MEDUSA
MARINE

S1221 – Pre-purchase full condition survey and sea trial report on:

Broom 37 Ocean [redacted]

For

[redacted]

Surveyed at [redacted]

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Tonnage Measurer for all
Red Ensign Flag States

Survey Report on Motor Yacht [redacted]

This survey was carried on the instructions of:

[redacted]

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1) General notes.

a) Responsibility

Any responsibility is to the above client only and their insurers, and not to any subsequent owner of the vessel under survey or holder of this report. Copyright is retained by Medusa Marine and copies must not be made or distributed except to the vessels insurers or repairers without permission of the copyright holder.

b) Location

The vessel was laid up ashore and later afloat at [redacted]

c) Purpose and scope of survey

Survey was carried out under Medusa Marine terms and conditions. These are YDSA standard terms of engagement and are available on our website: www.medusamarine.co.uk/index.php/terms-and-conditions/

This survey was commissioned by the purchaser for the purpose of establishing the condition of the vessel prior to completion. Unless otherwise stated, the vessel was not surveyed for compliance with any build standards (RCD) or operational codes of practice or local licenses. The vessel has also not been surveyed for suitability for any particular purpose or location. This survey report is a factual statement of the surveyor's examination as carried out and his opinion given in good faith as to the relevance of disclosed facts and defects so far as seen. It implies no guarantee against faulty design or latent defects.

d) Limitations

Unless the vessel was afloat, the mechanical condition of the engine was not covered by survey, only the installation and components normally available to routine maintenance could be assessed. If afloat, only assessment of the engines no load running condition was possible without a full sea trial. Surfaces coated with layers of paint cannot be examined for damage which is only evident on the substrate beneath the paint coat. Sails where present, were examined for general condition. The sails were not set, so no assessment of fit, shape or stretch could be made. Spars and rigging, where stepped, could only be examined visually from deck and ashore. All these limitations are subject to an assessment of what is reasonable and practicable due to the condition and location of the vessel under survey.

Navigational equipment, electrical installations and domestic appliances were assessed subject to limitations if battery charge or shore power was available. If there was no opportunity for sea trialling the vessel, no assessment of the vessel and her equipment under seaway conditions was possible. No opinion could be made or responsibility undertaken for condition or defect of those aspects of the vessel not accessible or evident due to the above limitations.

e) Recommendations

Recommendations have been subdivided into two categories. All Recommendations are annotated thus and are summarised at the end of the report

Category 1 (Cat 1) Recommendations are safety related defects which should be corrected before the vessel is put into commission.

Category 2 (Cat 2) Recommendations relate to defects which affect the efficient operation of the vessel in normal use and should be attended to at the earliest opportunity. They do not affect the safe operation of the vessel.

2) The Vessel specifications and description

Note: Dimensions and measurements given have been derived from manufacturers published data, and have not been verified by survey.

LOA:	11.30 metres
LWL:	10.50 metres
Beam:	3.66 metres
Draft:	0.91metres
Air draft: (arch down)	3.82 metres
Displacement: (light)	8.125 tonnes
Manufacturer:	Aquafibre Ltd / CJ Broom and Sons Ltd
Model or Type:	Broom 37 Ocean
Year of Build:	[redacted]
Registration (part three):	[redacted]
MMSI No.	[redacted]
Designer:	John Bennett
Construction:	GRP hull and deck
Engines:	2 x Perkins HT 6.354
Gearboxes:	2 x Borg Warner 72C Velvetdrive

This vessel was built before the 16th June1998 and therefore is not subject to the requirements of the Recreational Craft Regulations (SI 1996/1353). It was also built before the 2005 (Directive 2003/44/EC) to include environmental emission limits.

Vessels that were built before 1st January 1985 and within the EU prior to 1992 are considered VAT paid. This boat was built in the EU before 1st January 1985 so proof of VAT paid status should not be required.

The vessel displays a Small Ships Register (SSR) number. This is the minimum registration necessary for voyaging to foreign waters. It does not provide proof of ownership and is not transferable on sale or transfer. A new registration will need to be applied for which will usually be issued under the same number.

The vessel also shows a Part One official number which is assumed to have expired. A vessel cannot be on two registers at the same time. The Registered Tonnage (RT) of 13.5 tonnes bears no relation to the displacement of the vessel. It is a theoretical calculation of the cargo carrying capacity on which harbor and light dues would be based if the vessel was in commercial service.

This yacht was built in 1980 by CJ Broom & Sons of Brundall from a set of mouldings by Aquafibre Ltd of the nearby village of Rackheath in Norfolk. She is one of the later versions of the 157 vessels built to this design between 1973 and 1983. She has the standard installation of Perkins 5.8 litre six cylinder horizontal turbodiesels.

The hull design above the waterline is conventional for a semi-displacement motor yacht hull with broad bluff bows and excessive flare to allow a fine entry. Flared topsides at the bows run to flat vertical flanks amidships and a flat vertical transom.

The hull bottom has a deep long keel with reverse garboards and a shallow deadrise. There are radius chines and three almost full length spray rails per side. The long keel sweeps from shallow at the forefoot to a deep section in way of the sterngear. This gives good directional stability and prevents the tendency to wander at displacement speed. Low speed maneuvering is assisted by a recently installed bow thruster.

The side decks are raised above the rubbing band with shielded intake ports for the engine space. The superstructure is almost fully glazed with sliding windows to the saloon. The saloon is topped by a screen for a second helm position and cockpit above the aft cabin. This is accessed from the saloon by a companionway

The cockpit is a step up from the narrow full ring deck around the superstructure. The cockpit provides a large seating and sunbathing deck with varnished teak handrails and a teak laid sole. Above is a lowering stainless steel arch which carries all the navigation and communication antennae.

The saloon has a main helm to starboard and a large U shaped dinette to port. The narrow galley is at a lower level to port aft of the dinette. The galley is well equipped with a domestic sized gas cooker, front loading fridge and a microwave cooker.

Aft from the saloon, down a companionway is an aft twin berthed sleeping cabin with an en suite heads and shower compartment. Forward from the saloon, down a companionway, is a forward twin berthed cabin with another en suite heads and shower compartment. The engine space occupies all the under saloon sole space and is accessed by lifting hatches.

3) Survey details

a) Hull general

Hull construction is of solid skin glass reinforced plastic (GRP) laminates of woven rovings (WR) and chopped strand mat (CSM) bonded with polyester resins. The actual construction is relatively heavy for her length at just over eight tonnes. The hull is stiffened by longitudinal stringers of foam cored laminated box sections and deep transverse overlaminated foam cored floors.

The hull strength and security of the vessel is enhanced by two full height bulkheads up to saloon sole level although these do not appear to be watertight compartments. There are full width load bearing transverse floors and longitudinals to the engine space hull bottom. Additional stiffening is provided by all the internal joinery being fully laminated to the hull structure.

The hull has been moulded in one piece, but in a three part split mould of two hull halves and a transom. This is to allow the lower rubbing band and the tumblehome to the topsides to be moulded. It also aids the efficient lay-up of the projecting keel. The resulting flash in the stem and transom quarters would have been polished out.

This hull would have been built before the problems associated with moisture absorption into permeable resins and laminates were fully understood. The actual resins used in the construction could not be determined, but is likely to be mainly orthophthalic resins with isophthalic gel coats and initial laminates.

b) Bottom

The bottom is finished with a blue antifouling painted coating. This is a well adhered coating and appears to be several coats of the same colour deep. Beneath there is an alternate coating of grey and pink epoxy barrier coat and then a hard smooth coating of the original white gel coat.

Some antifouling coatings with high metallic components and solvent retention can affect moisture readings. The antifoulings extended about 5 cms above the waterline, so readings were taken for reference on the topsides and through the coating above the waterline.

The two adjacent readings were slightly different. No areas of antifouling were scraped back to gel coat to get representative readings, unless levels indicated a possibility of significant osmotic absorption. It is beneficial to avoid unnecessary scraping of antifouling coatings if possible as it can damage surfaces beneath.

Moisture readings were taken with a Sovereign Quantum Marine Moisture meter. This meter is a capacitance type tester and is equipped with both deep and shallow reading scales. This is useful to trace the depth of penetration of, and correspondingly the drying out of moisture. All polyester laminates will absorb some osmotic moisture to a degree without it effecting the structure or strength of the construction.

The comparative scale is 0 to 100, which is an arbitrary scale, and does not represent actual percentages of moisture in GRP. Thus figures are thus quoted as scale readings and not as percentages. Representative readings on a Sovereign Quantum comparative scale for moisture content in GRP laminates approximate as follows:

0-15 Regular readings for a ‘dry’ GRP laminate
16-20 Slight absorbsion typical of permeability of weather exposed GRP
20-30 Medium moisture content, could be osmotic but unlikely to blister
31-45 High moisture, osmotic process but not necessarily physical effects
46-60 Very high, usually physical effects, blistering and wicking evident
61-100 Extreme saturation moisture with a visible structural defects

The atmospheric conditions at the time of survey were as follows:

Weather:	Dry with occasional sunshine
Wind:	NE 10 to 12 kts
Air temperature:	18.6°c
Hull surface temperature:	19.5°c (port) 19.4°c (stbd)
Relative Humidity:	45.3%
Dew point:	6.5°c
Hull temp above dew point:	13.0˚c to 12.9˚c

It is normal best practise to want a difference of at least 5°C between hull temperature and dew point in order to ensure the evaporation of all surface moisture. The vessel had been lifted and washed off the day before readings were taken and moisture was well evaporated from the hull bottom surface.

The topsides shallow scale readings were in the range 14 to 16. The area of antifouling above the waterline showed shallow scale readings of 15 to 17. It could be seen that the antifoulings were influencing readings by one to two points. Below waterline readings can be discounted by this degree.

Shallow scale readings taken generally ranged from 23 to 29 over the majority of the hull bottom with a general increase progressively toward the keel. The deep scale readings were slightly, but not significantly lower at 19 to 28. The similarity of the two scales indicate that the moisture in the hull had nearly reached a stasis and was unlikely to drop further.

There were many areas where excessive readings of up to, and occasionally over 60 were seen. These areas were scraped back to gelcoat and all the readings dropped to 21 to 25 on the shallow scale. In general the scraped back areas showed dropped to readings comparable to the surrounded areas.

The hull was viewed from all angles. It was also hammer sounded all over. There was no sign of blistering or delamination in the surface, subject to the limitations of the poor surface finish to the antifoulings. There were no visible distortions or irregularities in the hull bottom surface.

The general condition of the hull bottom is considered to be structurally sound with a natural level, and the possibility of some low levels of osmotic absorption. This is not unusual for a vessel built of the older resins types. The osmotic absorption is not at a level that would cause structural defects to occur. There are other factors that need to be present for damage to occur.

The routine of laying up on hard standing for several months every season should prevent any chance of the hull laminates suffering any physical degradation. This preventative routine is good practise for a hull of this age. The present fair condition of the hull implies no automatic guarantee that structural defects could not occur in the future. (*See explanatory note 1)*

The hull bottom internally was examined where accessible. The bulkheads and joinery are fully laminated and the whole painted with a resin flo-coat. The hull bottom internally was seen to be dirty with the evidence of some past high levels of bilge water and stained in places where oils and water have been trapped. It did not appear that the water level had reached any vulnerable components.

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c) <u>Topsides</u>

The topsides are constructed of solid GRP laminates with a white gel coat finish. There is a broad blue painted boot top stripe above the antifouling line. The gel coat looked fair and true when viewed from a distance with only slight distortions from moulded in structure. These are bulkheads and stringers.

There is a small area of surface abrasion of the gel coat on the starboard side at the quarter. There are also general scuff marks from fender abrasion at the beam on both sides. None of the defects are significant or through to the laminate but all these areas could be repaired to bring the finish up to the same standard as the remainder of the topsides.

The topsides were tested with a Barcol impresser. This tests the hardness of the laminates and can measure the degree of consolidation of the lay up and the level of cure of the resins. Readings of 38 to 44 were recorded, 38 to 40 is considered as normal for isopthalic and orthopthalic resins. This is above the average.

The gel coat was tested with a Shore D durometer. This can test the degree of oxidisation which can soften the coating. Readings of 92.5 to 94.0 were seen, 88 to 90 is considered normal. These readings indicate that a good gloss level could be achieved when the surface was polished. It also means that the construction would be more vulnerable to stress crazing under impact.

There is a rubbing band of an aluminium extrusion fastened to a moulded projection in the upper section of the topsides. This extends around the transom and to the bows. The fendering is fastened into the moulding and the fasteners are covered by a PVC extrusion. All is secure and, apart from some minor abrasions, is in good condition.

The general condition of the topsides was seen to be good with a lower level of cosmetic defect than usually seen in a marina berthed vessel of this age. The hull bottom cannot be tested for consolidation due to the presence of painted coatings, but can be assumed that it is common to the topsides as it is all part of a homogenous construction.

d) <u>Deck and Hull to deck structure</u>

The deck and the raised topsides above the hull to deck seam is all part of the same moulding. This moulding is fastened to the hull moulding by what is popularly known as a ‘biscuit tin lid’ This is where the deck moulding has a downward flange which fits over the hulls upward flange. The joint is fastened through with the fixings for a rubbing band.

The joint is then laminated over internally to create a structural monocoque. This is good practice as it creates a stronger hull but it means that the fit out construction has to be made through apertures in the superstructure. To assist this there is a large access panel moulded in the saloon roof. This is primarily above the engine space for obvious reasons.

The deck is constructed from solid and balsa cored GRP laminates. The deck moulding is finished with a non-slip texture to the gel coat in the tread areas. The deck was walk tested for delamination, spring and heave. Apart from a slight spring in the foredeck there were no evident defects. The deck was also tested with a moisture meter.

This was tested with a Tramex Skipper Plus moisture meter which is also a capacitance tester. It is more suited to testing textured surfaces as it uses foam rubber pads. Representative readings on a Tramex Skipper Plus for moisture in GRP laminates approximate as follows:

0-15 Regular readings for a ‘dry’ GRP laminate
16-38 Slight absorption typical of permeability of weather exposed GRP
39-65 Medium moisture content, could be osmotic but unlikely to blister
66-100 High moisture with possible physical degradation at higher ranges

Moisture readings over the majority of the side decks ranged generally from 25 to 40. There were several significant areas of high moisture content with readings up to 70. These were to the port quarter and to a smaller are on the starboard quarter. These are assumed to be moisture that has penetrated into the balsa core through stress applied to the aft mooring cleats.

The majority of the foredeck was also found to have a high level of moisture absorption into the balsa core There are some old mounting holes in the foredeck which could have been for a liferaft mount. These have been filled, but probably would have been drilled through the deck and core without proper sealing.

This area coincided with the slight spring felt underfoot although this is a large and relatively unsupported area. Moisture in the balsa core is not unexpected in a vessel of this age and rectification would be highly intrusive and of little benefit unless the condition allowed the deck to become significantly soft underfoot.

Generally, the deck was considered to be in a fair condition and reasonably sound and firm underfoot. There was some stress crazing inside the moulded toe rail and around some of the stanchion bases. These could be repaired but are likely to return. The shape of stress crazing can indicate the type of stress that has caused it. *(see explanatory note 4)*

e) <u>Superstructure</u>

The superstructure is a regular triple box shape of a long low coachroof with a tall deck saloon rose above it. On the after end of the saloon top is an open backed wheelhouse. All but the saloon and coachroof forward face are virtually vertical and flat.

The saloon and wheelhouse front screens have two faceted raked screens and a distinct camber to the saloon and coachroof tops. The saloon top has the large removeable hatch over the engine space. The whole structure is integral with the deck moulding.

The saloon structure is near fully glazed above the line of the coachroof. The coachroof and saloon tops were tested for moisture in the same manner as the deck and all was seen to be at a low and acceptable level. There was a slight debonding of the deck skin from the balsa core in the area forward of the saloon windows centre frame. This is considered a trivial defect as the area read as acceptable dry.

The after coachroof top forms the cockpit for the open wheelhouse. This has been laid with a teak deck. This appears to be a 'kit' deck where the teak has been pre-spaced and laid onto an epoxy scrim and caulked. The whole panel is then shaped from a template and laid as a large panel.

There is a wider central caulked seam which indicates that the decking has probably been laid in two halves. This is a recent addition manufactured by Wattsons or KJ Howells who would hold templates for popular models such as this vessel. The teak decking is in good condition showing little erosion.

f) Upper helm

The after end of the saloon superstructure forms the upper helm on the starboard side. This has a full set of engine instruments and plugs for mobile navigation electronics similar to those fitted at the lower helm. There is also a socket for a VHF active handset. There is a single helm seat and crew seating along the cockpit aft These have hinged storage compartments beneath, secured by hasps and staple.

Alongside the helm is a raised section to the coaming moulding which forms the hinged mounts for the radar arch. This is a large tubular stainless steel construction which carries the radar scanner and communications and navigation antennae.

This arch also forms the central support for the full canvas cockpit cover. This appears to be a fairly recent addition and is in a blue polyester canvas with clear Vybak vinyl window panels and roll up access panels. The forward part is secured to the screen fame which is detailed elsewhere. All in good condition

g) Hatches & Companionways

There is a single hinged aluminium framed companionway door giving access to the saloon down some companionway steps. This has a clear toughened glass panel. Above the door is a white GRP sliding hatch panel to provide head room when going below. All is in good structural condition.

The hatch is secured by a barrel bolt and the door secured by a mortice lock which engages into the side frame. All operated satisfactorily but the mortice lock did not fully engage into frame due to some misalignment. This compromises the security of the vessel and should be investigated and repaired.

Recommendation

(Cat 2) Investigate the poor alignment of the mortice lock to the main companionway door and repair.

The only form of emergency access and egress from the forward compartment is the Trend opening aluminium framed hatch in the forward coachroof This is a square aluminium framed hatch with toughened glass glazing and aluminium bars for protection and security.

The hatch is in good condition and suitable for designation as emergency escape hatch being 500mm square and having a firm foothold beneath in the form of the forepeak berth base. There are no obvious signs of leakage, and the upholstery beneath is dry.

There is a suitable hatch in the afterdeck above the after cabin joinery This is a GRP moulded panel, hinged at the after edge and secured from beneath for security. It is also an escape hatch with a firm foothold in the joinery. This is also free of evident leaks and the joinery is undamaged beneath.

h) <u>Windows and ventilators</u>

Excluding the doors already detailed, there are 9 windows to the saloon. and coachroof. All are aluminium framed flat pane windows by Trend Marine of Gt Yarmouth. The glazing is all in toughened glass held in rubber gaskets. To the front of the saloon wheelhouse are additionally two window screens each, both approximately rectangular in shape.

To each saloon forward window is an electric linear type type screen wiper. To the starboard hand wheelhouse screen is a single arc type screen wiper. These all worked when tested. These are not of the self-parking type and the small arc type cleans only a small area of the window. The blades could not be tested in use.

The side windows to the saloon and the fore and aft coachroof all have sliding windows within them. These are made of two fixed and one sliding pane between. These windows have drains in the bottom channels which direct water outboard.

The fixed fore and aft panes are shaped to fit the styling of the topsides. The fore and aft coachroof windows are fixed. All the windows appear to be in good structural condition although there is some oxidation in the aluminium at the joints in the corners. These are usually joined by shaped steel spigots which can cause some electrochemical decay.

There is one apparent leak to the port side aft cabin aft corner where the joinery surrounding is waterstained. Once these windows start to leak at the corner joints the only real solution is to remove and partially dismantle the frame to re-seal the joint. Applying additional silicone sealant around the window rarely works.

<u>Recommendation</u>

(Cat 2) Water test windows for leaks and reseal the leak to the port quarter.

There is also some waterstaining to the joinery in the saloon front window bottom corners. This is the usual spot for the collection of condensate water from the screens, and is rarely the result of leakage. This water damage is best avoided by keeping the saloon well ventilated, particularly when leaving the boat with warm engines.

There are two fixed ventilators to the forward accommodation. All are semi-flush design stainless steel dorade type ventilators and are installed to ventilate the fore cabin and the forward heads compartment through mesh grilles in the headlining. There are similar grilles in the aft cabin and aft heads which do not appear to vent externally unless they are inside the side trim moulding.

There is a motorized extractor fan in the galley compartment joinery which is switched at the bulkhead. This discharges through a stainless steel vent under the port side cockpit seat. These are the only fixed ventilation to the accommodation. All other ventilation is via the opening windows and hatches.

i) <u>Deck gear and fittings</u>

The majority of deck gear fittings are related to mooring and anchoring (detailed in section p).

To the transom is a pair of fabricated aluminium buttresses. These are for the mounting of davits and have been used as such in the past. There is some surface oxidation over the whole buttress on both sides. These are unattractive in this condition and could be removed if not intended for use.

In the topsides between the rubbing bands are the air intakes for the engines. These are five stainless steel clam shell louvres each side, each covering a 5 inch diameter hole through to the engine space. A calculation on combustion air capacity for the size of engines indicates a total requirement of about 150 square inches of air intake cross section. These intakes total nearly 200 sq inches so are quite adequate for the size of engines and have additional capacity for engine space cooling.

Fastened to the transom each side of a boarding ladder are two small boarding platforms. These are stainless steel tubular fabrications with teak slats inset. They are bolted through the transom and braced beneath by tubular struts. These are in good conditional and well able to take a persons weight.

Fastened to the transom between the platforms is a tubular stainless steel boarding ladder. This is an extending ladder with a captive section which can be extended to well below the waterline. This can be extended by a person in the water to enable them to regain the vessel unaided. This is a good design and is in good condition.

j) Safety equipment

A stainless steel handrail extends all around the vessel sat upon the deck edge on flanged feet. These are single bolt fixings through the deck. There is a top tubular rail and a smaller rod half height rail in an all welded construction. All is stable and secure.

There are three gates in the guard rails. One each side alongside the wheelhouse and one in the centre of the aft rail. These are closed by short stainless steel chains secured by pelican hooks. There are non-slip cast alloy tread plates installed on the toe rail to provide security underfoot

At the bows, the top rails are run down to the deck with a half height bar. This is to allow boarding over the bows in the continental manner. The guard rails are of a good minimum height and the design provides good security for crew when moving round the deck. There are also stainless steel handrails to the wheelhouse sides and a good hand hold in the tubular radar arch. These are all well secured.

Stowed below decks is a yellow horseshoe lifebelt. This is equipped with an automatic floating flashing light. The light did not work when tested and the lifebelt should also be permanently marked with the vessels name and port of registry. There is a mounting bracket provided on the port pushpit rail.

Recommendation

(Cat 1) Install batteries and bulb as necessary to the floating light and mark lifebelt with the vessels name and port of registry

Also stowed below decks is a liferaft. This is a Seago 4 man liferaft in a valise. This appears to be a new unit and does not have an initial commissioning date or next service date marked on the service record. This should be investigated and a proper service record maintained.

Recommendation

(Cat 1) Investigate the history of the liferaft and maintain a service record

Also seen stowed below decks is an Ikaros offshore flare pack in a waterproof canister. These have an expiry date of 12 / 2016. These must be disposed of legally. Advice on safe disposal can be obtained from the local MRCC office Dover 01304 210008

Recommendation

(Cat 1) Dispose of outdated flares legally. Obtain advice from MRCC office

k) <u>Skin fittings & seacocks</u>

Note; Bronze is conventionally an alloy of copper and tin, but the term is now popularly used to describe a wider range of copper based alloys which have no tin content but zinc and other elements which can provide similar dezincification resistance. There is no non-destructive test for alloy composition which is practical within the scope of this survey. Where visible casting marks or apparent magnetic flux can indicate a particular alloy, it will be described. Otherwise, where the term 'bronze' or 'brass' is used in this report it denotes a copper based alloy of indeterminate composition. (See explanatory note 7)

There are a total of 9 through hull skin fittings under the waterline. One is a spinner for the Sumlog speed and distance log recorded. This is under the saloon sole in the starboard side forward engine space and is a conduit for a rotating cable. This is well seated and free of evidence of leakage.

Four skin fittings are associated with the toilet compartments. The forward heads toilet skin fittings are both under the forepeak sole one either side. The flush water valve is a ¾ " Blakes conical plug valve. The discharge valve is a 1 ¼" Blakes conical plug valve. These were both hammer sounded for security and the handles turned freely.

In the same compartment is a 1" Blakes conical plug valve. This was similarly tested and found to be sound. This is for the deck wash and supplies an ITT Jabsco Water Puppy pump mounted on the bulkhead. This delivers seawater under pressure to a port fitting in the foredeck. This was not tested as the switch could not be identified.

The aft heads toilet skin fittings are both under the aft cabin sole one either side. The flush water valve is a ¾ " Blakes conical plug valve. The discharge valve is a 1 ¼" Blakes conical plug valve. These were also both hammer sounded satisfactorily for security and the handles turned freely.

In the after engine space on the starboard side are the two seawater intake valves for the engines raw cooling water. Both valves are bronze gate valves with a tall seawater strainer designed to stand above the static waterline. These valves were sound when hammer tested and the valve handles closed satisfactorily.

The final valve is for the holding tank drain. This is located in the starboard engine space under the manual bilge pump. It is a 1 ½" brass ball valve and could not be tested as it is under the exhaust hose and a maze of pipework. It is a recent addition and therefore assumed to be in a serviceable condition.

Where bronze valves are not marked for alloy quality the assumption must be that they are of an ordinary zinc brass. These valves and skin fittings should be regularly checked for dezincification. Where dezincification occurs in brass the metal turns an orange carrot colour and becomes dull when sounded.

When replacing valves or skin fittings always use dezincification resistant alloys which will be marked DZR or CR or with the alloy classification CW602N or CZ132. The Blakes conical plug valves are known to be made from a good quality marine bronze.

Not all the hose tails were seen to be properly fastened with double worm drive hose clips. Double hose clips should be used on all under water fittings. This is only where the hose tail is long enough to safely accommodate them. The second clip must seat comfortably within the length of the hose tail or it could actually cause the hose to become detached.

Recommendation

(Cat 1) Secure all the underwater skin fitting hoses with double hose clips

There is no bonding wire system linking a hull anode to all the skin fittings. These bondings are no longer considered best practice. *(See explanatory note 8)*

There are an additional 6 skin fittings in the topsides. These are drains for the basins, sink and electric and manual bilge pumps. There are no valves although above the waterline their security is less critical. All the hoses are in nylon reinforced PVC and are single hose clipped.

There are no tapered bungs attached to any skin fittings Tapered bungs should be instantly available for sealing a skin fitting in an emergency. It is advisable that a bung of the appropriate size should tethered to each skin fitting should it fail in service.

Recommendation

(Cat 1) Install appropriately sized tapered soft wood bungs tethered to each skin fitting.

I) Engine

The engines are Perkins HT6.354 Diesel engines. These are mechanically fuel injected 5,860 cc 6 cylinder turbocharged engines, intermittently rated at 145 hp at 2,500 rpm. This engine type was manufactured between 1968 and 1981 so are probably original These engines are an unusual configuration being a heavily slanted (60˚) version of the T6.354 with a modified crankcase and lubrication system. to reduce overall height.

The engines are matched pairs with the port engine having a conventional left hand rotation and the starboard engine a non-standard right hand rotation. This is viewed from the output shaft. This is a set up typical of the era when gearboxes were not designed to accommodate full power transmission in both rotations. When ordering parts it is essential that the engine rotation is quoted.

The height of the engines has also been reduced by use of a dry sump system. This involves having a shallow sump pan in which the oil is drawn out by a scavenge pump and delivered to an oil well. Oil is then pumped back into the engine oil ways by the engine oil pump after passing through an integral oil cooler and filter. Only Perkins oil filters must be used as they have a pressure relief valve incorporated.

The principal items that are unique to the horizontal engine are the scavenge pump, exhaust turbo extension, and the main engine block incorporating the oil cooler and oil well. These parts are all no longer available although there are some substitutes and other work round arrangements. For example, it is possible to use an electric scavenge pump in place of the engine driven pump.

The engines are in a fair cosmetic condition being painted in a broken coating of blue/silver paint. The rocker covers and pipework are lightly oxidised under the paint and some of the ancillaries. The injector pumps and alternators are unpainted or freshly painted indicating that they have previously been removed for servicing or replacement. The turbo charger on the starboard engine has clearly been recently replaced.

There is an area of surface corrosion on the port engine under the Jabsco raw water pump indicating that it has had a history of leakage. This appears now to have been repaired. The most vulnerable components to corrosion are the raw water cooled parts such as the turbo intercooler, exhaust manifold, exhaust turbo extension, gearbox oil cooler and the water injection elbow.

Where viewed these components all appeared to be in good order but the exhaust manifold could not be fully viewed as it is underneath the head. Unlike other engine manufacturers, Perkins did not fit sacrificial anodes into the raw water jackets to these components.

The engine were not started as the vessel was out of the water. It is understood that the vessel will have a full sea trial where the engines can be brought up to full working temperature and placed under full load. These engines have a reputation for smoking on start up and at idle. Turbo charged engine have low compression pistons and will smoke until turbo boost pressure builds. This is not necessarily a defect.

The engines are mated to Borg Warner 72C ‘Velvet Drive’ gearboxes. These are hydraulic reduction and reversing gearboxes. The ratios could not be read as the plates are hidden by the oil cooler mounts. These gearboxes are not designed to take full power in reverse as the hydraulic pump is run backwards.

This is the reason for the opposite rotation of the engines. The engines are flexibly mounted on steel channel section girders slung between the substantial transverse moulded floors. These appear solid and securely mounted into the hull. The engine mounts are not symmetrically arranged and so have very different loadings.

There are three engine mounts, one either side of the gearbox bell housing and a single forward mount on a cross beam slung between the girders. These must be ordered specifically for these engines as the forward mounts are unique to the engine type.

This girder type of installation can lead to higher engine noise due to harmonic vibration. The mounts were good with no signs of deterioration in the rubbers. The alternator and ancillary drive belts were tight and surrounding areas showed only light deposits of rubber powder.

The oil level was not checked as it must be done with the engine running at idle or immediately after shutting down. This is the only time when the oil will be in the correct position for the dipstick. Testing the oil level when cold will probably cause the oil level to be overfilled.

Overall, the physical condition of the engines was fair for their age and had indications of some recent servicing and replacement of components. These engines are very under stressed units running at semi-commercially rated revolutions. The expected rebuild interval for these engines would be 10,000 to 15,000 hours. The engine hours meter shows just 1,860 hours run.

m) <u>Fuel system</u>

The fuel tanks are welded and painted steel tanks each of approximately 450 litres capacity. The main tank is located between the propeller shafts under the after saloon sole. The secondary or reserve tank is located under the starboard aft cabin bunk. Both tanks are of 450 litres capacity and were 7/8th full according to the gauges at the helm.

What can be seen of both tanks are in good condition and there is no evidential leakage from either tank. The forward tank is filled by a deck filler in the adjacent starboard side deck, and the aft tank filler is on the starboard quarter. There is a large diameter fuel transfer pipe between the tanks with a shut off valve at the after end of the aft tank.

Fuel is fed from siphon fittings in the tops of the tanks to fuel valves under the steps of the companionway ladder. There are four valves enabling each engine to be run from either tank. The fuel is fed to twin CAV 796 element type fuel filters beside the main tank. These have water separator bowls under the filter bodies. Fuel is then fed to the engine lift pumps. All pipework is in solid drawn copper piping to a fitting beside each engine and then in flexible fuel hose to the lift pump.

There is a level sender in the top of each tank and fuel level is measured by twin moving coil fuel gauges on the helm switch panel. Both the fuel gauges indicated when the ‘fuel’ switch was thrown. Both showed 7/8th full which could not be corroborated, but assumed be accurate. All was in a good and leak free condition.

The fuel supply to the Webasto heater is from a small additional fuel tank under the port side deck. This has a separate deck filler. Fuel for other appliances should not be drawn direct from an engines fuel supply. If done so it can cause air locks in the engines fuel supply which stop the engines.

n) <u>Stern gear</u>

The propeller shafts are 1 ½ ” stainless steel held in clamp type couplings and driven through R&D flexible drives. There is an electrical bonding wire across both the couplings for cathodic protection. The couplings and bonding wires appeared to be clean and new. Possibly replaced to correct the electrolysis in the propellers.

The shafts turn in conventional stuffing glands. There is no evidence of leakage from the glands or deposits of salts on the stern tube flanges. There are no greasers fitted so the glands should be packed with pre-impregnated gland packing material. The dogging nut should be periodically tightened down to compress the packing. There is a gland with water feed from the engines raw water cooling system to cool the shaft logs.

The shafts are held in a small P bracket and a large A bracket bolted to the hull. These all contained brass cased cutless bearings. The shafts are firm in the bearings. The brackets are firmly mounted in the hull with no signs of movement or leakage. The hull laminations around the mountings was hammer sounded with no signs of delamination.

The propellers are matched 20” propellers with opposing rotation. They are 3 blade equipoise propellers. The blades showed slight magnetic flux indicating they were probably Manganese Bronze. This is not a bronze but a zinc brass with some manganese and iron added for some dezincification resistance. The iron accounts for the slight magnetic flux.

Both propellers are in an only fair condition with extensive shallow pits of erosion visible over the whole blade surface. These propellers have clearly had some past issues with electrolysis but the blades sounded good when rung. There was a good zero ohm electrical bonding recorded between the hull anode and the propellers on both sides. There was also good bonding to both the shaft brackets and the rudders.

A calculation based in the vessels dimensions and displacement, and the engine specification indicated that a possible peak performance of 15.4 knots should be possible. This is based on a lightly loaded vessel with a clean bottom and the engines delivering their quoted horsepower.

o) <u>Steering system and handling</u>

The twin rudders are cast bronze blades with integrated rudder stocks. These turn in bronze rudder tubes bolted and laminated into the hull bottom. The tubes have stuffing boxes in the upper ends. The blades and shafts were snug in the tubes. There is a cross beam carrying an upper rudder stock bearing. The rudders are in a fair condition considering that they are probably original.

The steering is a dual helm system with a mechanical drive system of shafts, universal joints and bevel gearboxes. This is a very efficient system, free turning and smooth in operation. Both wheels are permanently linked and there is a pendulum type rudder position indicator on the hub of each wheel.

The steering flat is behind a panel under the aft cabin joinery. The final gear box has a steering arm which operates directly on the starboard tiller arm. There is a drag link which connects to the port tiller arm. There is no obvious degree of slack in the steering ram or the drag link. All felt tight and smooth.

There is a linkage attached to the centre of the drag link which pivots on a fitting on the transom. This is for an emergency tiller to be attached and the steering linkage is light enough that it could be back driven. There was no tiller seen that could be inserted into the fitting. This should be located or replaced.

<u>Recommendation</u>

(Cat 1) Locate or replace the tiller for the emergency steering system.

Trim and level of the boat is assisted by trim tabs mounted on the transom. These are moveable stainless steel trim planes powered by hydraulic rams. The rams are all plastic and the system is powered by a Bennett hydraulic power pack mounted in the steering flat. The trim tabs are controlled by rocker switches at each helm. The rams have senders incorporated and there are linear indicator displays alongside the controls.

Low speed maneuvering is assisted by a Sleipner Side Power 80 kgf bow thruster in a tunnel in the forefoot. This has a joystrick control at each helm. This is a relatively new installation as the GRP bondings to the tunnel are overcoating the waterstaining from bilge water. All is a well executed install.

There is also an autopilot installed. This is a mechanical system by Normand Electrical Co (NECO). It has a course computer with trim and yaw controls at the lower helm. This unit gets its heading from an electronic transmitting compass located under the forward heads cupboard. This is a standard gimballed magnetic compass with an electronic sender incorporated.

The autopilot controls a gear motor with an electric clutch and sprocket and roller chain drive acting directly onto the lower helm steering hub. The system appeared to operate when tested although there is a heading deviation with the steering compass.If the system needs replacing the motor, clutch and drive can be retained and controlled by any modern course computer.

p) Anchoring and mooring gear

Stowed on the stem is an FOB anchor held within a hawse pipe. The stem has a scotch plate round the hawse pipe to protect the stem from damage. There is an uncalibrated length of 10mm welded link chain fitted which runs over a gypsy in the windlass and then through a chain pipe into the chain locker. This chain locker is accessed through a panel in the forepeak cabin.

The windlass is a Lofrans Cayman 1000 watt horizontal windlass with a drum and gypsy. The windlass appears well seated and secure. It appears to be in good condition although it has been painted over the original bare aluminium finish. There is a plug socket for a remote control but the remote control could not be connected as there appeared to be a broken pin in the socket.

Recommendation

(Cat 2) Remove the blocked pin socket for the windlass and test for function

The cast aluminium bow roller assembly is mounted on the stemhead. It has single roller shaped for warp. This a closed fitting with a cross over slot for the entry of mooring warps or chain. A large fisherman anchor and chain are seen stowed in the deepest part of the keel moulding.

There are two sets of chocks on the foredeck for the stowage of kedge anchors. Either side at the bows, mounted on the deck edge are bitts for mooring warps. Amidships is another pair, and a third pair on the aft quarters. All are in cast aluminium, are well seated and secure and lightly oxidised. There are no fairleads for any of the mooring cleats.

q) Heating and Air Conditioning systems

Installed in the port hull side is a 5kW Webasto Airtop 5000 diesel fueled warm air heater. The control unit is on the bulkhead to the galley and the unit exhausts through the port topsides. The unit couldn't be accessed to check for condition. The unit was powered up and worked producing warm air from outlets around the accommodation.

r) Sea toilet and shower compartments

There are two sea toilets, one in each en suite heads compartment. Installed in the forward heads compartment is a Blakes Lavac vacuum operated toilet. This uses a seal in the lid to close the bowl and a vacuum pump simultaneously draws out the waste whilst drawing in flush sea water. The vacuum pump is usually a large bilge pump type diaphragm pump, and this is installed in the bulkhead. This toilet has however been modified to electric operation with a Henderson electric diaphragm pump.

This is mounted under the forepeak sole. This is in-line with the manual pump which can still be used as a back up. The pump is operated by a timed air switch on the toilet bulkhead. The toilet is mounted on a plinth. The plinth is part of a grey GRP moulded module which includes a moulded basin inset in a worktop with cupboards beneath.

This also incorporates a shower tray and drain in the sole which is covered by a teak grating. The tray drains directly to a Jabsco water puppy pump in the bilge beneath and shower water is discharged through skin fittings in the topsides above the waterline.

The moulded basin has individual hot and cold faucets. Alongside is a shower mixer faucet with a shower head on a flexible hose. The rest of the fit out is in a tan coloured marble effect high pressure laminate faced plywood. There is also a shaver point, hand rail and a mirror. All is in good clean condition.

The after heads compartment is en suite with the master cabin. This also has a Blakes Lavac toilet with an electric pump under the sole and a manual pump in the bulkhead. Both these electric pumps worked when tested. This heads compartment is larger than the forward compartment and is also equipped with a shower head and a draining shower tray in the sole.

This compartment has a shower curtain on a track installed in the deck head. The moulded basin plinth is in the same grey gel coat with a cupboard beneath and the joinery all executed in the marble effect laminate plywood. there are similar additional toilet fittings.

Both toilets draw water and discharge through valves in the bilges beneath. There are also diverter valves in the discharge hoses which alternatively route the waste to a holding tank in the after starboard engine space. This is a rotationally moulded HDPE tank by Tek Tanks.

This Tank has five ports in the top, two inlets, two outlets and a vent. There are two means of discharging the tank. A manual Whale diaphragm pump is mounted above the tank and discharges through the through hull valve and skin fitting beneath which is previously detailed.

There is also a deck pump out fitting in the adjacent side deck. The vent pipe is the same diameter as the deck pump out pipe which is recommended. Many tanks have small vent hoses which can caused the tank to collapse under the vacuum from shore pump out stations.

s) <u>Fresh water system</u>

Fresh water is stored in a welded and painted steel water tank Located under the port bunk in the cabin aft. The water tank is filled from a flush deck filler in the after deck at the port quarter. Pressurised cold water is delivered by a Par Max diaphragm pressure pump located under the forepeak sole. There is an accumulator tank to smooth out the water supply.

The pump delivers water to faucets in the two heads compartments and the galley. It also delivers cold water to a 50 litre hot water calorifier located in the starboard side engine space. This is heated from the closed cooling system on the starboard engine.

There is also an immersion heater in the calorifier which runs off the shore power supply. Hot water is then also delivered to five mixer faucets. Outlets were tested and water was delivered. The tank water level is measured by a sender in the tank top and a moving coil meter displays at the galley. All appeared in good condition and well installed.

t) Galley

The galley is located on the port side of the saloon down a short companionway. The work tops are in a teak effect high pressure laminate and the joinery is in real teak veneered plywood. There is also teak effect laminate to the splash back paneling behind the sink and the cooker

The galley is in a line along the hull side facing outboard with an aft facing cooker athwartships at the after end. It is a narrow corridor with cove lockers opposite the worktops. Housed in the worktop is a stainless steel sink and drainer unit with a mixer faucet and there is a good teak fiddle rail to the front.

Stood on the worktop is a mains voltage microwave cooker which appeared to be in a good clean condition. The gas cooker is a Thetford Caprice Mk III and beneath the worktop is a front opening Camping Gaz T618 fridge. This is a triple fuel fridge capable of being supplied by 12volt DC or 240 volt AC electric and also butane gas. These gas appliances are both detailed elsewhere

The galley has good sized cupboards and drawers under the worktops and cove lockers behind and at each end. There is an extractor fan in one of the cove lockers and good ventilation through opening windows in the saloon sides above. All is in good and clean condition and the appliances appear to be of recent installation and little used.

u) Electrical system

There is a total of six batteries installed. These are installed in two 24 volt battery banks. Two 12 volt batteries in series for the 24 volt engine starting bank, and four 12 volt batteries in two seriesed pairs paralleled as a 24 volt domestic bank.

All the batteries are located under the galley sole in a secure battery compartment. The engine start batteries are 125 amp/hr 900 CCA commercial truck batteries which showed 25.37 volts when tested. These are isolated by a large rotary switch in the galley forward joinery. The domestic bank is isolated by a similar switch in the starboard saloon joinery cupboard.

The domestic services batteries are 120 amp/hr 750 CCA Exide heavy duty batteries which showed 25.20 volts when tested. These banks are charged by the engine alternators via a diode charge splitter in the engine bay. They are also charged from a sterling battery charger in the forepeak cabin cupboard.

There is a crossover switch in the panel in the galley which directs the battery charger supply to either the domestic services or the engine start batteries. This should be unnecessary as the charger has twin isolated outputs and can charge both banks simultaneously without bridging them.

Individual domestic services circuits are supplied by a 19 breaker switches in the same cupboard as the isolator switch. None of the switches except one are labelled for function, just numbers. There should be a key to the switch numbering but one could not be seen. All circuits were switched and tested.

Recommendation

(Cat 2) Label all the breaker switches for function.

Lighting to the cabins and the saloon are by fluorescent lights in the headlinings and the deck head which are switched at the bulkheads. There are also swivel downlighters to the bunks which are individually switched, and lights to the engine space. All worked when tested.

All the navigation and communication electronics will be tested during sea trial. The VHF was tested and voice was heard. It was noted that the MMSI number which has been issued to the vessel was not entered into the VHF memory. This must be done.

Recommendation

(Cat 1) Enter the MMSI number into the DSC function on the VHF

There is a pair of side navigation lights to the saloon superstructure and a stern light to the transom and a steaming light and an all round white anchor light to the radar arch. The steaming light did not work and the side lights have badly etched lenses which will cut down the light output.

Recommendation

(Cat 1) Repair the steaming light and replace the side light lenses

The horn worked when tested as did the fresh water pump and the bilge pump. There is a spotlight in the saloon coachroof head which is hand steered from below. This was powered up but the light did not work. This should be investigated and repaired.

Recommendation

(Cat 2) Repair the spotlight

There are also five 12 volt breaker switches which were also not labelled for function. There was no separate 12 volt system seen on board and a 12 volt supply must not be taken from one battery of a pair connected in series. Both batteries in a 24 volt bank should have identical load to prevent overheating and potentially discharging highly flammable hydrogen gas.

An independent 12 volt supply must be installed as either a dedicated 12 volt battery charged by a voltage dropper from 24 volts, or the system supplied by a transformer. This should be investigated. Modern navigation electronics are usually capable of using a wide range of input voltages.

Recommendation

(Cat 2) Investigate the proper installation of a 12 volts supply system

The 240 volt shore power input socket is located beside the upper helm. There is a consumer unit which has the vessels own RCD device and 2 separate MCB breakers. These supply the ring mains around the vessel and the immersion heater to the calorifier. The battery charger is plugged into one of the ring main sockets.

There is also no reverse polarity warning system. The live and neutral poles are reversible in Europe and all European sockets use double pole switching. UK sockets use single pole switching only which can cause problems when connecting to European marina supplies. (*See explanatory note 17)*

There does not appear to be a galvanic isolator in the shore power grounding wire. A galvanic isolator works to isolate all voltages below 2 volts whilst still allowing RCD devices to protect from earth leakage. Both of these devices would be recommended if the vessel is no be left connected to shore power or connected to continental shore power. (*See explanatory note 19)*

Recommendation

(Cat 2) Consider installing a reverse polarity warning device and a galvanic isolator

v) Gas system

The gas storage locker is under one of the seats in the cockpit. Installed are two 4.5kg gas cylinders with one connected via a regulator to the vessels gas supply system. It is usually recommended to replace gas hose every five years. The gas hose is dated 02/2012 and should be replaced.

Recommendation

(Cat 1) Replace the flexible gas hose in the gas locker

There is a T fitting and two separate isolation valves, one for the cooker and one for the fridge. There is also a gas pressure test point. Gas is delivered is drawn copper pipe through to the galley. The gas cooker is a Thetford Caprice Mk III which is a full sized four burner cooker with an oven and a grill. This is in a good clean condition and showing little sign of use.

The cooker has a shut off valve in the space under the cooker which involves removal of all the items stored in the locker. This is not convenient for regular use and the supply should be re-routed so that the shut off valve could be closed after every use.

Recommendation

(Cat 1) Re-route the gas supply to the fridge and install a shut off valve in a convenient position for regular access

In the galley is a CampingGaz T618 refrigerator. There is a shut off valve in the cupboard alongside. This is a triple fuel fridge capable of being supplied by 12 volt DC or 240 volt AC electric and also butane gas. The fridge when in gas mode appears to draw its combustion air from a vent in the joinery below and the flue appears to be routed to a vent in the topsides.

A fridge is classified as an unattended appliance so must be a room sealed device which means that it must draw combustion air from, and exhaust to outside the accommodation. Technically this installed fridge is not a sealed room unit and if run on gas it draws combustion air from the accommodation. Which can result in oxygen depletion. It should be investigated that the flue is intact and discharging all exhaust to outside the vessel.

Recommendation

(Cat 1) Investigate the fridge flue to ensure exhaust is ducted outside vessel

It should also ideally only be used on gas when the saloon is well ventilated with open windows or hatches. When on electrical power the fridge works by an electric heating element rather than the conventional compressor. This method of refrigeration is less efficient and so the fridge will use more 12 volt battery power than a compressor type fridge of the same size.

w) Firefighting equipment

There are five fire extinguishers seen on board. There are three 2kg 13A 55B C dry powder extinguishers, one in the forepeak, one under the companionway steps and one in the aft cabin. These all have a gauge showing good pressure but there are no service records attached.

There are also two fire blankets seen, one in the saloon and one located in the galley. All fire extinguishers are due an annual service and a discharge test five years after manufacture. On these smaller units the cost of a test and recharge is likely to be more than the purchase of new units.

Recommendation

(Cat 1) Service or replace all the manual fire extinguishers At least one extinguisher should be accessible outside the accommodation.

In the engine space are two automatic extinguishers. One is a BCF Halon 1301 and the other is Halon 1211. These extinguishant have been banned for leisure use in Europe since 1998. These extinguishers must be disposed of at a licensed recycling centre. Automatic engine space extinguishers should be Halon replacement gas type containing FM200, FE36 or FE125 heptaflouropropane extinguishant.

Automatic dry powder extinguishers should not be used in engine spaces as the powder can cause serious damage if ingested into the engine. Insurance companies have been known to refuse claims for damaged engines when inappropriate extinguishant has been used.

Recommendation

(Cat 1) Replace engine space extinguishers with Halon replacement gas extinguishers

x) Bilge pumping

There is an electric bilge pump installed in the hull bilges. The make and capacity could not be seen as it is at a low level in the bilge. It was seen to have an automatic float switch in circuit. This pump did however work when tested with the manual switch at the helm although there was no water to discharge.

There is a Whale manual bilge pump located in the engine space and this discharges water through the port topsides. The pump handle is located on clips on the panel alongside. This pump was tested but there was no water to discharge.

y) Interior fit-out

The fit-out is typical of a 70's / 80's vintage motor yacht. There is little use of internal tray mouldings. These are confined to individual modules for the heads and shower compartments. The accommodation is fully lined out with teak veneered plywood paneling and teak hardwood mouldings.

The fit out has been executed to a good basic standard which was current at the time of build. The joinery is quite heavily built and the cupboard doors open and close smoothly. The teak joinery is in good condition and finished in a satin effect varnish. This includes a fold down chart table in the saloon

All the companionway and cupboard doors are flush fitting and edge banded with matching veneers. These are all well fitted. Most of the cupboards and drawers use finger holes with internal brass catches to secure which are awkward in operation. There is a drop leaf saloon table which can be lowered to form an infill for an additional double berth with the dinette seating.

There is some water staining as already detailed, but this not in highly evident areas. There is significant water staining to the joinery in the corners of the saloon forward windows. This is almost certainly due to condensation rather than leakage and is not uncommon in vessels with large glazed areas. The glasshouse effect evaporates bilge water which then condenses onto the glass when cooling. This can be minimised by maintaining good ventilation.

The cabins headlinings are in a cream coloured vinyl stretched between battens fixed to the deck head. The heads and shower compartments are covered plywood panels retained with screws. These give access to cable runs and fastenings for deck fittings.

The forward and aft accommodation and the saloon soles are carpeted with a cream latex backed polypropylene carpet. This is in good condition and is not fixed down but close fitted to all the joinery. Some of the main lifting access panels in the saloon are carpeted and trimmed with aluminium flanged frames

All the saloon and cabin windows have cream cotton fabric curtains on tracks. All the window hangings are in good clean condition. Upholstery to the dinette and all the cabin bunks is in a light tan moquette fabric. All the foam to the seating is a good depth to the cabins and sculptured to the saloon dinette. This would have originally have been in a deep buttoned tan vinyl which is still in evidence on the bunk fronts and hull sides.

The accommodation is heated by a Webasto Airtop 5kw heater and warm air is ducted in insulated aluminium ducting to both the sleeping cabins and the saloon. The control is in the galley and the heater fired up and worked. In the saloon is a swivel chair and foot stool in a blue leather.

All the fit-out is in basically sound condition with minor imperfections. It has stood up well to 38 years of use and evidently been well cared for although much of the soft furnishings have been replaced over the years.

z) Additional equipment

The following equipment was seen on board the vessel. Inclusion does not guarantee that the equipment is necessarily included in the sale inventory

Sestrel Moore main steering compass
Lowrance HDS9M multifunction display
Lowrance 18” radar scanner dome
Hummingbird 150 Depth sounder and fishfinder display
NECO electronic compass display at helm
NECO gimballed electronic transmitting compass in forepeak
Standard Horizon Explorer DSC VHF, no MMSI installed
Standard Horizon Ram 3 VHF active handset
Extension VHF speaker to upper helm
Navico ES120 LED type depth sounder display
Sumlog speed and distance gauge, 0358.8 miles recorded
SEI AL12 TV and radio signal booster
Rocktrail 20 litre solar powered shower bag
Set of piped white vinyl cockpit cushions
Removeable pilot seat to upper helm
Engine bay extractor fan and ducting
Pioneer FM/Cassette player to saloon
Pioneer stereo speakers to saloon, untested
Brass cased clock and barometer set, working
240 volt electric kettle, working
Portable FM radio, untested
Seago 4 man liferaft, no service record seen
Quantity of auto inflating lifejackets
Blue polyester canvas full cockpit cover
Blue polyester canvas cockpit dodgers
Stainless Steel wire fender baskets on pushpits
Firdell Blipper radar reflector
Quantity of warps and fenders
Boat hook
Small safe in aft cabin
Handbooks and equipment manuals
Quantity of engine service spares
Ensign and ensign staff

4) Sea Trial

The engines were run briefly to calibrate the tachographs. They started almost instantly and settled into an even idle with a small emission of grey smoke. The engines revolutions were measured with a digital optical laser revolutions counter acting directly on the crank shaft pulley. All readings were taken from the instruments on the lower helm.

Engine	Displayed rpm	Actual rpm
Port engine	1000	959
Starboard engine	1000	985

The tachograph calibration tests showed that both engines tachographs were slightly over reading but by varying amounts. The subsequent trial engine revolution measurements were adjusted by down by 4.1% (port) and 1.5% (stbd) where relevant.

The engines initially emitted small amounts of grey smoke at idle. This is not unusual for cold diesel engines, particularly engines with pressure induction systems such as turbochargers. The compression ratios are lower than for naturally aspirated engines until the temperatures and pressures build. Once the engines warmed to running temperature the smoke disappeared. A series of runs were made at different engine revolutions.

The speeds selected were at idle, at a typical restricted speed limit, at an optimum cruising revolutions at 70% to 80% of the maximum, and at peak power. Performance was therefore measured at 700 rpm, 1,200 rpm, 1,500 rpm and at full power rpm which was around 2,100 rpm. Two opposite runs on a compass bearing were made at full power to compensate for the tide. This was seen to be running at 1.7 knots and all other observations were adjusted by that figure for accuracy.

Sound levels were also measured in the saloon at different engine revolutions. This is an indication of sound proofing of the engine compartment and the comfort of the crew. The Health and Safety Executive gives the maximum safe exposure time for sound levels above 85 Db at eight hours. A 3 Db increase is double the noise level and the safe exposure time is halved

Engine revolutions	GPS Speed (knots)	Sound (Db)
700 rpm	4.9	64
1,200 rpm	6.9	75
1,500 rpm	9.1	77
2,100 rpm (ave 2 runs)	14.1	80

This maximum performance is slightly below the theoretical maximum. A calculation based on waterline length and beam, displacement, engine power and drive train characteristics indicate a theoretical maximum speed of 15.4 knots. At this speed the engines should be achieving within 200 rpm of their maximum revolutions of 2,400 rpm.

The performance figures assume a lightly laden boat and a clean bottom. The trials were made with five persons on board and nearly full tanks. There was also a slightly swell running. There were also high air temperatures which will reduce the engines thermal efficiency. Engines will also lose power slightly over time. The performance was therefore considered to be adequate for the conditions and circumstances.

The engines were also subjected to a stress test. This involves runs with one engine at full power and the other engine at idle. This tests the comparative output as each engine and each drive train and propulsion system is placed under full and equal load.

Engine under load	Revolutions	GPS Speed (knots)
Port engine	1,900 (1,820) rpm	8.8
Starboard engine	1,800 (1,775) rpm	8.8

In these tests it is seen that the engines are delivering identical performance at slightly different engine revolutions, although after compensating for calibration they are actually quite similar. This calibration does however assume that errors are consistent across the revolutions range.

The vessel was also subject to a cavitation test. This places one engine at full power ahead and the other at full power astern. This is to attempt to cause the propellers to cavitate and loose thrust, and therefore tests the efficiency of the propellers. The vessel rotated as exactly as possible within its own length on both rotations showing a good efficiency on both shafts.

The engines exhibited no unusual sounds or vibrations during the power runs. As already noted, there were apparent emissions of grey smoke at the first start up. Grey smoke is usually a mix of unburned fuel (black smoke) and water (white smoke). This is a common result of a combination of low initial compression causing incomplete fuel burn on start up, and condensation burning off. Water will condense out of the exhaust gases trapped in the engine when it cools from the previous operation.

There were also emissions of blue smoke when the engines were throttled up after clearing the berth. Blue smoke is usually from burning oil. The engines at this point were not up to running temperature and so had not reached their operating tolerances. There will be leakage past the piston oil control rings. Neither of these emissions are unusual for engines of this type and age.

The engine temperature and pressures were recorded after the full power trials. The engines were scanned and videoed using thermal imaging and spot temperatures were recorded. It is difficult to measure exactly the same point on each component due to access. Oil pressures were recorded from the helm gauges.

	Port engine	Starboard engine
Oil Pressure	40 psi	50 psi
Block temperature	92˚c	84˚c
Turbo temperature	140 ˚c	127˚c
Head temperature	83˚c	81˚c
Heat exchanger temp	38˚c	35˚c
Gearbox temperature	41˚c	39˚c

There are engine temperature difference across the two engines. The port engine does seem to be showing consistently higher temperatures, and it is also showing a slightly lower oil pressure which would be the consequence of temperature leading to a drop in viscosity.

Overall however, the temperatures seen were not excessive in any area given that it was a warm summers day. The thermostats are intended to open at 80˚c and will maintain temperatures at a point generally above that level. Overtemperature alarms are usually set to react at 100˚c. There is no direct cooling to the turbo or the block below the cylinders so these would be expected to run at a higher temperature.

The cooling system to the starboard engine appears to be running more efficiently that the port engine. These temperatures were taken immediately after full power runs and the differences reduced as the engines cooled. Blockages in the raw water side of heat exchangers and oil coolers can be caused by the salt precipitating out of seawater at high temperature.

There are also no anodes in the raw water cooling system on these engines so the heat exchangers and oil coolers are prone to developing galvanic erosion of the alloy depositing onto the copper cooling pipes. It would be recommended to flush the raw water cooling systems with proprietory descaler to remove mineral and biological deposits.

Recommendation

(Cat 2) Flush through and clean both the raw water and closed cooling systems with proprietory descalers and fouling removers.

It was also observed that both the turbo boost gauges were showing negligible boost pressure which eventually reduced to zero boost as the engines warmed. This was despite the turbos being clearly heard spinning during the sea trial.

The engines were also delivering close to their intended power output so there was clearly some boost pressure being delivered. The gauges are aneroid gauges supplied by a simple capiliary tube which could be leaking or alternatively being blocked by oil and carbon. This should be investigated.

Recommendation

(Cat 2) Investigate the turbos and capillaries for apparent zero boost pressure

5) Summary of Recommendations

This is intended as a check list. Full details must be read and can be found in the body of the report. Page references are given (p#)

Category 1 Recommendations are safety related defects which should be corrected before the vessel is put into commission.

(p13) Install battery/bulb as necessary to light and mark lifebelt with name
(p13) Investigate the history of the liferaft and maintain a service record
(p13) Dispose of outdated flares legally. Obtain advice from MRCC office
(p15) Secure all the underwater skin fitting hoses with double hose clips
(p15) Install appropriately sized tapered soft wood bungs to each skin fitting
(p19) Locate or replace the tiller for the emergency steering system.
(p23) Enter the MMSI number into the DSC function on the VHF
(p23) Repair the steaming light and replace the side light lenses
(p25) Replace the flexible hose to the gas locker.
(p25) Re-route supply to cooker and install valve in good position for access
(p25) Investigate the fridge flue to ensure exhaust is ducted outside vessel
(p26) Service or replace all the manual fire extinguishers
(p26) Replace engine extinguishers with Halon replacement gas extinguishers

Category 2 Recommendations relate to defects which affect the efficient operation of the vessel in normal use and should be attended to at the earliest opportunity. They do not affect the safe operation of the vessel.

(p10) Investigate the poor alignment of the mortice lock to door and repair
(p11) Water test windows for leaks and reseal the leak to the port quarter.
(p20) Remove the blocked pin socket for the windlass and test for function
(p23) Label all the breaker switches for function.
(p24) Repair the spotlight
(p24) Investigate the proper installation of a 12 volt supply system
(p24) Consider installing reverse polarity warning device and galvanic isolator
(p31) Flush through and clean both the raw water and closed cooling systems
(p32) Investigate the turbos and capillaries for apparent zero boost pressure

6) Conclusions

[redacted] is an example of a popular class of semi displacement motor yacht. The design concept favours the good seakeeping abilities of a radius chine semi-displacement hull with a deep keel for good directional stability. This is combined with a large deck saloon, good sized cockpit and a secure, full walk round deck.

Brooms background in the building of commercial hire vessels for the Broads has led them to eschew the trend toward light displacement deep V planing hulls. The weight of this vessel is more than an equivalent modern continental built motor yacht. The engines, although of a similar capacity, only deliver half of the output. This kind of vessel will endure longer and in better condition than the current genre of lightly built performance planing hull motor yachts.

This boat is a testament to that concept. Although now 38 years old the hull and superstructure are relatively unmarked. The few defects are around the stem and flanks which are always vulnerable to berthing damage. The accommodation is in a good, clean and functional condition. There is some moisture ingress into the deck core which is not unusual for a vessel of her age. This is not at a saturation level and the skins are still well bonded.

The engines are an old technology and there are reports of parts that are hard to obtain. The Broom owners community have found ways around most of the likely problems. The engines are very lightly stressed low revving units that have long rebuild intervals and the hours recorded indicate that they should have some good years of service ahead. The sea trials showed good performance quite up to expectation given the engines age and conditions.

The engines have been well maintained and regularly serviced, and there are indications of many items having been replaced to keep them up to condition. The navigation and communication electronics have been replaced and good investment has been recently made in a bow thruster, a holding tank, new upholstery and galley appliances.

The recommendations list is long and includes many duty of care issues intended to bring the vessel up to current safety standards. There are also some time expired items that need replacement. The list also includes some minor problems that are easily rectified. There are no significant structural or mechanical defects reported.

The vessel is a good prospect for a purchaser when considering the basic soundness and good cosmetic condition, combined with the considerable recent investment made. It does however need prompt attention to the safety issues noted, particularly if taking the vessel offshore. When completed the vessel will be in a safe and efficient condition, capable of many more years of reliable service.

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