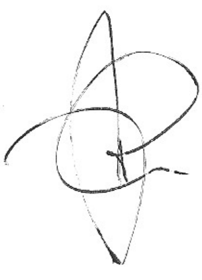
Capacitance type: a small current is made flown between two pads, thus calculating the capacitance that material they are placed onto: again, the higher the capacitance, the higher the moisture content. This type of meters may be used on a variety of materials, but the readings do not express a real amount of water contained in such body, but give a simple indication whether the body is dry, at risk or wet.

For using both of above the surface must be fully dried, so a boat cannot be inspected by means of a capacitance type moisture meter before about 72 hours form her hauling out.

The third type moisture meter works like a radio transmitter receiver: on one end of the instrument there is the transmitter, and the body to be measured acts as an antenna, conducting the radio waves though the material to the receiver placed on the body of the instrument. A dry material do not conduct radio frequencies, and the intensity of the received signal is proportional to the moisture content. This kind of instrument is negligibly affected by surface moisture: I tried several times to pour water on a surface, simply wiping it away with a cloth, and the reading was not affected. This is useful on recently hauled vessels, providing that the antifouling compound is enough dry or could be scratched in pads.

None of the above instruments works on conductive materials, such as metals or carbon fibre.

The Protimeter MMS2 I use is of the latter type. The scale it uses is 60 to 999, and the meaning of the readings may be considered as follows:



Readings	Guidelines	Examples
60-99	**Dry** for all purposes (even for osmosis treatment).	1. Modern yacht with epoxy protection from new. 2. Yacht with Gelcoat removed after drying out period prior to epoxy treatment scheme.
100-169	For all practical purposes may be considered **dry**.	
170-199	**Some moisture present** at low levels, but of no great concern. Other factors must be taken in account (boat age or type of material)	1. Yachts with isophthalic and vinyl ester gelcoat resins after initial lift out, but will quickly reduce dependant on weather conditions. 2. Older orthophthalic resins that may take longer for readings to reduce.
200-299	**Risk** of associated moisture defects considered medium, but toward top of this range levels are becoming significant. Bilge backwater may induce this level of readings	
300-449	Considered **high** and at a level where the risk of moisture related defects being present, but not yet physically detectable, is significant.	
450-599	**Very high** and is usually accompanied by physically detectable signs.	1. Blistering is visible or where the gelcoat has been starred or cracked. 2. Water intrusion from hull cracks or delamination (grounding)
600-999	**Extremely high** and indicative of possible laminate damage in addition to osmotic blistering and physically detectable signs.	

The colour associated to the readings reflects the LED indicator on the meter.

MMS2 has a pin probe resistance type sensor for measuring wood moisture content in percentage.

The Extech MO55 moisture meter used is a duplex resistance/capacitance tester, with four scales: Pin mode (resistance) or Pinless mode (capacitance), wood or building material (here including also compound materials such as fibreglass). Pin mode scale is expressed as a percentage, Pinless mode scale is relative, 0.0 through 99.9. It could be interpreted as follows:

Measurement mode	PIN MODE		PINLESS MODE	
Material	**WOOD**	**BUILDING**	**WOOD**	**BUILDING**
Total range	0.0~50.0%	1.5~33.0%	0.0~99.9	0.0~99.9
Low moisture	**5.0-11.9%**	**1.5-16.9%**	**0.0-16.9**	
Medium moisture	**12.0-15.9%**	**17.0-17.9%**	**17.0-29.9**	
High moisture	**16.0-50.0%**	**18.0-33.05**	**30.0-99.9**	

Moisture metering is a punctual testing method: the informations obtained are related solely to the exact point of measurement; nothing can be inferred for adjacent points (except for a very limited area in the surrounds). So a 100% survey of a wide are such as a canoe body can not be performed.

8.3 Thermal imaging

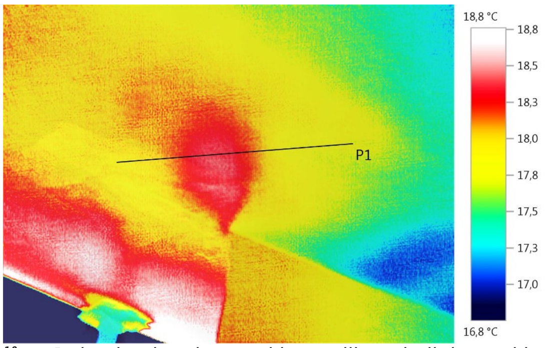
Thermal imaging is a non destructive test method based on acquisition of images in the infrared range. By means of a thermal imager we can do non contact, non intrusive inspections; thermal imagers may detect radiation in infrared range, make measurement related, and produce images of that radiation.

On yachts thermal imaging applies to fibreglass and wooden hull (underwater body, topsides, deck), engines and electrical system inspection.

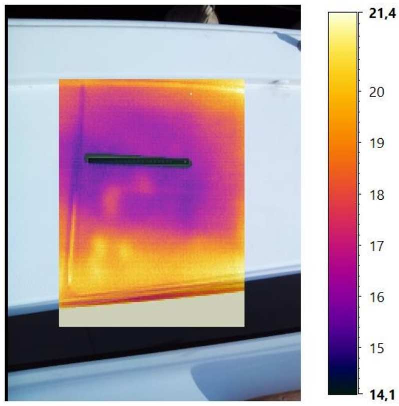
In composite hulls (fibreglass, carbon, sandwich) active thermography – performed by application of a heating or cooling of the surface to be inspected – may detect delamination, repairs, air or water inclusion, osmosis, disbonding. Teak or sandwiched decks may be inspected to find leaks, rotten planks or voids.

Thermal imaging could be applied to working engines, thus finding overheated spots along fuel lines, cooling system, exhausts. Overheating in electrical systems may be easily detected by means of a thermal image.

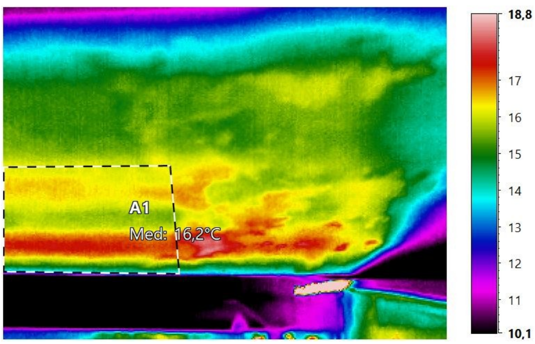
There a re two basic procedure for Infrared Inspections: active and passive. Active IR requires a heating source to trigger a heat transient in the body about to be inspected; in this case several sources are available: first of all the solar radiation, that can be direct or indirect (i.e., the sun heats the sole under the hull, the sole releasing long wave radiation that heat the vessel), halogen lamps, infrared heaters, airflow heaters or heatguns.

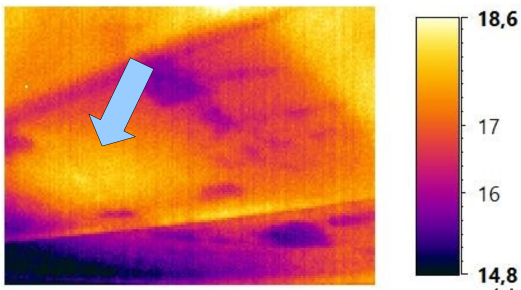


10. *Delamination detected in a sailboat hull; heated by indirect solar heating*



11. *Gel coat voids detected on a sail boat deck; heated by direct solar heating*





13. *Delamination on a power boat bottom, heated by*

12. *Repairs on a power boat bottom; heated by a 2000W IR heater*

2×500W halogen lamps

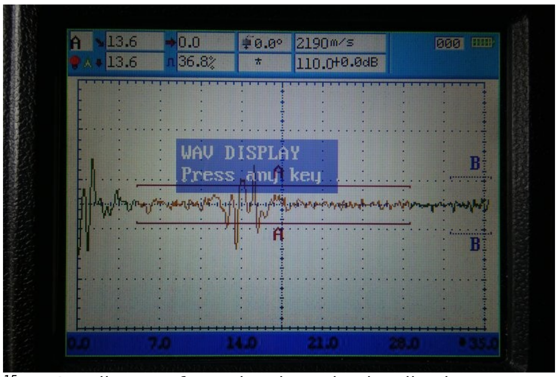
8.4 Ultrasonic Non-destructive Testing

Ultrasonic testing is based upon measurement and analysis of propagation of ultrasonic waves, with frequencies between 50kHz and 10MHz. When an ultrasonic wave transmitted through a solid body meet a discontinuity, it will be reflected, and a suitable instrument calculates the time between transmission and reception of the echo.

In composite hulls we may mainly detect delamination, disbonding and air intrusion. In metal hulls UT is used for weldings test and thickness measurement (corrosion monitoring). There is no use for UT in other hull materials.

The instrument I use is a so called Flaw Detector: it shows on a screen a radiowave form, and by the position of the wave and by its shape it's possible to determine hull thickness and material characterisation.

14. *Mitech MFD620C coupled with a 25mm/0,5MHz Olympus delay-line probe*



15. *A radiowave form showing a backwall echo at 13.6mm: this is the laminate thickness in that point.*

Ultrasonic testing is a punctual testing method: the informations obtained are related solely to the exact point of measurement; nothing can be inferred for adjacent points. So a 100% survey of a wide are such as a canoe body can not be performed.

8.5 Conductance testing

Conductance describes the ability of a battery to conduct current. It is the real part of the complex admittance of the equivalent Randle model of battery.. Various test data have shown that at low frequencies, the conductance of a battery is an indicator of battery state-of-health showing a linear correlation to a battery's timed-discharge capacity test result. This can be used as a reliable predictor of battery end-of-life. This correlation is nearly linear, meaning that if conductance can be measured, timed-discharge capacity can be predicted. Since voltage and specific gravity testing are not predictive, timed discharge testing is very time-consuming and expensive, and impedance testing does not correlate directly and linearly with timed discharge capacity, conductance testing is a very effective and economical alternative.

Simply by connecting the two test set leads to the positive and negative posts of the cell or battery under test, a measurement is taken in a matter of seconds.

Known the nominal CCA – Cold Cranking Amperage – of the battery under test, the instrument gives the following data:

Internal Resistance (IR): the most important information; a brand new battery should have a very low IR, as much as 2~3mΩ (milliOhms); the higher the IR, the shorter the remaining life of the battery – IR up to 4,5mΩ could be acceptable, over this value the direction given is to replace the battery.

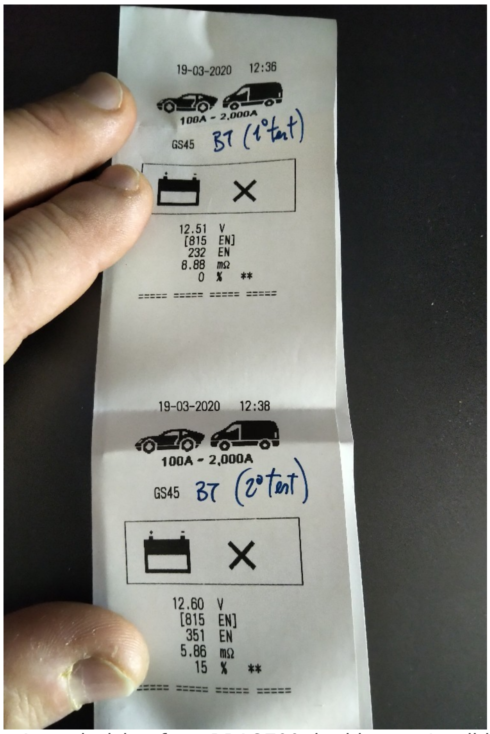
CCA: the actual Cold Cranking Amperage the battery can deliver; usually it is around the nominal value – sometimes higher, but when it falls down the battery is likely to be replaced.

SoH: State of Health, expressed in percentage. Indicate in a clearly understandable manner how much of a battery's life is expected to remain. 100% means the battery is in the prime of its life, 0% means it is flat dead. For safety reasons a battery should never be used under the 50%.

I use two different testers only because the Ring RBAG700 may be used with unknown nominal CCA – as it often happens, whereas the Autool BT660 provides measurement for Gel batteries, which the Ring tester does not.

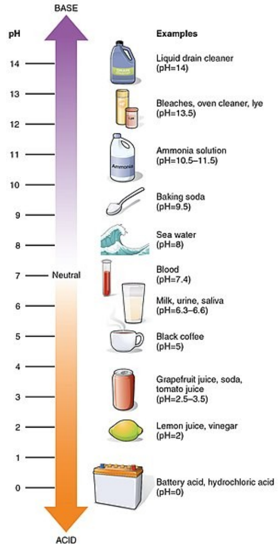
16. *RBAG700 at work; this battery is a t its 75%, with an IR of 2,3mΩ, so it's still good*

18. *Autool BT660 on a Gel battery*



17. *A result ticket from RBAG700: in this case I redid the test twice because the first test was negative, but the second didn't went much better; this battery is to be replaced*

8.6 Litmus paper



Litmus is a water-soluble mixture of different dyes extracted from lichens. It is often adsorbed onto filter paper to produce one of the oldest forms of pH indicator, used to test materials for acidity. In chemistry, **pH** (power of Hydrogen) is a scale used to specify how acidic or basic a water-based solution is. Acidic solutions have a lower pH, while basic solutions have a higher pH. At room temperature (25°C or 77°F), pure water is neither acidic nor basic and has a pH of 7, and seawater around 7.7~8.3. At 25°C, solutions with a pH less than 7 are acidic, and solutions with a pH greater than 7 are basic. The neutral value of the pH depends on the temperature, being lower than 7 if the temperature increases.

In osmosis blistering (see technical note §8.2) the water find its path through the hull and start to dilute the hardener that didn't catalyse during the cure, thus originating acetic acid – that's why, when we pierce an osmotic blister, we feel a pungent vinegar smell). As you may read in the pH scale on the right, vinegar pH is as low as 2 (2.9, to be precise), and acetic acid is the main component of vinegar apart from water. A solution of acetic acid in water may have a pH of 2.4, so a low pH number found in blister content is a sure tell tale of acidic content of the blister, and very likely caused by acetic acid. So we use litmus paper to determine how long is the hydrolysis process going: the lower the pH, the more advanced the osmosis phenomenon is.

8.7 Cathodic protection control

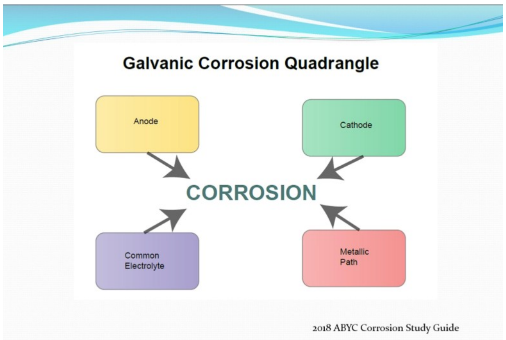
Galvanic corrosion occurs when we have the so called Corrosion Quadrangle: two metals, a common electrolyte (e.g.: salt water) and an electric path between metals. In this situation a very low voltage is found between the two metals, according with their relative position on the so called Galvanic Series of Metals in Seawater: a small current flows from one metal to the other, and the less noble metal corroded.

To protect metals fitted on board (or the same hull, in case of metal boats) we usually place a given amount of anodes (zinc, aluminium or magnesium) on the bottom of the hull, or straight on metal fittings we're eager to save; this way the sacrificial anode becomes the less noble of metals and will corrode instead of our precious propeller.

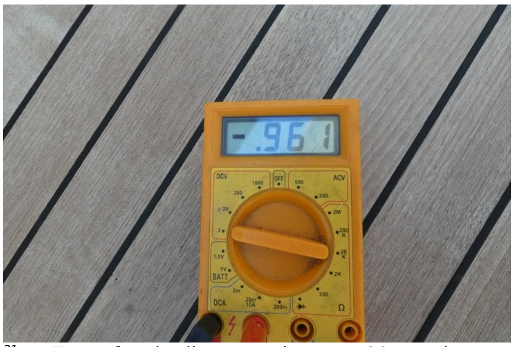
The America standard ABYC E-02 outlines the following procedure for determining if metals on board are enough protected:

1. With a multimeter in the range of milliVolts (mV) test the voltage between the metal we're about to protect and a reference electrode (I use a silver/silver chloride half cell); that should read something like the values given in the Galvanic Series Table;
2. Put the anodes on;
3. Re-test the voltage: now it should read 200 to 400mV more negative, meaning that the fitting is correctly protected; a lower difference means that the metal isn't

adequately protected, whilst a higher voltage difference may lead to overprotection issues, such as paint bubbling or alkali attack to wood.



19. *The Galvanic Corrosion Quadrangle*



21. *Test of cathodic protection on a 90' steel motor yacht: the unprotected steel potential is (see table aside) -600 to -710mV; the reading is -961mV, so the difference is in the range of 251~361mV, I.e the hull is correctly protected. The readings were taken in various locations around the vessel.*

	Ag/AgCl REFERENCE CELL POTENTIAL (mVDC)
ANODIC OR LEAST NOBLE	
Magnesium and Magnesium Alloys	-1600 to –1630
Zinc	-980 to –1030
Aluminum Alloys	-760 to –1000
Cadmium	-700 to –730
Mild Steel	-600 to –710
Wrought Iron	-600 to –710
Cast Iron	-600 to –710
13% Chromium Stainless Steel, Type 410 (active in still water)	-460 to –580
18-8 Stainless Steel, Type 304 (active in still water)	-460 to –580
Ni-Resist	-460 to –580
18-8, 3% Mo Stainless Steel, Type 316 (active in still water)	-430 to –540
Inconel (78% Ni, 13.5% Cr, 6% Fe) (active in still water)	-350 to -460
Aluminum Bronze (92% Cu, 8% Al)	-310 to -420
Nibral (81.2% Cu, 4% Fe, 4.5% Ni, 9% Al, 1.3% Mg)	-310 to –420
Naval Brass (60% Cu, 39% Zn)	-300 to –400
Yellow Brass (65% Cu, 35% Zn)	-300 to –400
Red Brass (85% Cu, 15% Zn)	-300 to –400
Muntz Metal (60% Cu, 40% Zn)	-300 to –400
Tin	-310 to –330
Copper	-300 to –570
50-50 Lead- Tin Solder	-280 to –370
Admiralty Brass (71% Cu, 28% Zn, 1% Sn)	-280 to –360
Aluminum Brass (76% Cu, 22% Zn, 2% Al)	-280 to –360
Manganese Bronze (58.8% Cu,39%Zn,1%Sn, 1%Fe, 0.3%Mn)	-270 to –340
Silicone Bronze (96% Cu Max, 0.80% Fe, 1.50% Zn, 2.00% Si, 0.75% Mn, 1.60% Sn)	-260 to –290
Bronze-Composition G (88% Cu, 2% Zn, 10% Sn)	-240 to –310
Bronze ASTM B62 (thru-hull) (85% Cu, 5% Pb, 5% Sn, 5% Zn)	-240 to –310
Bronze Composition M (88% Cu, 3% Zn, 6.5% Sn, 1.5% Pb)	-240 to –310
13% Chromium Stainless Steel, Type 410 (passive)	-260 to –350
Copper Nickel (90% Cu, 10% Ni)	-210 to –280
Copper Nickel (75% Cu, 20% Ni, 5% Zn)	-190 to –250
Lead	-190 to –250
Copper Nickel (70% Cu, 30% Ni)	-180 to –230
Inconell (78% Ni, 13.5% Cr, 6% Fe) (passive)	-140 to –170
Nickel 200	-100 to –200
18-8 Stainless Steel, Type 304 (passive)	-50 to –100
Monel 400, K-500 (70% Ni, 30% Cu)	-40 to –140
Stainless Steel Propeller Shaft (ASTM 630:#17 & ASTM 564: # 19)	-30 to +130
18-8 Stainless Steel, Type 316 (passive) 3% Mo	0.0 to –100
Titanium	-50 to +60

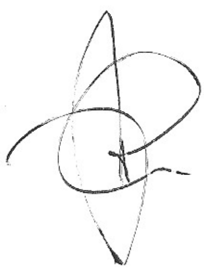
20. *Galvanic Series of Metals in Sea Water*

8.8 Salinity gauge

When I find water in a bilge, the first question I ask myself is: “Is it fresh or sea water?”. The simplest way to answer is tasting it, but sometimes (please read: often, or almost always) the water is too filthy to be tempting, so I use a simple pen-type salinity meter. I just put the meter in the water, and the reading in ppt (parts per thousand), and could be interpreted as follows:

Water classification according with the salinity (as mass fraction)			
Fresh	Brackish	Sea water	Brine
0-0,5ppt	0,5-30ppt	30-50ppt	>50ppt

Note that Black Sea water has a salinity of 16ppt, so it’s much like an estuary; mean ocean salinity is 35ppt. In case of doubt I simply test the water the boat is floating in.



8.9 Fire fighting

Fire extinguisher are pressure vessels containing an extinguishing agent, that can be ABC-powder, foam (rare), water (rarer), CO_2, Condensed Aerosol or Re-Hydrogenated Hydrocarbons. The basics is that the fire extinguisher must be capable of be used on energized electrical equipment (Class E fires), that's why foam and water are not used on board of yachts, with the exception of water mist systems, that are usable on class E fires.

Aboard a CE-marked craft it's the builder that instruct how many fire extinguisher are to be placed on board, and where. On ante-CE boats the registration flag requirements should be followed.

Besides the extinguishing agent mass (1kg, 2kg etc.) fire extinguisher size is indicated by a number followed by the letter A or B, indicated its rating for class A or B fires (the higher the rating; the greater amount of solid – A – or liquid – B- burning material can be extinguished).

8.10 Inflatable liferaft

ISO9650 standard defines 2 types of rafts according to the navigation type:

Offshore navigation: type I liferafts (ISO 9650-1); liferafts designed for long voyages or cruises when gusts of wind can be expected, together with exceptional wave height (excluding abnormal conditions such as hurricanes). ISO 9650-1 liferafts are classified in 2 groups (A and B) to reflect the temperature conditions in the sailing area: Group A: liferafts designed to inflate in an environment temperature of -15°C to +65°C; they feature an insulating double floor. Group B: liferafts designed to inflate in an environment temperature of 0°C to +65°C; they feature a single floor. Liferafts may be equipped with 2 types of survival kits, depending on how long the victim is likely to spend in his raft waiting to be rescued: Emergency kit: rescue forces expected after 24 hours, or Standard kit: rescue forces expected within 24 hours.

Coastal navigation: type II liferafts (ISO 9650-2); liferafts designed for sailing in areas where moderate conditions are expected, such as coastal waters, bays, estuaries, rivers and lakes. ISO 9650-2 liferafts are designed to inflate in an environment temperature of 0°C to +65°C and feature a single floor, and usually come with a standard survival kit.

ISO9650 liferafts, especially type I, are heavy and bulky, very hard to put in the water, so they should be placed where the least effort would be made to launch the raft in case of distress. Deep lockers or peaks are not suitable as liferaft location.

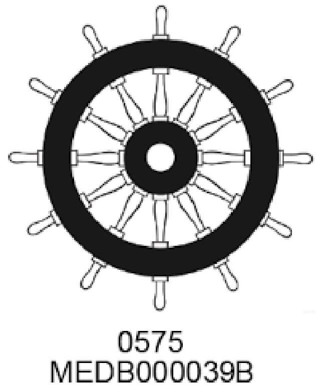
8.11 Life jackets

Two kinds of life jacket are allowed on board of yachts: those CE-marked and those SOLAS-marked. In the first case you'll find the CE-mark CE along with a buoyancy rating: according with the relevant ISO12402 standard the buoyancy may be defined as 50N, 100N, 150N and 275N, where the N stands for Newton, the international unit of force (1N is 0,098kg, that is to say that more or less 10N=1kg). 50N lifejackets are not intended as life-saving devices, and should be used only as a buoyancy aid in watersports; 100, 150 and 275N are suitable as life-saving devices, the higher the rating the better aid to survival they give.

SOLAS/MED devices are recognisable by the “wheelmark” and are classified in the same way, with a rating followed by the letter N indicating the buoyancy.

Some flag regulation, Italian for instance, requires a specific rating according with the navigation limits the vessel is engaged in: 100N are limited at 12 nautical miles from the coast, requiring at least 150N for sailing farther.

22. *CE rating marks*



23. *The “wheelmark”*