Commodities International Shipping and Survey

**CISS GROUP North America Ltd.**

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# VESSEL GENERAL CONDITION INSPECTION REPORT

## Tug boat "H.N. HODDER"

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| **Address of inspection:** | **16031 River Road, Richmond, B.C. Canada V6V 1X5** |
| **Date of inspection:** | **October 10-th, Oct.13-th 2024** |
| **Time of inspection:** | **12:50 – 4:00 PM, 9:30-11:30 AM** |
| **CUSTOMER:** | **Hodder Tugboats CO. LTD.** |
| **Vessel particulars:** | **Official Number: 801590**<br>**Year Built: 1981**<br>**Port of Registry: VANCOUVER, BC**<br>**Vessel Type: TUG**<br>**Gross Tonnage: 74,99**<br>**Net Tonnage: 21,66**<br>**Vessel Length (m): 17,08**<br>**Vessel Breadth (m): 7,02**<br>**Vessel Depth (m): 2.41**<br>**Engine Description: 2 @ Mitsubishi**<br>**Model S6A3-Y3MPTK-4**<br>**Propulsion Power: 1.086 BHP** |

Based on the survey inspection, the technical condition of the tugboat **"H.N. Hodder"** was evaluated while it was afloat at the Hodder Tugboat Co. Ltd. dock in Richmond, BC. The inspection evaluation is descriptive and based on an engineering analysis.
The key findings are as follows:

## I. Hull and Deck Structures:

The hull is in satisfactory condition overall; however, corrosion is evident, particularly around the fenders, sides, and deck rails. There are signs of significant surface metal deterioration, which may indicate a reduction in hull thickness in certain areas. The underwater portion of the hull was not accessible for inspection since the vessel was afloat during the survey. Inspection of the internal accessible areas revealed the bottom plating to be in good condition, with no visible dents or significant corrosion.
Recommendations for Continued Service: To ensure the vessel's continued safe operation, it is recommended to conduct sandblasting followed by the application of protective anti-corrosion coatings. Additionally, thickness measurement of the corroded zones using non-destructive testing techniques (such as ultrasonic thickness gauging) is advised to identify sections requiring repair or replacement.

## 1. Bow and Stern Sections and Fenders.

The tugboat's bow and stern areas, including fendering systems and steel structures, show wear and corrosion. Rubber fenders are in good condition but in some places exhibit physical deterioration, reducing their effectiveness in protecting the hull during maneuvering and docking. Metal brackets and welded joints display clear signs of rust, suggesting the need for immediate anti-corrosion treatment and potential replacement of certain elements. Although worn, the fender system still fulfills its function of protecting the hull from impact during docking, maneuvering and other operations.

## 2. Mooring Equipment.

Visible corrosion on mooring equipment, including bollards, fairleads, and winches, suggests reduced reliability in service. Bolt connections show signs of corrosion, which could lead to weakened connections under load. It is necessary to remove corroded fastenings and replace them with new or anti-corrosive materials (stainless steel or zinc-coated alloys).

## 3. Winch and Mooring Devices.

Winch mechanisms and mooring devices require internal cleaning, inspection of blocks and cables, and replacement of worn parts. A thorough inspection of all load-bearing assemblies and tensioning devices is crucial to ensure safe operation.

## 4. Deck Covering (wooden protection).

The wooden deck covering shows severe wear and biological/physical damage. The surface is deformed, potentially compromising crew safety. Replacement of damaged deck sections is required.

## 5. Strength and Reliability Assessment.

The existing damages are not critical but require restoration. Fender systems continue to serve their protective purpose, but their wear may lead to hull damage if replacement is delayed.
Operational Suitability:

Despite the corrosion and wear, the overall hull structure remains stable. If preventive measures, such as anti-corrosion treatment and replacement of worn components, are undertaken, the tugboat can continue its operations at full capacity.

Recommendations for Repairs and Upgrades:

*Hull:* Sandblasting of the hull and fendering system (metal parts, bolts) is necessary, followed by the removal of rust and the application of primer paint and multi-layer anti-corrosion coatings. Additionally, hull thickness should be measured in critical areas, with possible local repairs or replacement of metal panels.

*Deck:* The complete replacement of the wooden deck covering is recommended, using panels treated with antiseptic and anti-corrosion compounds capable of withstanding marine conditions.

*Mooring Equipment:* All corroded fastening elements should be replaced. Servicing of winches and tension mechanisms should be conducted. Braking lines should be inspected thoroughly. Structural load-bearing parts and force transmission systems should be inspected and repaired.

Economic Justification: Performing the necessary repairs, addressing corrosion, replacing or repairing fenders, and renewing protective coatings are justified for extending the service life of the vessel. Upgrading the hull protection system could reduce long-term operational costs and prevent further damage. Preventive repairs are economically advisable, rather than delaying them to a later stage, which could incur higher costs.

## II. Main Deck and Machinery

### 6. Bow Deck.

The bow deck is fitted with a drum-type anchor windlass equipped with a large reserve of anchor chain, coiled on the drum. The windlass and chain show signs of corrosion, indicating the need for repair or, at the very least, anti-corrosion treatment. Despite the corrosion, if the mechanical components (gears, shafts, axles) are operational, the equipment can be restored with minimal cost.
Stored within the forward bulwark are a spare anchor and davit, serving as emergency equipment. The starboard bulwark is equipped with an anchor hawse pipe through which the anchor chain is tensioned during anchoring operations.
A central fairlead is located in front of the bow fitting, securely fastened to the bow deck, ensuring reliable mooring and towing operations.
Standard mooring bitts are installed for line handling. The external condition of the bitts is satisfactory, with paint wear and minor corrosion, expected in marine operations. However, the mechanical integrity remains, making them suitable for continued service.

The vessel employs synthetic ropes/lines in green and red. While their appearance suggests normal wear, routine fiber inspections are necessary to prevent line breakage under heavy loads. They are currently fit for service, though regular monitoring for mechanical damage and wear is recommended.

Some control components, such as hydraulic drives, show rust. Hydraulic connections require replacement or repair to prevent oil leaks. Some parts display cracks or mechanical damage, potentially impacting reliability. A thorough inspection and overhaul are recommended.

Deck lighting is provided by projectors located around the perimeter of the bow, which facilitates good visibility and safety of work at night and in poor visibility conditions.

On the bow deck's centerline, just ahead of the wheelhouse, a raised 22-inch hatch with a triple-spindle emergency evacuation mechanism is installed. Nearby is a vent cap, providing natural ventilation to the internal engine room compartments. The ventilation ducts and hatch are painted and in good condition. However, the hatch shows surface paint wear. These components remain operational but require routine maintenance to prevent rust. Overall, the technical condition is satisfactory.

The bow deck is also equipped with ventilation openings and signal devices, ensuring ventilation for technical compartments and audible signaling during maneuvers or mooring operations.

All windows, ports, doors, and hatches on the exterior of the wheelhouse were inspected and found to be in good condition. The external paintwork of the superstructure shows minor cosmetic imperfections, such as chips and discoloration (slightly faded), but remains functional, providing adequate protection against the elements.
The wheelhouse (navigators watchman bridge) and upper deck equipment, including life-saving appliances such as lifebuoys, appear to be in good condition.
All communication equipment, antennas, radar, and lighting systems are securely mounted on the mast and are in good condition, with no visible signs of corrosion or damage, and no noticeable deterioration.

## 7. Aft Deck Equipment.

The aft deck is equipped with a towing winch fitted with a galvanized towing wire.
The winch serves as the primary mechanism for winding and controlling the towing cables, featuring a steel drum for the wire and linked to a hydraulic control system. The winch and its components show signs of corrosion, indicating prolonged use in a marine environment.

The hydraulic hoses and metallic parts appear worn, though they seem to retain functionality. The hydraulic cylinders require anti-corrosion treatment.
The gear system displays wear but is covered with fresh grease, which indicates ongoing maintenance. Despite the visible wear on the gear teeth, their shape does not show critical damage. However, regular monitoring of gear engagement and metal tooth wear is recommended. The gear system is currently suitable for operation but will require future maintenance and observation.
The wire-winding mechanism exhibits signs of aging, with oil contamination and rust present. However, the visible components do not show any critical damage that would jeopardize operational reliability.
Visually, the towing wire rope is in good condition, although there are signs of rust, likely from the towing roller.
The hooks and shackles are covered with rust, indicating the need for replacement or repair. The visible wear on the metal suggests regular maintenance is required, with some parts potentially needing partial replacement. Despite the corrosion, the structural integrity remains sound.
On the starboard side of the aft deck, opposite the aft side of the wheelhouse, are the controls for the stern engine and winch.
The remote control system for various deck systems includes a panel with levers and buttons for operating different mechanisms.
The winch control panel includes several controls, such as switches and indicators for operating various ship systems: pumps, lighting, ventilation, and the fire system. The control housing and elements appear relatively new, and the equipment is likely fully functional.
On the left wing of the control panel roof, a marine-grade spotlight is mounted on a specialized bracket to illuminate the rear-central and right-side areas. The control lever for the spotlight is conveniently positioned adjacent to the main control panel
At present, there are no clear signs of malfunction or the need for immediate repair. However, as with all ship systems, this equipment requires regular inspection and maintenance. It is recommended to check the contacts and switches for signs of oxidation and monitor the hydraulic systems and pressure gauges to prevent future breakdowns.
Additionally, the aft part of the tug is fitted with an aft bulwark and a stern roller.
The towing hook roller also shows signs of wear.
On the aft deck, opposite the aft side of the wheelhouse, exhaust outlets pipes are located on both the starboard and port sides.
These serve to discharge exhaust gases from the ship's engine.

Ventilation ducts are installed to ensure air circulation in the engine room and other technical areas of the vessel. There are also fire extinguishing system components on the tug.

A fire hose is neatly coiled in a metal fixture on the deck. Its condition is visually satisfactory, with no visible cracks or damage, indicating that it is suitable for further use. The hose is essential for supplying water in case of a fire. Its operational suitability is high, but due to potential environmental exposure, regular checks for leaks and integrity are recommended. For improved reliability, periodic lubrication and care for the fixtures may be necessary.
Corrosion is visible on the fire main, shut-off valves, pipelines, and fittings, indicating a need for maintenance and possibly partial replacement or anti-corrosion treatment. These pipelines and valves are key components of the fire suppression system, and their condition directly affects the safety of the vessel. The condition of some valves and the fittings is unsatisfactory due to severe rust, which may compromise the system's seal integrity. Cleaning, applying anti-corrosion coatings, and checking system tightness are recommended.
The fire protection equipment, including hoses and fittings, requires preventive inspection and maintenance. Overall, the system is operational, but in the long term, it may require modernization and anti-corrosion repair. For enhanced operational reliability, it is advisable to maintain regular inspections of all system components and monitor the condition of shut-off valves and pipelines.
In conclusion, the deck equipment presented is in a satisfactory condition for operation. However, monitoring should be increased for certain components, such as the gear systems and winch cables, and anti-corrosion measures should be implemented.

## III. Boat Deck

The port side handrail of the boat deck is equipped with a properly labeled lifebuoy with a lifeline. This side of the deck is also fitted with an Ocean Signal EPIRB1 Pro emergency radio beacon (EPIRB) and a SART (Search and Rescue Transponder).
The starboard side handrail is equipped with a properly labeled lifebuoy that features a "Man Overboard MK9" emergency signaling device from Pains Wessex for rescue operations.
Two Spotlights with a power of 500 watts each are mounted on special brackets on the handrails of the boat deck, at the rear corners on both the starboard and port sides.
According to the markings, the spotlight uses the SPD12-10KA surge protection system, designed to operate at 240V and a frequency of 48-62Hz. The spotlight is classified as IP65, indicating its dustproof and waterproof properties. This spotlight is used to illuminate the aft section and lateral hemispheres of the vessel, ensuring safety during nighttime maneuvers and operations in low-visibility conditions.

A plastic toolbox is installed on the aft side of the port side of the boat deck, containing Shell SRS 2000 grease cartridges and a Milwaukee grease gun. The Shell SRS 2000 is a water-resistant, semi-synthetic grease designed for use in extreme conditions, particularly in marine

environments, while the Milwaukee grease gun ensures precise and efficient application of the grease to the equipment.

The two fire buckets on the starboard aft side of the boat deck are in excellent condition and appear brand new. Their pristine state ensures they are fully ready for immediate use in case of an emergency, contributing to the overall fire safety preparedness of the vessel.
The aft edge of this deck secures the front side of the funnel casing for the exhaust system.

## IV. Flybridge and House Top

Access to the flybridge is via a ladder from the starboard deck aft of the wheelhouse.

The flybridge is equipped with a dedicated control console.
It is a comprehensive interface for tug control and navigation, incorporating key elements for safe and efficient vessel operation.

*Steering Wheel:* Central to the console, the wheel is used for manual directional control of the rudder, connected to the vessel's steering system.
*Throttle and Gear Controls:* The chrome throttle lever allows precise control of the engine's forward, neutral, and reverse operations. The buttons on the handle include functions like "Sync" and "Troll Slow" for throttle synchronization and trolling speeds, essential for controlled movements in tight spaces.
*Rudder Angle Indicator:* The Kobelt rudder angle gauge provides real-time feedback on the current rudder position, allowing the operator to monitor and adjust the vessel's direction accurately.
*Engine Monitoring Gauges:* Pressure and temperature gauges, such as the Green Line gauge, monitor critical engine parameters, ensuring the vessel operates within safe limits.
*Communication Systems:* An ICOM VHF radio is mounted for direct communication with other vessels and the harbor. This device is crucial for coordinating operations, especially during docking, towing, and emergency scenarios.
*Hydraulic System Controls:* Joysticks and other switches are likely linked to the tug's hydraulic winches or thrusters, providing direct control over these systems, which are vital for towing and positioning the tugboat.
*Navigation and Lighting Controls:* The array of switches, including controls for the navigation lights, deck lights, and perhaps winch operations, are essential for managing the tugboat's visibility and functional systems during nighttime operations or poor visibility conditions.
*Electronic Engine Controls:* The ComNav system indicates this vessel is equipped with electronic throttle and gear control for smooth and precise adjustments of engine speed, contributing to

efficient maneuvering.

The forward face of the console is fitted with a 3 trumpet Airschime ship's whistle.

Overall, the console integrates multiple operational and safety features, ensuring both manual and automated control over critical systems. Regular maintenance, especially for electrical and hydraulic components, is essential to ensure continued reliability.

The starboard and port sides handrail of the flybridge are equipped with properly labeled lifebuoys, each fitted with lifelines.

The starboard and port wings of the flybridge are equipped with float-free cradles, each holding a Survivetek SAS 6-person SOLAS B-compliant life raft.

The port aft side of the flybridge carries an emergency spill kit.

The marine radar antenna unit from Furuno Electric Co. Ltd., model RSB-0070-085A is fitted to an elevated stand to port of centerline. This marine radar system has a compass-safe distance of 1.95 meters in standard mode and 1.2 meters in steering mode. The unit was manufactured in 2016, as indicated on the label.

The marine radar antenna unit manufactured by Furuno Electric Co. Ltd. The model is RSB-0070-086A with the specific IP Code IP26 for water and dust protection is fitted to an elevated stand to starboard of the centerline.
The radar unit has a compass safe distance standard of 1.00 meters and a steer distance of 0.60 meters. The serial number is R000-0910-5027, and it is made in Japan. The unit was manufactured in 2020 and complies with FCC and IC standards under specific certifications for maritime use.

Two marine-grade spotlights, manufactured by The Carlisle & Finch Co., model number 104105, are installed on elevated mounts located at the forward corners of the flybridge, on both the starboard and port sides. These spotlights are remotely operated from the wheelhouse.
This type of spotlight is designed for use in marine environments, providing powerful illumination for nighttime navigation and operational tasks. The spotlight's robust design includes weatherproof housing to protect against harsh marine conditions, with corrosion-resistant fasteners and components.
The fixture is mounted on a rotating bracket, allowing for easy adjustment of the beam direction to aid in maneuvering and other deck operations.

Navigation lights are mounted at the forward ends of the flybridge wings, adjacent to the wheelhouse, and are in good operational condition.

Two spotlights, each with a power of up to 500 watts, are mounted on the flybridge handrails on both the starboard and port sides. The spotlights are rated IP65, indicating they are dustproof and waterproof. These lights provide additional illumination for the vessel's lateral hemispheres, ensuring safety during docking maneuvers at night or in poor visibility conditions. The lens of the starboard spotlight is damaged and cracked, which may lead to loss of sealing and failure of the LED arrays. To maintain functionality, the glass should be replaced and resealed or a new spotlight installed.

The central mast of the tugboat, made from marine-grade aluminum alloy, is in good condition and resistant to the harsh marine environment. The following devices and equipment are installed on it:

- Weather station for measuring and monitoring atmospheric conditions.
- The antenna unit of the marine satellite internet system, VSAT Intellian, along with its antenna and protective dome, is mounted on a dedicated platform located on the forward section of the central mast.

Intellian’s highly efficient RF design delivers the best performance compared to other class systems, enabling higher data rates. The Intellian VSAT is ideal for commercial vessels, where uninterrupted communications are required.

- Navigation lights appropriate for towing operations.
- Floodlights/spotlights: positioned at various angles to enhance visibility during night operations or in poor weather conditions, with an approximate power rating of 500 watts each.
- Communication antennas for systems such as VHF radio and radar, ensuring efficient communication and navigation.
- Radar unit: Mounted higher for optimal detection of obstacles and navigation in fog or low-visibility conditions.
- Thermal or night vision cameras, employed for monitoring and navigation in low-light or poor visibility environments.

At the base of the mast, there is a well-organized electrical terminal box containing two separate busbars. The left side is designated for 110V AC connections, while the right side is allocated for 24V DC. The wiring is meticulously color-coded and labeled for straightforward identification and maintenance. The system appears to be well-insulated and shielded against environmental exposure, thanks to the gasket lid of the box. The wires are routed neatly through sealed grommets, ensuring a water-resistant connection at the cable entry points.

## V. Interior spaces. Wheelhouse.

The wheelhouse is arranged with a central control console and side consoles to the right and left. The following instruments and equipment are visible on the central console of the tug's bridge:

1) Steering wheel: a traditional metal wheeled steering wheel used for manual steering and control of the vessel's direction. Main engine throttle control: located to the right of the wheel, these levers are used to control the speed and power of the engines, which is critical for maneuvering during towing and docking.

2) Navigation systems: the central console features multi-function displays, including a GPS heading indicator and potentially radar displays, providing important navigation data such as speed, course, and obstacles.

3) Magnetic compass: located centrally at the wheel, allows manual and accurate navigation even in the event of failure of the electronic systems.

4) Alarm and indicator panels: including engine start/stop buttons and various warning lights (green for operating status, red for faults), these panels offer essential monitoring and control functions.

5) Communication systems: The top panel shows the VHF radios needed to communicate with nearby vessels and port authorities. Together, these components allow the tug captain to safely operate and steer the vessel in a variety of conditions and tasks.

6) On the central control panel of the tugboat, we observe three throttle control stations for the vessel's propulsion system. These stations are located at different positions: the midships station, the port wing station, and the starboard wing station. Each control lever set allows for the synchronization (SYNC) of engines, slow trolling (TROLL SLOW), and system checks. These throttle controls are critical for maneuvering during towing operations, providing precise speed regulation for each engine, essential for tugboat handling and docking operations.

The integrated navigation and control system, positioned centrally on the tug's main control panel, consists of several key components:

7) Simrad Autopilot System: A digital autopilot providing crucial navigational data such as heading, course over ground (COG), and speed over ground (SOG), aiding in automated steering.
8) Kobelt Rudder Angle Indicator: An analog instrument showing the rudder's deflection from the centerline, ensuring precise maneuvering.
9) CANSTAR Marine Interface: A digital system, potentially managing critical vessel functions, likely integrated with the towing or navigation controls, ensuring efficient operation and system monitoring.

These instruments are essential for maintaining accurate heading, rudder control, and overall vessel navigation, especially during towing maneuvers.

10) On the left and right sides of the main control console, two Furuno radar displays are installed, critical for the tugboat's navigation and obstacle detection. These radar systems provide real-time information about nearby vessels, landmasses, wooden logs and navigational hazards, aiding the crew in making informed decisions. They are especially useful during conditions of reduced visibility, such as fog, nighttime operations, or heavy weather. The radar's clear interface, with distance scales and time markers, allows the navigator watchman and wheel operator to safely execute maneuvers like docking, undocking, and navigating in congested areas.

11) On the right side of the main console, there is an Electronic Chart Display and Information System (ECDIS), a specialized marine navigation system that integrates digital nautical charts with real-time data from sensors like GPS. ECDIS provides critical information such as vessel position, speed, heading, water depths, and navigational hazards. It is essential for route planning, monitoring, and collision avoidance, ensuring safe navigation, particularly in challenging environments or busy waterways like the Fraser River shown on the display.

On the left side of the central console are located:

12) VHF Marine Radio (Furuno): The top device in the panel is a VHF radio, critical for ship-to-ship and ship-to-shore communication. It ensures coordination with other vessels, harbor authorities, and emergency services.
It operates on marine VHF frequencies for communication in busy waterways or emergencies.

13) AIS (Automatic Identification System, Furuno FA-150): Below the VHF radio, this system

transmits and receives data about the vessel's position, speed, course, and identification to nearby vessels and maritime authorities. This is crucial for avoiding collisions and improving navigational safety.

14) Navtex Receiver (Furuno NX-700): The Navtex receiver gathers navigational and meteorological information, crucial for keeping the crew informed of weather warnings, navigation hazards, and other essential information in text format.

15) ALP610 Alarm Panel: This alarm monitoring system tracks critical parameters such as engine oil pressure, engine room bilge levels, battery voltage, and fire alarms. Red lights indicate faults or alarms for various systems, allowing quick identification and response to prevent or manage emergencies.

**The internal telephone system and engine control breaker panel.**

*Internal Telephone System:*
This is a Newmar Phone-Com shipboard intercom system, allowing communication between various parts of the vessel, including the wheelhouse, galley, skipper's cabin, mate's cabin, and other compartments. The labeled keys facilitate direct connection to specific areas, enhancing onboard communication.

*Engine Control Breaker:*
This breaker switch is part of the vessel's control system, used to activate or deactivate the engine control system, ensuring safety during operations.
These systems are vital for crew coordination and operational safety.

On the right side of the central console are located:

Bilge Pump Control Panel: This panel consists of three bilge pump switches, each having automatic (A), manual (M), and off (OFF) modes. These pumps are critical for managing water accumulation in the vessel's bilge, ensuring the tug remains stable and preventing flooding.

Wheelhouse Breaker Panel #2: This is a DC distribution panel that monitors and manages 24-volt DC electrical systems on board.

The panel includes breakers for individual circuits, and the analog gauges at the top display the system’s voltage and amperage, helping monitor power consumption and battery health.

At the top of the center console are several important navigation and communication devices:

- Furuno GPS GP-39: A GPS providing accurate positioning data, including latitude, longitude, course over ground (COG), and speed over ground (SOG).
- Sailor VHF DSC Radio: A radio system used for communication with other vessels and shore stations, capable of transmitting distress signals and safety alerts via Digital Selective Calling (DSC).
- Raymarine Wind/Speed Indicator: Displays real-time wind speed and direction, helping the crew adjust navigation in varying weather conditions.
- Raymarine Depth Sounder: Measures the water depth beneath the vessel, critical for avoiding shallow areas.
- JRC GPS Compass: Provides heading information, using GPS for accurate direction data.
- Stockberger barometer

These instruments are essential for ensuring safe navigation and maintaining communication at sea.

In the aft part of the wheelhouse, starboard side, there is a chart table with a forward-facing seat for navigation tasks. Positioned above the chart table in the upper aft section of the wheelhouse are a clock and a display. The table also holds satellite communication equipment, which includes devices for internet and television connectivity, as well as a laptop for administrative and communication tasks, ensuring the vessel stays connected during its operations.

The navigational bridge wheelhouse is equipped with storage lockers for deck gear and a rack for life jackets.
Watertight 4-point access doors to the main deck are located aft on both the starboard and port sides of the wheelhouse.

The windows provide an unobstructed view essential for navigation, with intact glass and sealed frames to prevent water ingress.
All forward wheelhouse windows are fitted with air ventilation defrosters for clear visibility.
All windows, portholes, doors, and hatches were inspected from the inside and found to be in good condition.

The vessel maintains up-to-date operational logs, indicating that records are carefully managed. This is a positive indicator of compliance with regulatory standards.

In the wheelhouse, fire extinguishers are properly installed in multiple locations for fire safety. These portable fire extinguishers are visibly marked with operating instructions, and the inspection tags show they are regularly checked, with the next service date indicated.

## VI. Galley

The galley is located starboard on the main deck, six steps below and aft of the wheelhouse.
It spans approximately 4 square meters and is equipped with a four-burner electric stove with an oven, about 300-liter refrigerator, a Panasonic microwave, a toaster, an electric kettle, a bread maker, and a coffee machine.

The galley also features ample countertop space, a sink, and overhead cabinets. There is a sufficient supply of cutting boards, knives for different food preparations, and tableware.

The galley is well-maintained, with adequate facilities to support a crew of four.
Safety equipment, including a fire extinguisher, alarm, and intercom, is installed in the passage between the galley and the mess room.

## VII. Mess Room

Opposite the galley, on the port side, is the mess room (dining area). It is furnished with a dining table, a spacious sofa, and a television. Two large windows provide an unobstructed view of the river, adding natural light and comfort to the crew's living space.

## VIII. Crew Accommodation

The crew quarters are located centrally and forward, beneath the Navigational Bridge and Bow Deck. Access to the crew block is via six steps down and forward of the mess and galley on the main deck, through a watertight door.

110V and 220V AC distribution panels are installed flush with the starboard bulkhead without obstructing the passageway. The corridor is well-lit with ceiling-mounted fixtures, and equipped with a fire extinguisher and alarm system.
On the port side, aft is a twin cabin, and forward is a single cabin. Starboard side features two single cabins, located aft and forward, respectively.

Although the cabins are compact, they are furnished with hanging lockers and sinks. Each cabin is equipped with a fan, air purifier, electric heater, and television. Additionally, every cabin has a communication phone linked to the bridge and a control panel for the Furuno Bridge Navigational Watch Alarm System (BNWAS), model BR-540.
This system enhances navigational safety by requiring periodic watchkeeper acknowledgment.

If no response is received within the set interval, the system triggers an alarm to notify the crew. The panel features "ALARM" and "DUTY" indicators and a test button for system checks.

Life jackets and immersion suits are stored in accessible locations in every cabin.
The FitzWright immersion suit and standard adult life jacket comply with international safety standards, such as those set by the Canadian Coast Guard (C.G.G.A.) and the U.S. Coast Guard (U.S.C.G.A.). All safety gear is in excellent condition, ensuring operational readiness for emergencies.

One of the cabins is equipped with an escape ladder leading to an emergency exit on the Bow Deck.

Aft of the watertight door, five steps down on the starboard side, is access to the crew's toilet and shower. The port side features a freezer and laundry facility.

This area also contains three $CO_2$ cylinders for the engine room fire suppression system.

The aft bulkhead is fitted with a watertight door, secured with six locking points, providing access to the engine room.

## IX. Engine Room

The engine room is spacious, well-organized, and in good condition. Minimal water accumulation is observed in the bilges. A sufficient stock of spare filters and operational supplies is available. Fuel is properly filtered and separated for the engines.

### 1. Propulsion Systems.

The vessel is equipped with two six-cylinder Mitsubishi main diesel engines, each producing 543 HP and torque of 2500-3000 Nm. The drives connect to propeller shafts through Twin Disc 516 reverse gearboxes with a 4.50:1 ratio. The engines are electrically started using four 8D batteries per engine. These marine engines are designed for heavy-duty operation with water-cooled closed-loop cooling systems.

*Turbocharging:*

The Mitsubishi TD13M1-48QHZ3.5VRCN turbocharger is used to increase engine power by delivering compressed air into the combustion chamber, enhancing efficiency and output.

*Engine Components:*

Air Filter: Cleans incoming air to prevent foreign particles from entering the engine.
The Fleetguard air filter, model Dual Stage Air Cleaner, is designed for high air throughput necessary for diesel engine operation. No visible damage to the filter housing is observed, and the connections are sealed properly. The filter is operational and connected to the engine's air intake system.
Exhaust System: Insulated flexible connections minimize heat exposure risks.
Air Intake Duct: Red-colored duct ensures optimal airflow for system cooling.
The engine control panel, located above the engine, displays critical parameters such as oil pressure, RPM, and engine hours. It also features start/stop buttons, status indicators, and alarms, ensuring efficient monitoring of engine performance.

Overall, the equipment is clean and well-maintained, with no visible signs of leaks or damage.

## 2. Pumps and Filters.

The Zexel high-pressure fuel pump controls the distribution of diesel fuel to the injectors, delivering it at high pressure into the engine's combustion chambers. The visible fuel lines and valves are in good condition, with no apparent signs of corrosion or leaks. The markings on the pump confirm the model and technical specifications, including torque and lubrication requirements.
The Parker RACOR primary fuel filter, model C1000D, is marked with "1681 hrs," indicating the number of operating hours since the last filter change or installation. These fuel filters are used to remove impurities and water from the fuel, which is crucial for the stable and reliable operation of marine diesel engines. This filter likely requires regular maintenance, and the marking on the housing helps vessel owners and technical personnel track the replacement schedule to keep the vessel’s systems in working condition.

## 3. Auxiliary diesel engine.

The 6-cylinder Isuzu auxiliary engine block is responsible for powering auxiliary systems such as the generator or hydraulic pump. The engine appears to be in good condition, with no visible leaks, properly secured piping, and a clean, new filter. The belts and pulleys are in working condition, showing no visible signs of wear.

## 4. Air compressor.

The Ingersoll Rand air compressor is designed to generate and maintain air pressure in the

vessel’s pneumatic systems. The compressor shows signs of corrosion and wear on some components, likely due to prolonged exposure to high humidity and salty air. The compressor’s piston head appears operational, and the belt drive is connected to the electric motor, which also exhibits wear. To ensure reliable operation, regular maintenance is recommended, including lubrication, inspection of belts, and cleaning the system from dust and contaminants, along with checking oil levels and pressure gauges.

## 5. Propeller shaft

The visible section of the propeller shaft, which connects the gearbox to the propeller shaft that drives the propeller, includes a shaft coupling that connects the shaft to the gearbox's output shaft. The coupling appears securely fastened, although rust is visible on surrounding metal parts. This indicates the presence of moisture or leaks, which should be addressed to prevent corrosion and maintain the system’s proper sealing, avoiding further deterioration of the vessel's propulsion system components.

## 6. Electrical Equipment.

The vessel's electrical wiring consists of well-organized cable harnesses and clearly labeled switches for battery isolation and selector switches, allowing for efficient power management between the vessel's systems. The engine room is illuminated by modern LED lighting, which is in excellent condition, providing adequate lighting for inspections and maintenance.
The electrical equipment has been upgraded and organized with new wiring and properly secured connections.

The electrical power distribution panel appears to be brand new. It features fuses, protective circuit breakers, and numerous wires connecting the system’s components. Additionally, the panel houses battery banks and chargers for these batteries. This panel is typically used to manage the vessel’s power supply, ensuring the operation of various systems and equipment on board.

The vessel is equipped with two battery chargers, manufactured by Analytic Systems, model BCA 1000W-110-24. These chargers are used for recharging the main engine batteries (M/E Charger) and the house system batteries (House Charger). The chargers regulate the charging process, monitoring both voltage and current, and are equipped with LED indicators to display operational parameters: Voltage (VOLTS) and Current (AMPS).

The 24V Electrical System Panel includes:

Voltmeters and Ammeters for measuring current voltage and amperage in the 24V system.
Main Circuit Breakers for various systems, such as: hydraulic system control, fire pump, bilge pump, engine room ventilation, aft deck searchlight.
This panel is a key component of the vessel's electrical distribution and control system.

## 7. Engine Room Layout

The forward bulkhead of the engine room is equipped, from port to starboard, with the following components:

1. Seafari Versatile desalinator and cooling water tank for the port-side main engine.
2. Electrical junction box for the port-side main engine control panel.
3. Engine room ventilation switch.
4. Marinco 20A battery charger.
5. Two surge protection batteries and backup power batteries for electronic control systems.
6. Electrical junction box for the starboard-side main engine control panel.
7. Cooling water tank for the starboard-side main engine.
8. 32 VDC battery bank.

The port side of the engine room is equipped, from forward to aft, with the following elements:

1. Rheem 40-gallon hot water heater for domestic use.
2. Manifold for the fire and bilge pumping system.
3. Small air receiver.
4. Two hydraulically powered fire and bilge pumps.

The starboard side of the engine room is equipped, from forward to aft, with the following elements:

1. Distribution box and alarm connection box.
2. 32 VDC battery charger.
3. 32 VDC battery control switches.
4. 12 VDC battery charger.
5. 120 VAC ground fault indicators.
6. 120 VAC and 240 VAC distribution panels and circuit breakers.
7. Shore power transformers.
8. Isuzu diesel engine generator.

The aft bulkhead of the engine room is equipped, from port to starboard, with the following elements:

1. Evacuation ladder from the engine room to the main deck.
2. Small air compressor and receiver tank.
3. Detroit Diesel engine, powering the hydraulic power pack pump system.
4. Generator distribution switchboard.
5. Hydraulic-powered motor generator.

## 8. Steering Gear room.

The vessel is fitted with a Wagner T-unit steering system, installed on the starboard rudder stock, with a connecting linkage on the port-side rudder stock.

This layout ensures organized placement of essential systems within the engine room, contributing to the efficient operation and maintenance of the vessel's propulsion, electrical, and safety systems.

*Overall Impression:*

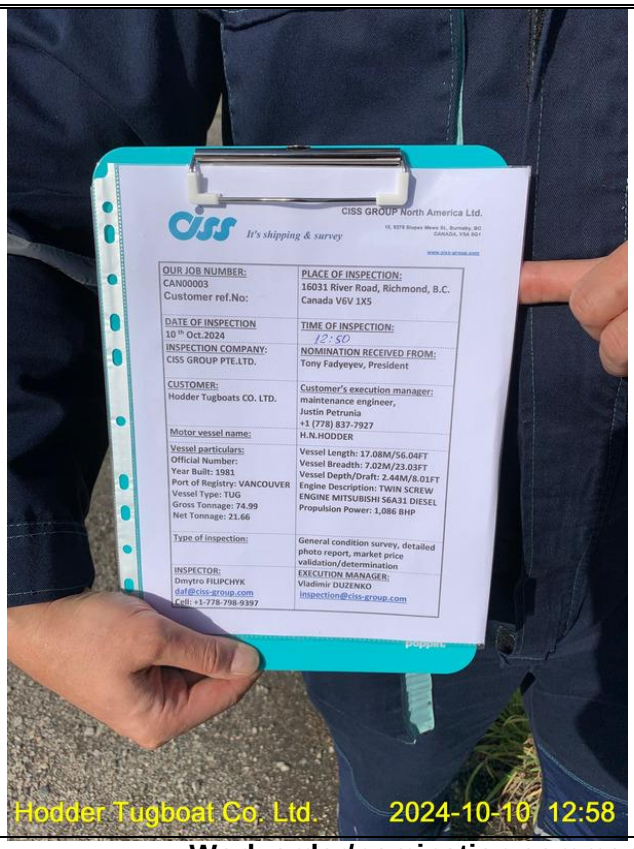
The H.N. HODDER presents as a robust and well-maintained vessel, exhibiting a well-thought-out design suitable for rigorous towing operations. The hull structure and external fittings, including the fenders and mooring lines, show signs of regular use and exposure to environmental elements, with areas of surface corrosion that may require routine maintenance. The deck equipment, such as winches and towing gear, appears operational, although minor surface wear suggests the need for preventive upkeep to maintain performance. The bridge and control panels are equipped with essential navigation and communication equipment, providing a functional layout conducive to effective vessel management. The crew accommodations and galley areas are clean and organized, indicating a good standard of onboard living conditions. Overall, the vessel appears seaworthy, though some external wear suggests a need for minor refinishing to ensure durability and operational readiness.

These observations suggest that while the tugboat is operational, there are several areas where routine maintenance, and deck repairs, especially rust prevention and surface treatment, could help extend the service life of the vessel. Possible replacement of the fendering system is required. Attention to the condition of the mooring gear is also advised to maintain operational safety.

In conclusion in the engine room, the electrical and mechanical systems appear to be largely operational, with some areas requiring maintenance or re-painting (some areas in the engine room, bilge, exhaust gas pipe and the muffler with the heat-resistant paint). The battery system and associated wiring are well-managed, though further testing of electrical and engine performance is recommended to ensure long-term reliability.

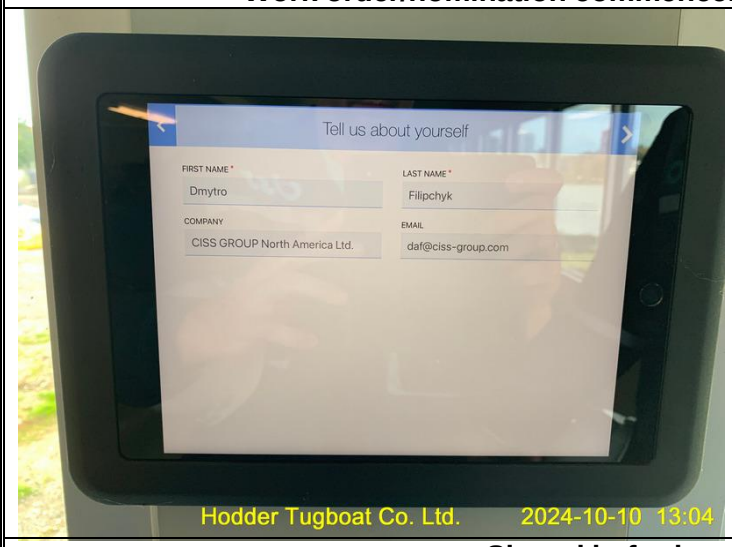
DETAILED PHOTO REPORT

## I. General View and Main Deck of the tug vessel.



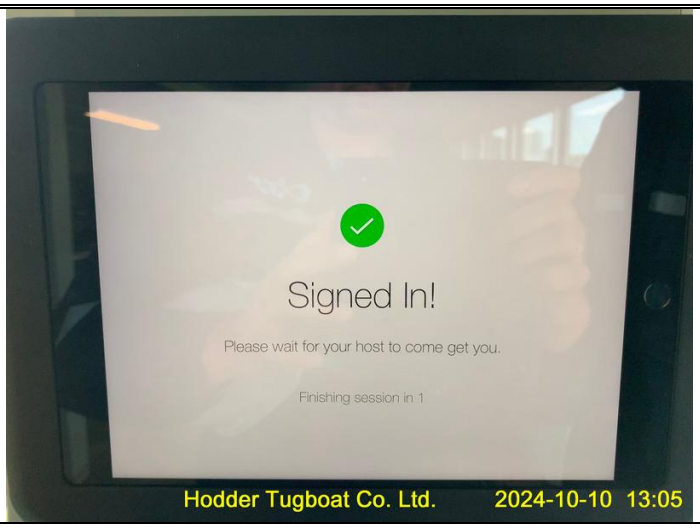


**Work order/nomination commencement, Hodder Tugboat Co.Ltd. office**





**Signed in for inspection in the office**




**Exit from the office to the berthing area**


**General view of berthed tugboats**

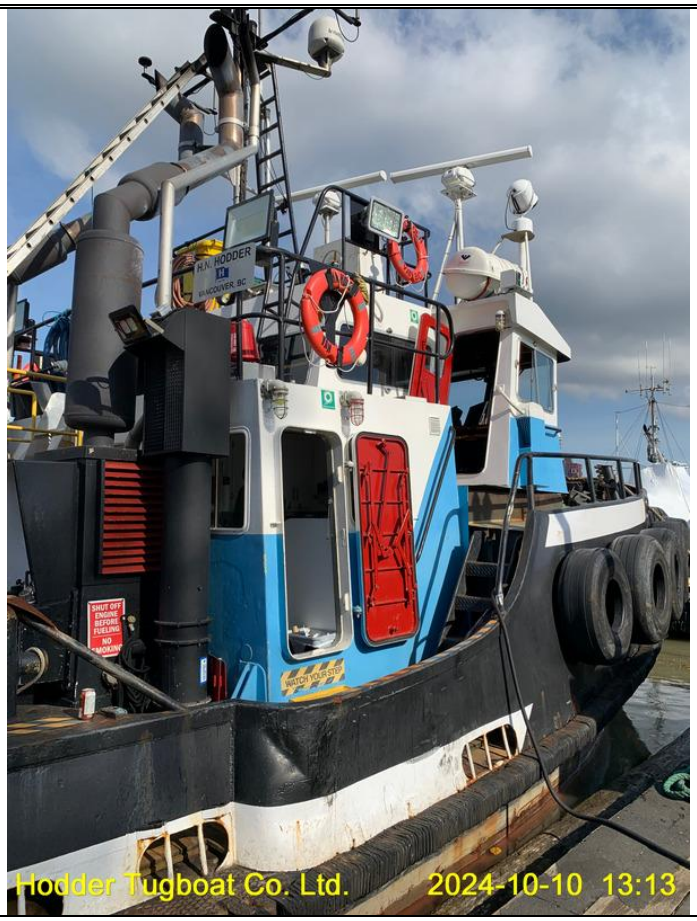

**General view of the HODDER's berthing area**


**Berthed tugboat H.N.Hodder**



**Bow/starboard side of the tugboat**


**Inspector of CISS GROUP North America**



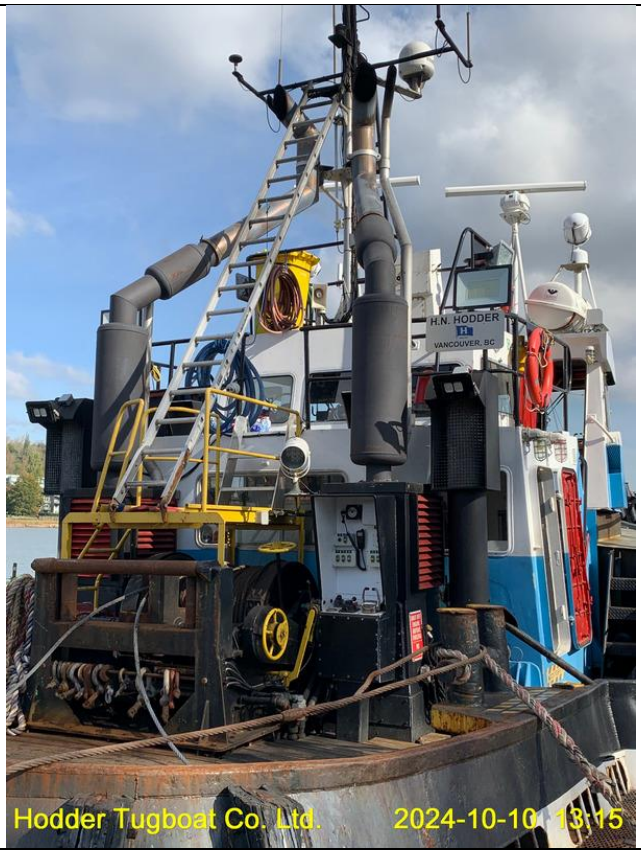

**Starboard side general view**



**Stern fender/view from the starboard side**

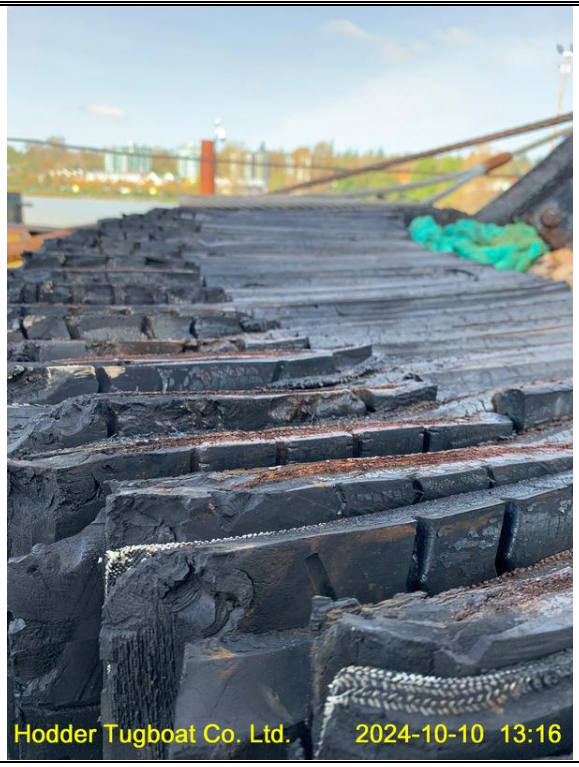


**Stern fender/view from the starboard side**





**Ship's sign board**

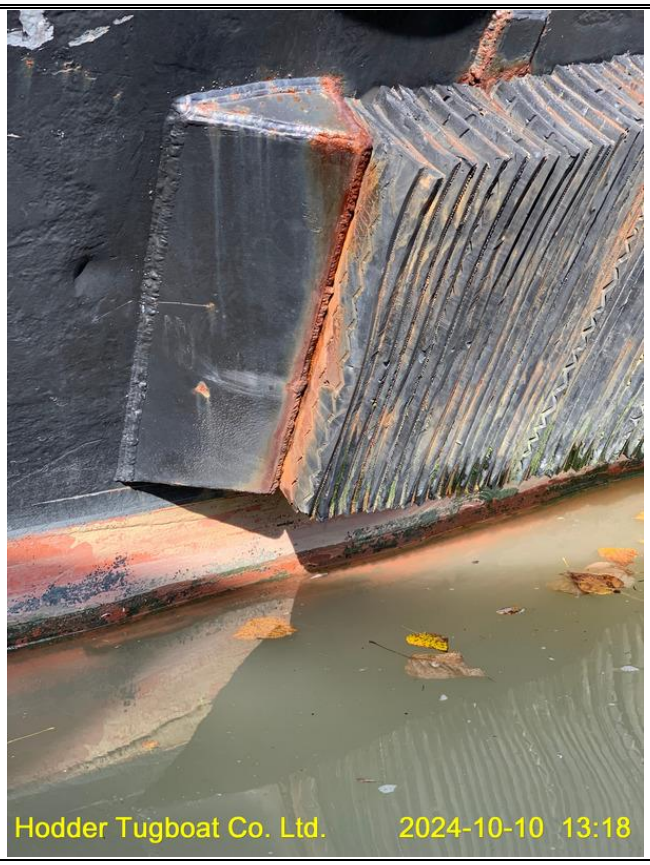




**Stern fender close view**

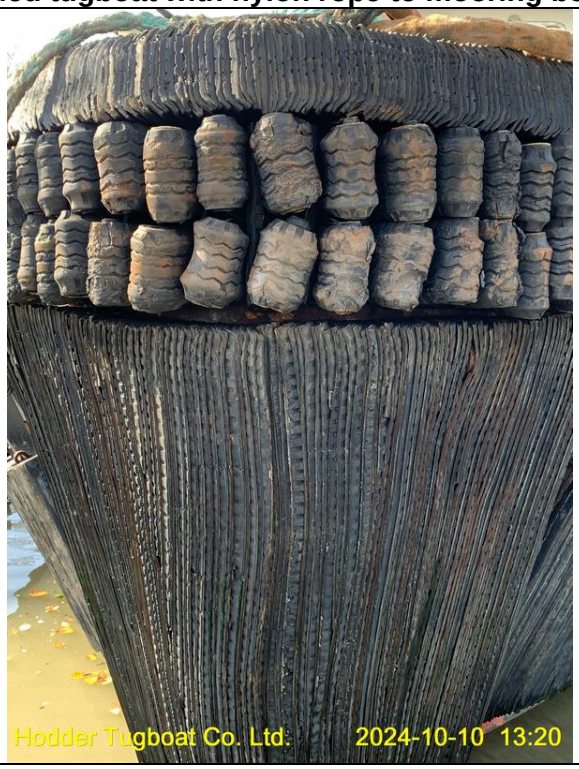


**Starboard fenders, general view**

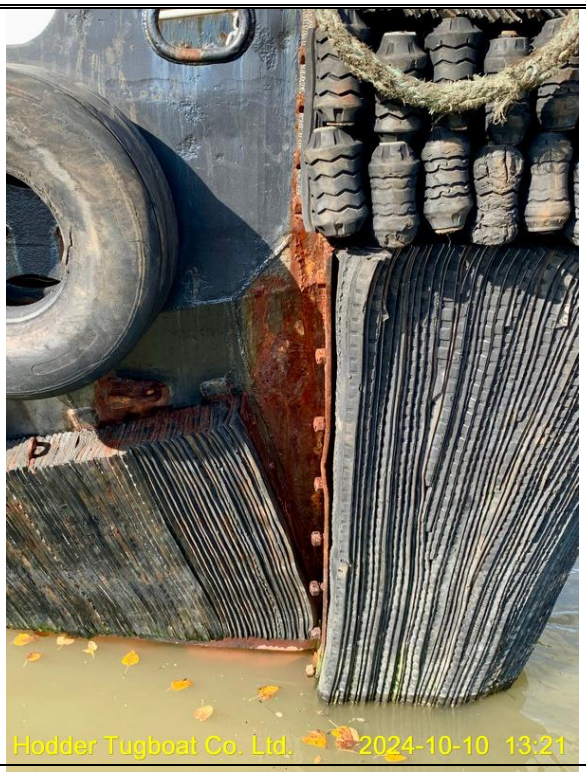



Starboard fender above the water line


Berthed tugboat with nylon rope to mooring bollard


Bow fenders

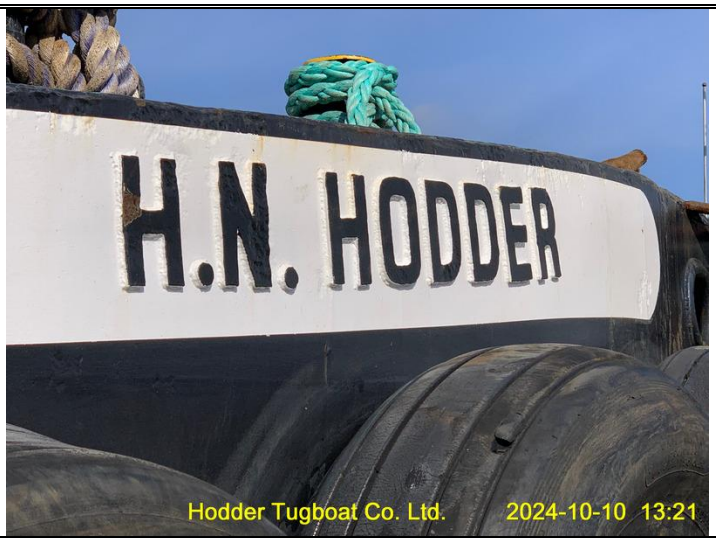




**Bow fenders**

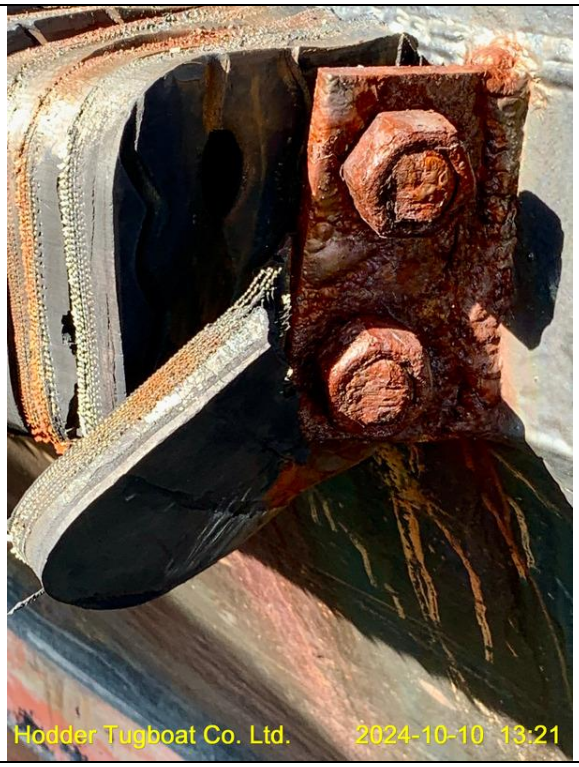


**Close-up view of rusted metal surface (including welded seams and bolts) on the bow fender holders**

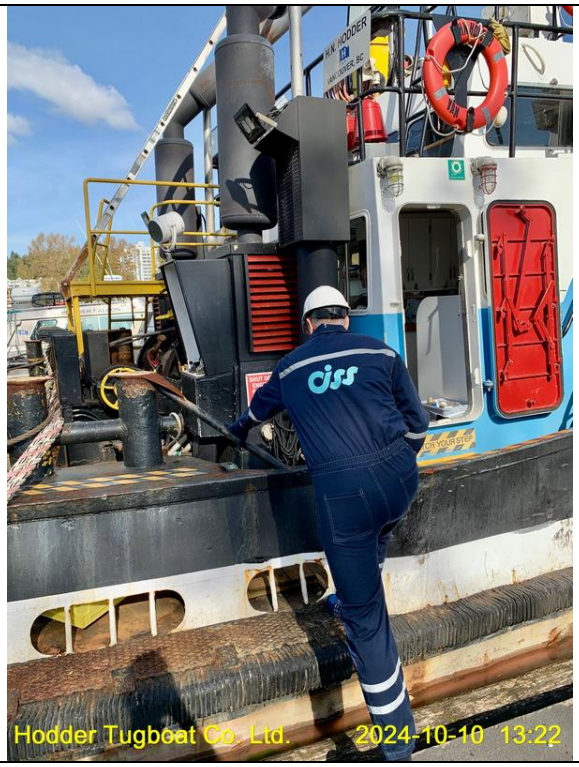

**Bow fenders**



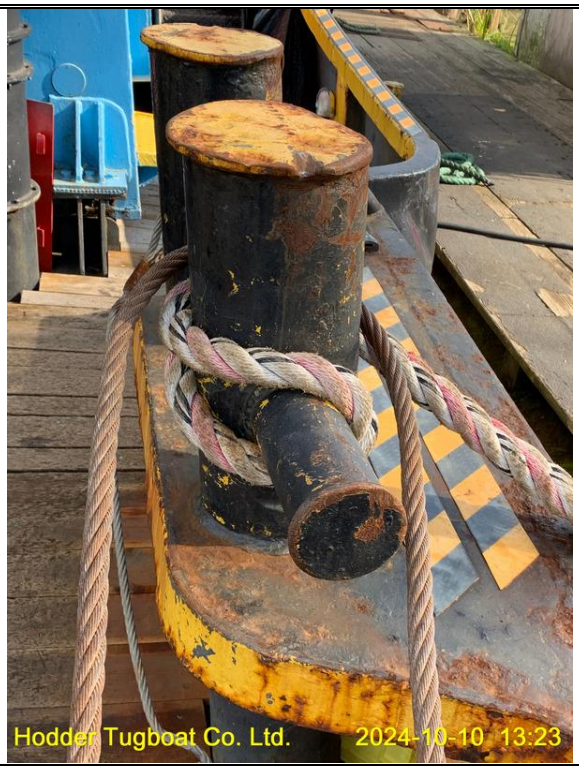

**Name of the boat**




**Starboard fender mounting**

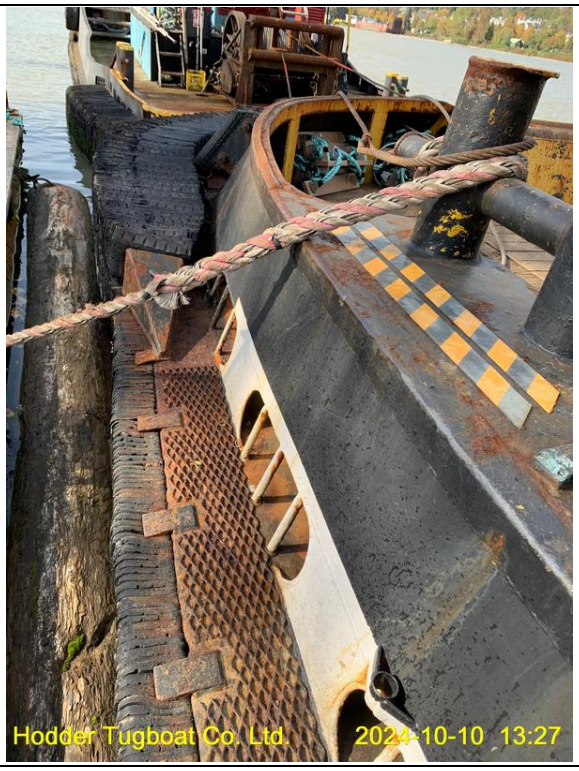



**Inspector entering the tugboat**



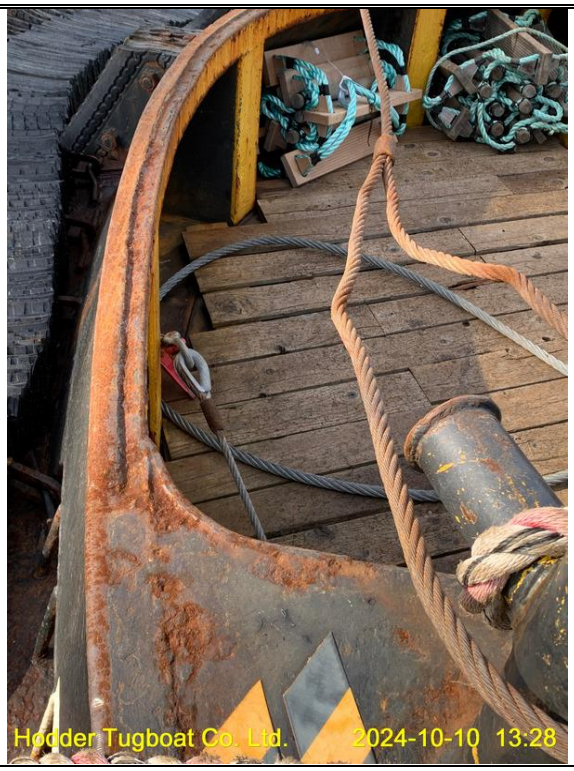


**The boat's starboard mooring bollard**





**Anti-slip flooring**





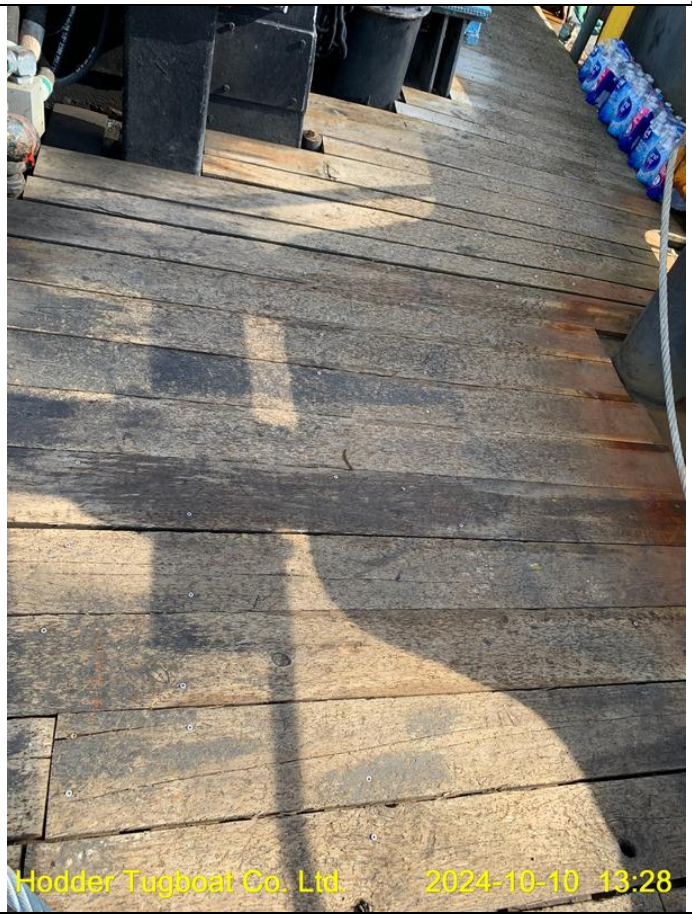
**The rusted and visibly pitted starboard side of the boat**

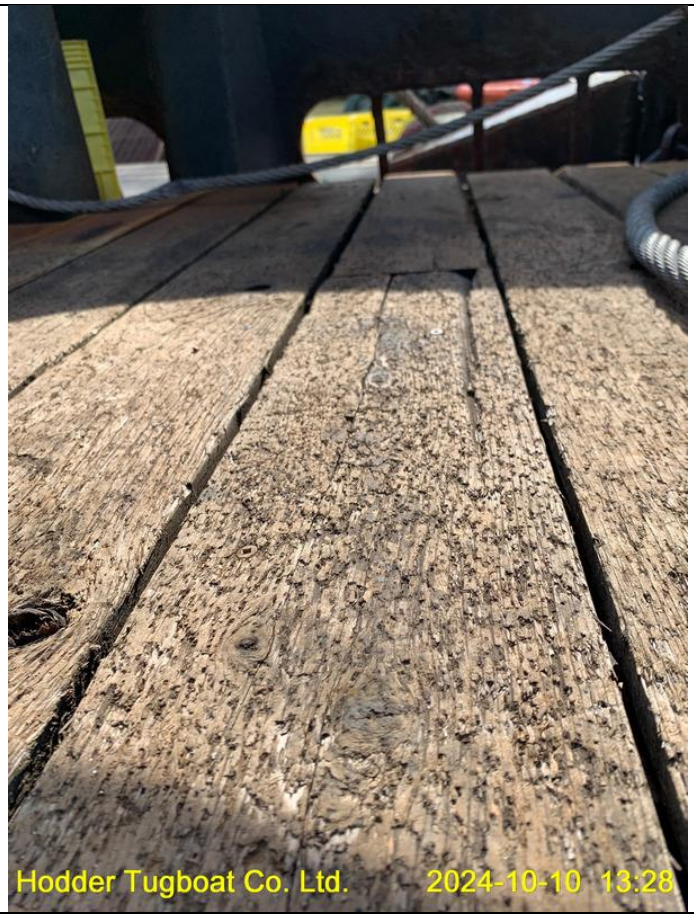


**The boat's substantially rusted bollard mount**



**Rusted waterway of the boat's deck**

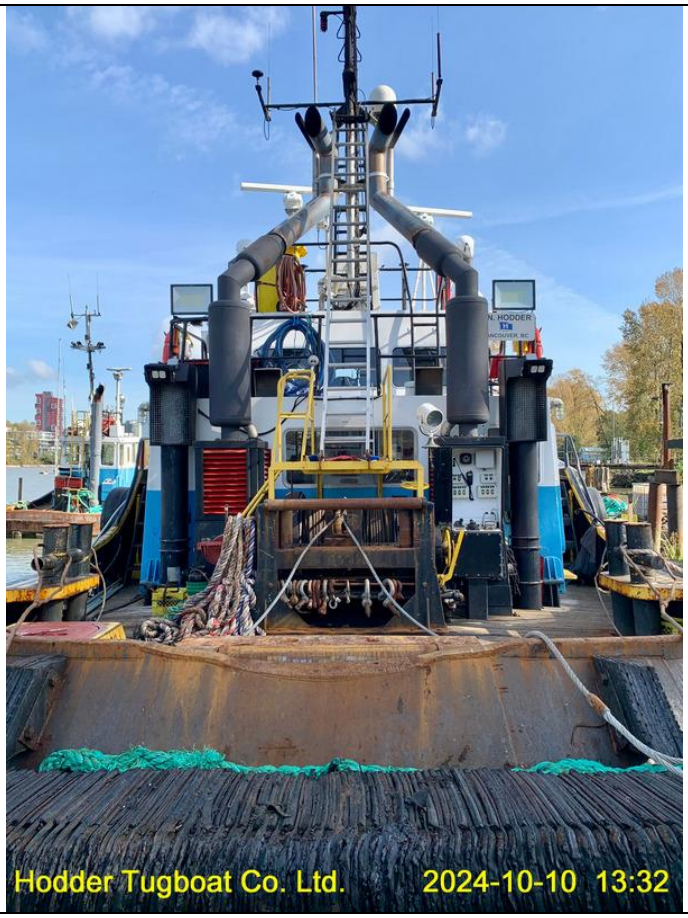



**Condition of the wooden flooring of the deck**



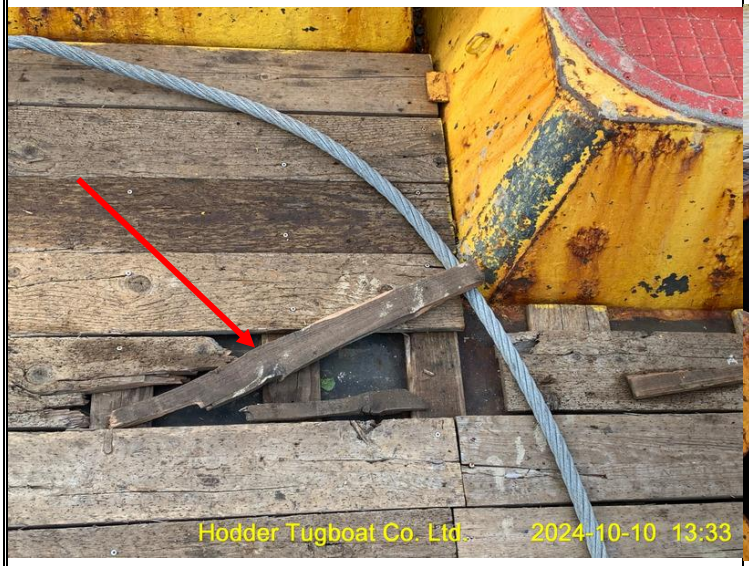
**Rusted fairlead roller and foundation**


**General view of the stern side of the boat**


**Port side mooring bollard**

**Towing winch roller with wire ropes**

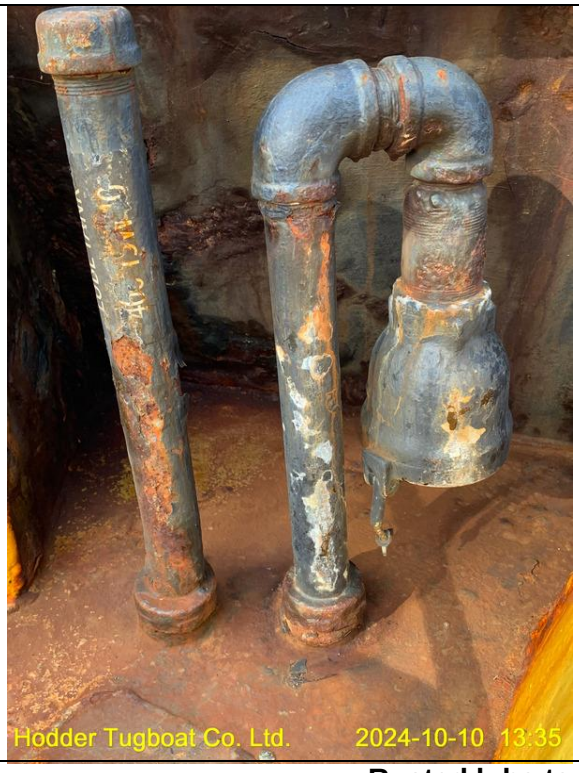


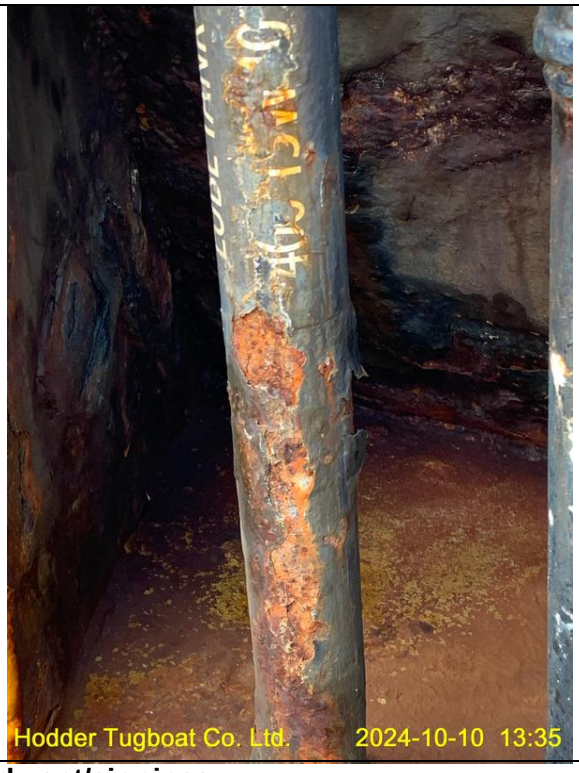


**Damaged wooden deck flooring next to the emergency exits from the engine room**

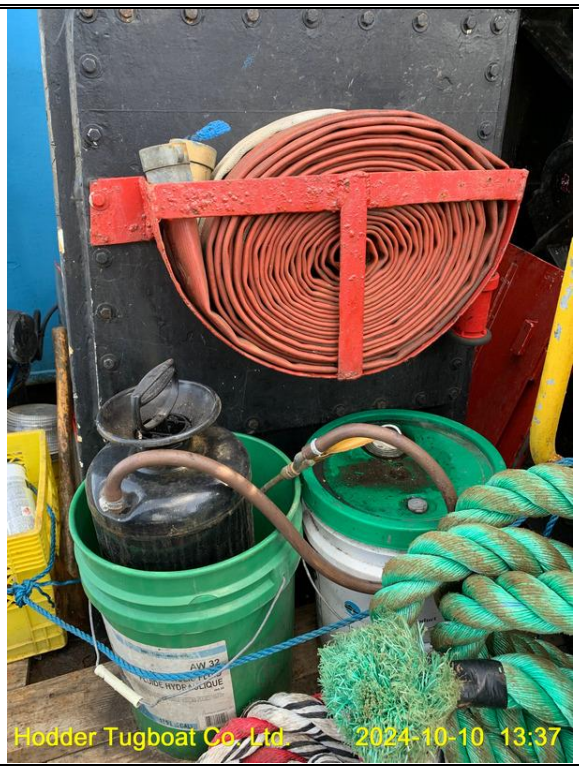

Side view of the fairlead roller foundation


Port side of the deck



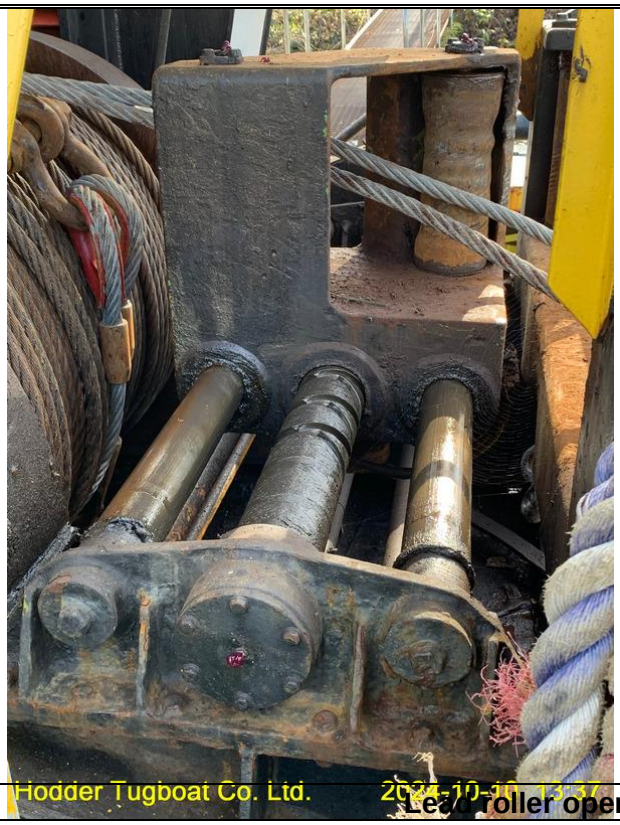

Rusted lube tank pipes and vent/air pipes


**Ventilation duct and fire hose on the main weather deck**



**Properly greased lead roller of the towing winch**

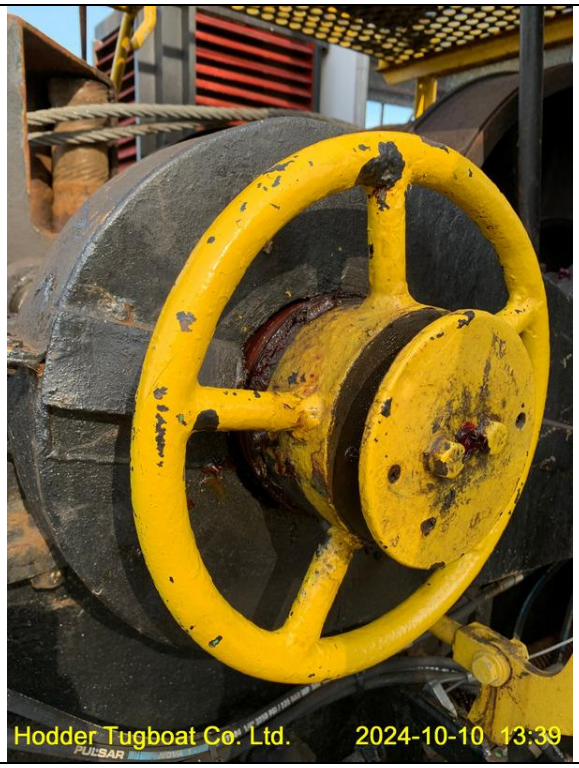


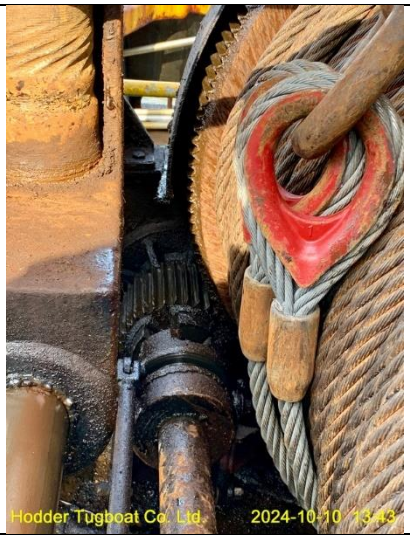


Lead roller operating range mechanism


Lead rollers with wire ropes of the winch


Winch gear transmission and braking system

| | |
|---|---|
|   |   |
| **Lead roller** | **Hydraulic fluid pipes for the braking system** |
|   |   |
| **Braking wheel of the winch** | **Operational station** |

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td colspan="2">The braking system of the winch</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Light projector</td><td>Winch gear mechanism</td></tr>
</table>

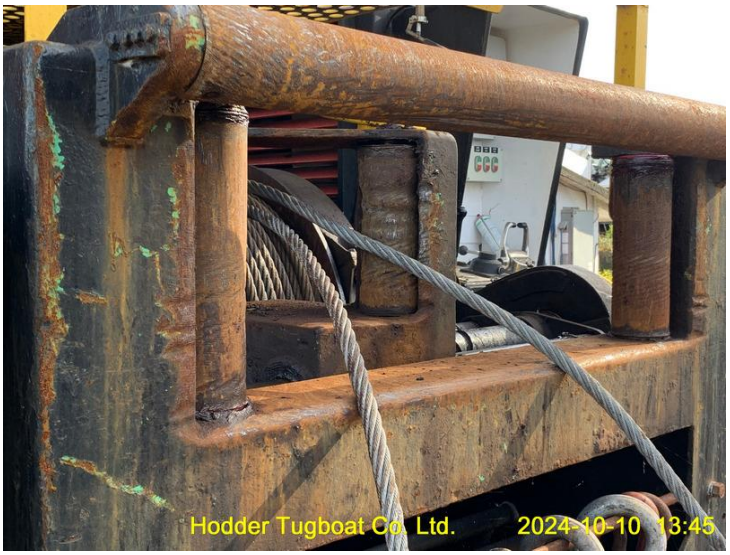

**Operational console station**



**Hydraulic system of the braking mechanism**

**Winch rotational mounting and bearing**


Hooks for steel cables




Lead rollers


Exhaust pipe from the engine room

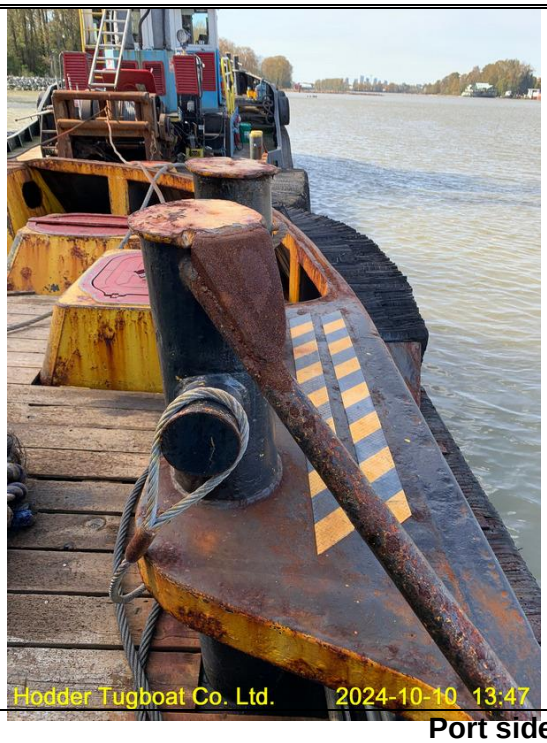

Dirty and greasy deck surface (under the towing winch)


Rusty exhaust pipe mounting


Exhaust manifold ventilator parameters

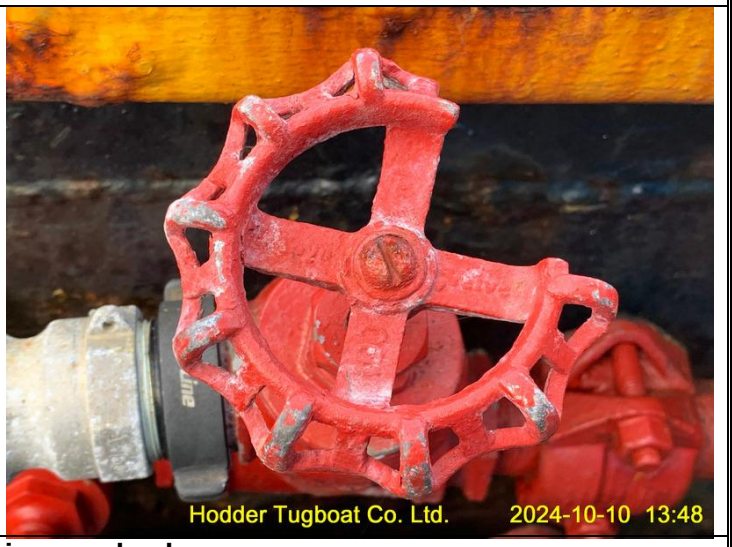

Exhaust gas pipe producer label


Towing winch port side view

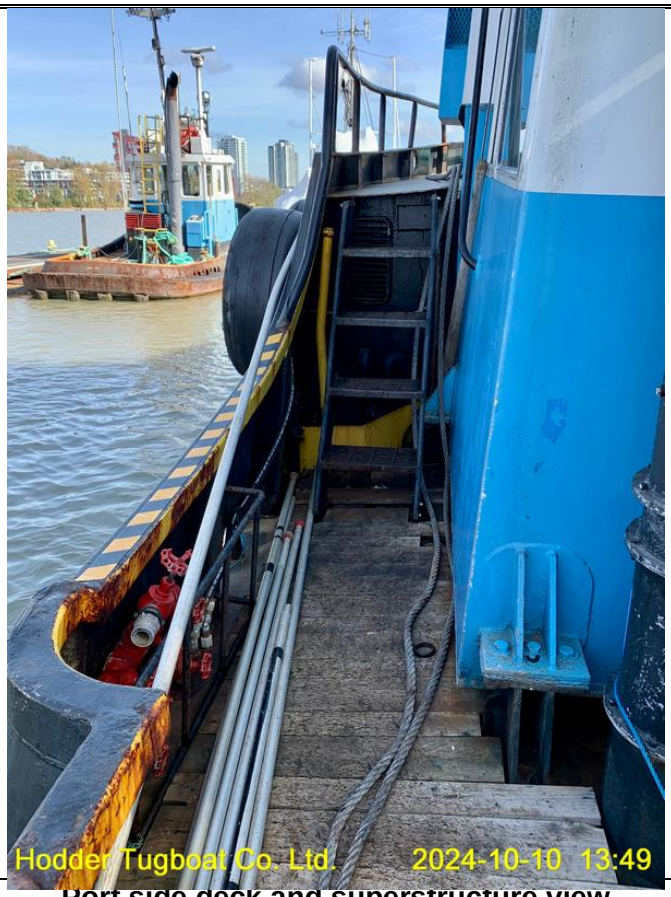




**Port side rusted bollard mount**

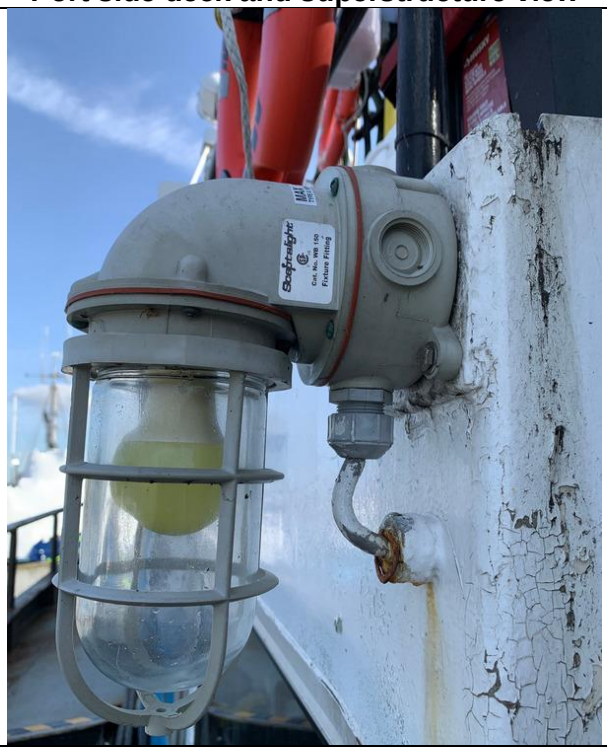




**Fire emergency pipes and valves**




Port side deck and superstructure view


Galley window

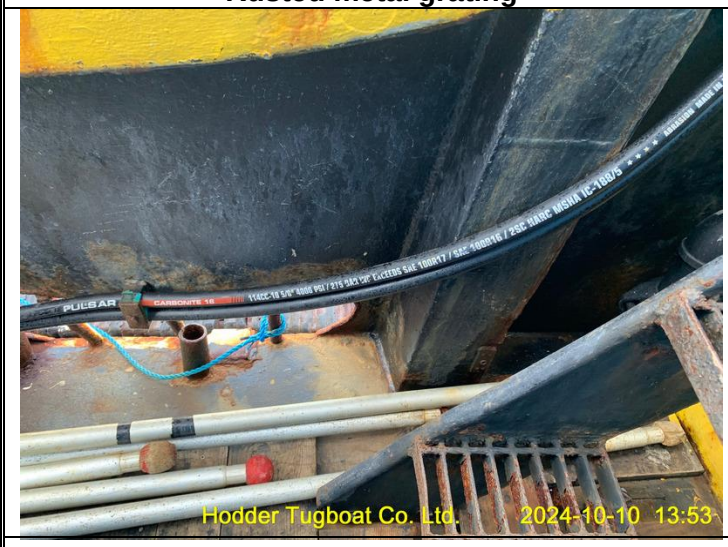


Light bulb marine protected


Fluid flexible pipes

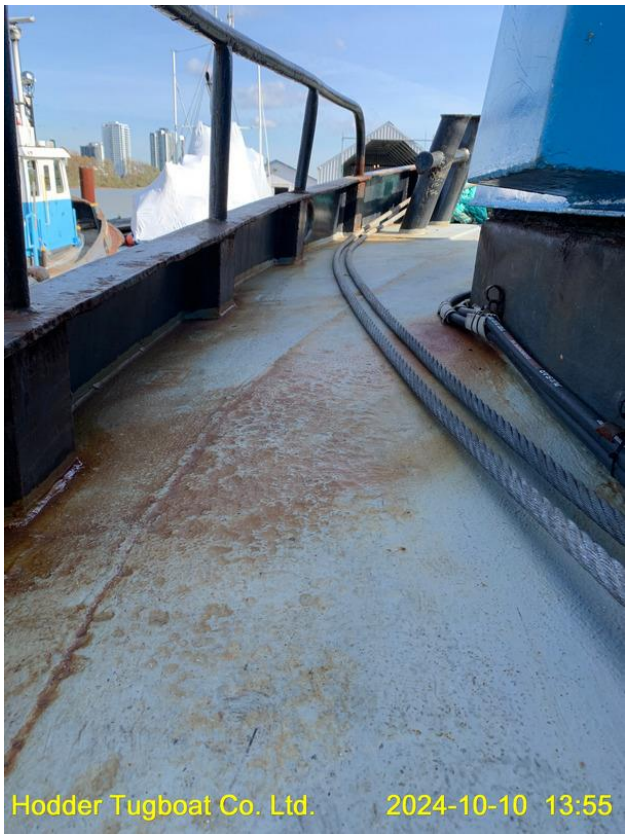
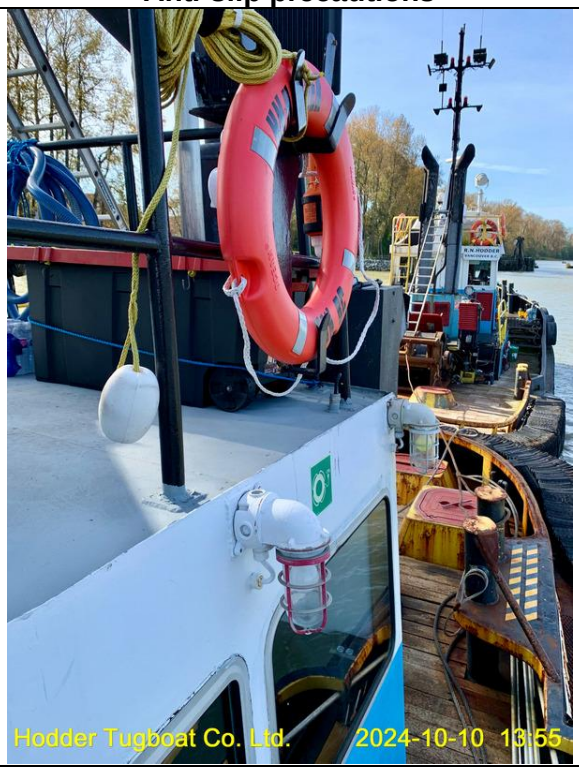
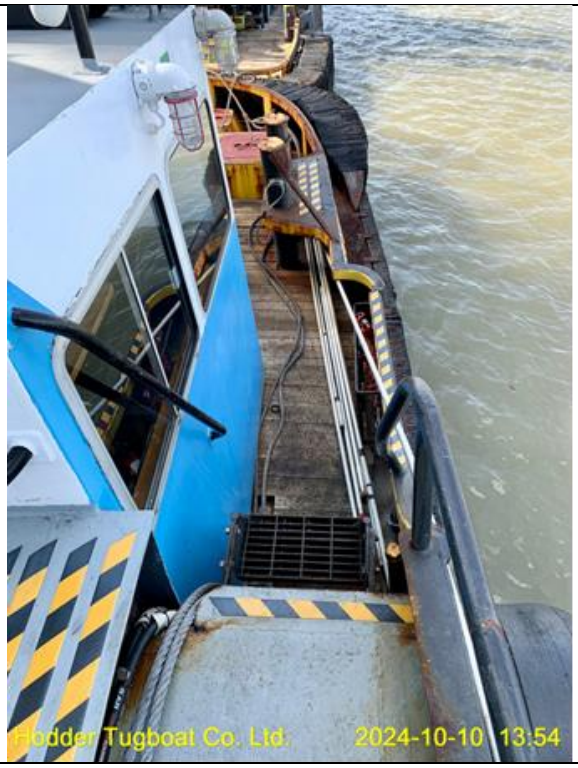

**Rusted metal grating**

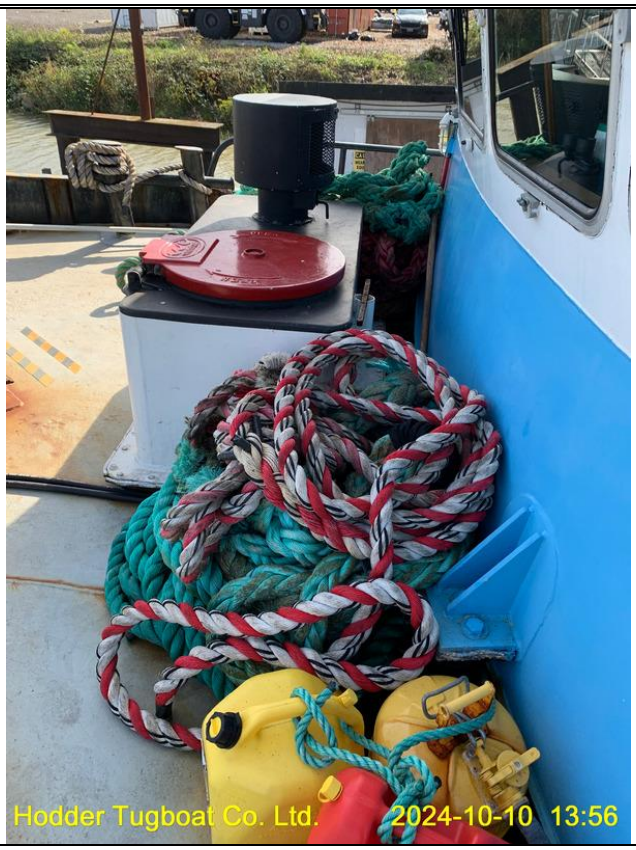
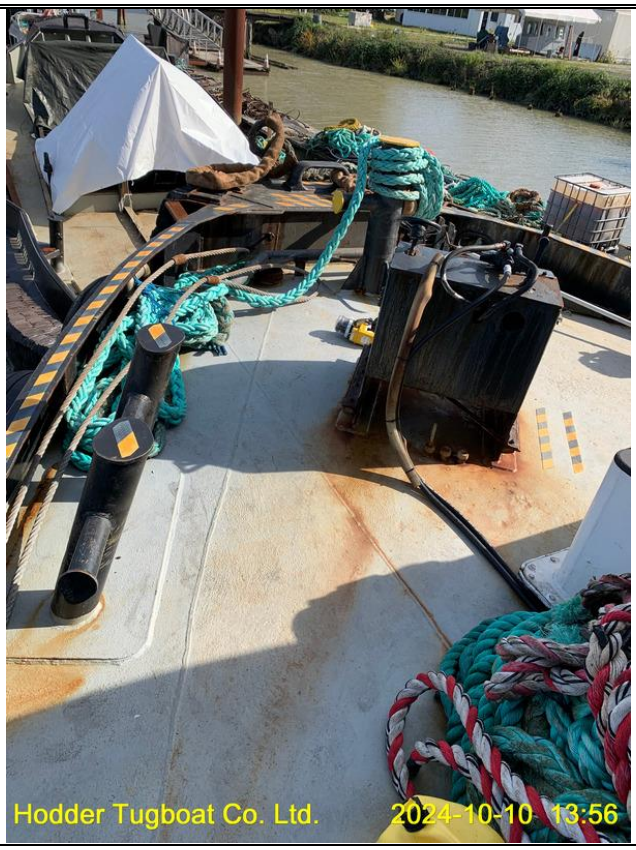

**Bunkering piping section and oil spill area**

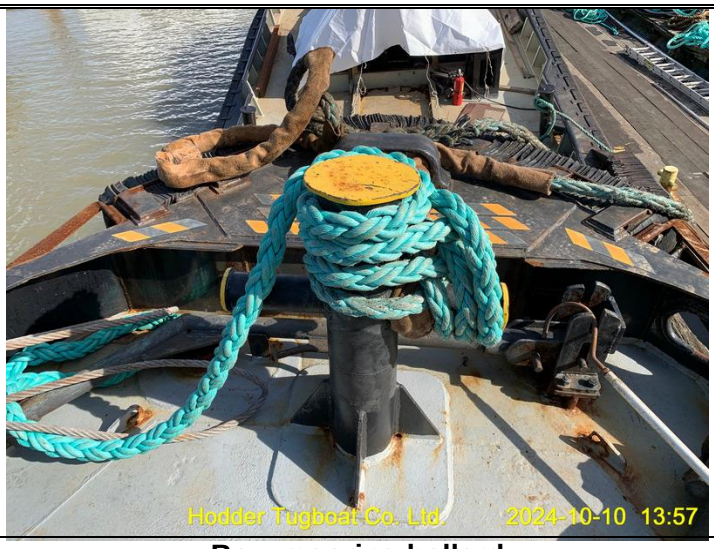


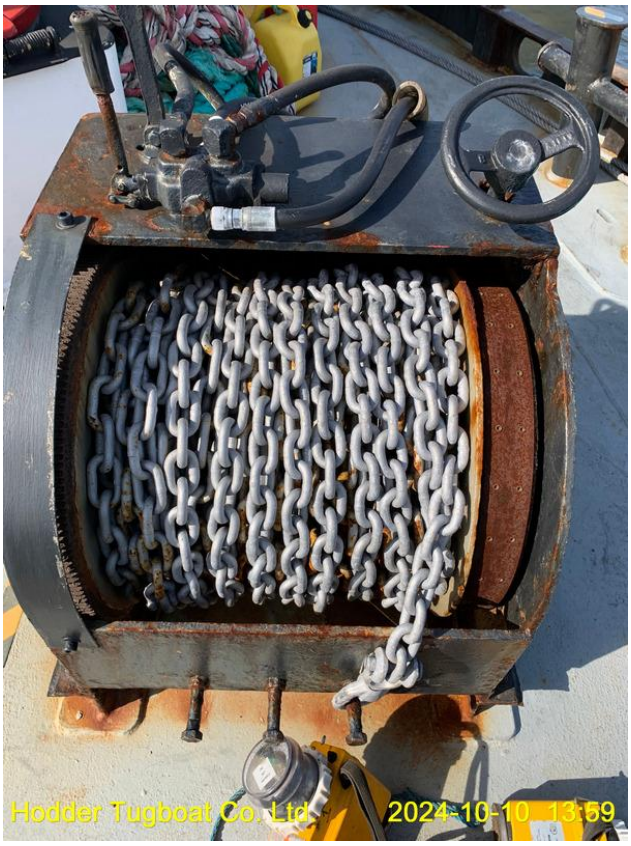


**Flexible fluid tubes**

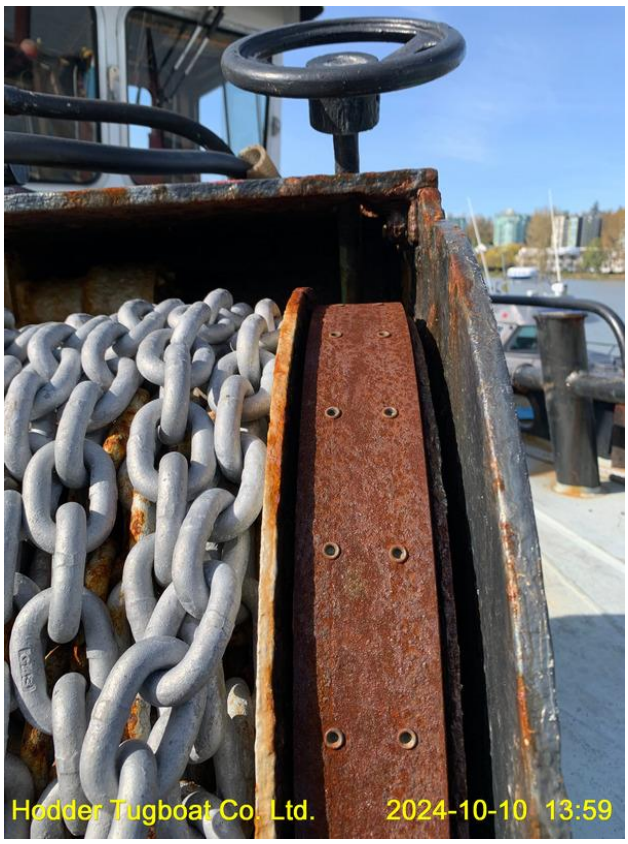
| | |
|---|---|
|  |  |
| **Anti-slip precautions** | **Port/bow side of the main weather deck** |
|  |  |
| **Safety lifebuoy** | **Port side deck view from the navigators bridge** |

| | |
|---|---|
|  |  |
| **Mooring nylon ropes and emergency exit from the engine room** | **Bow weather deck** |
|  |  |
| **Bow deck** | **Bow/Port side bollard** |

| | |
|---|---|
|   |   |
| **Bow mooring bollard** | **Spare anchor** |
|   |   |
| **Captain/watchman cabin, view from bow deck** | **Rusty gear/ancor winch station close-up** |

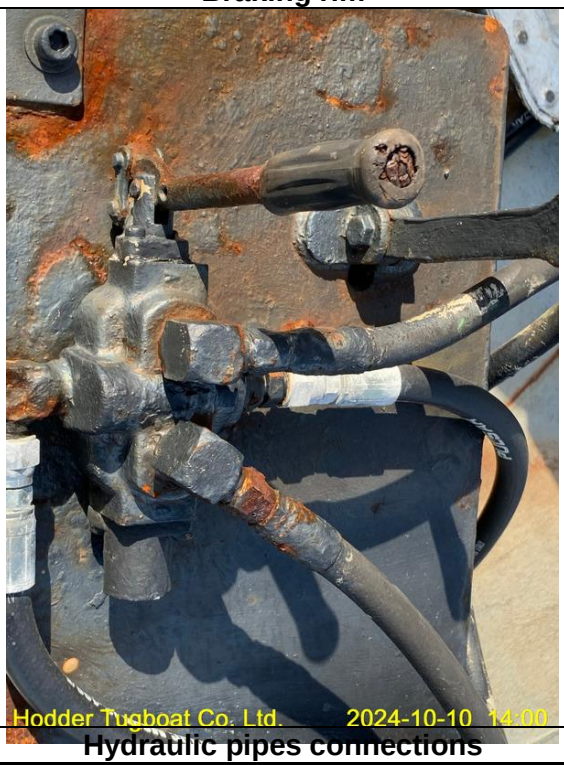



**Anchor operation equipment**




**Braking rim**


**Corrosion on the cogwheel**

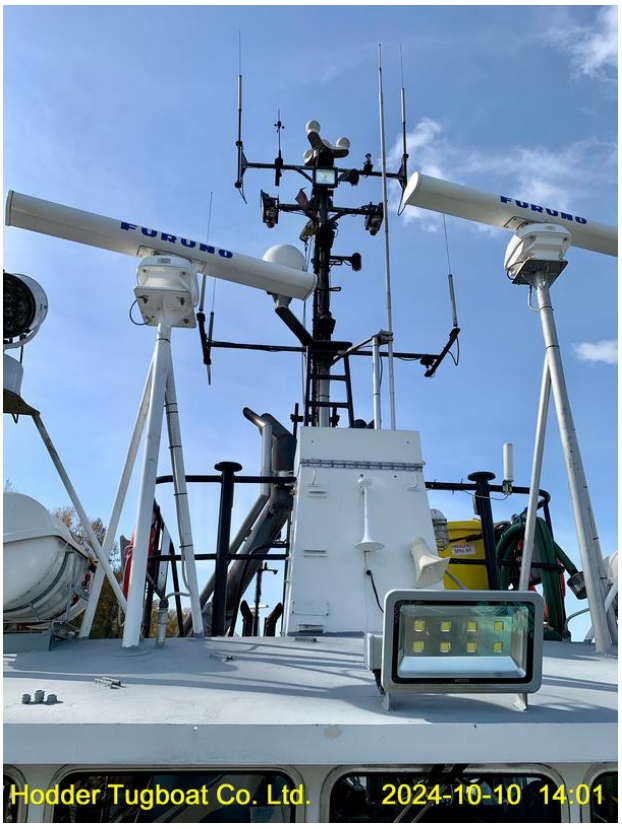



**Hydraulic pipes connections**

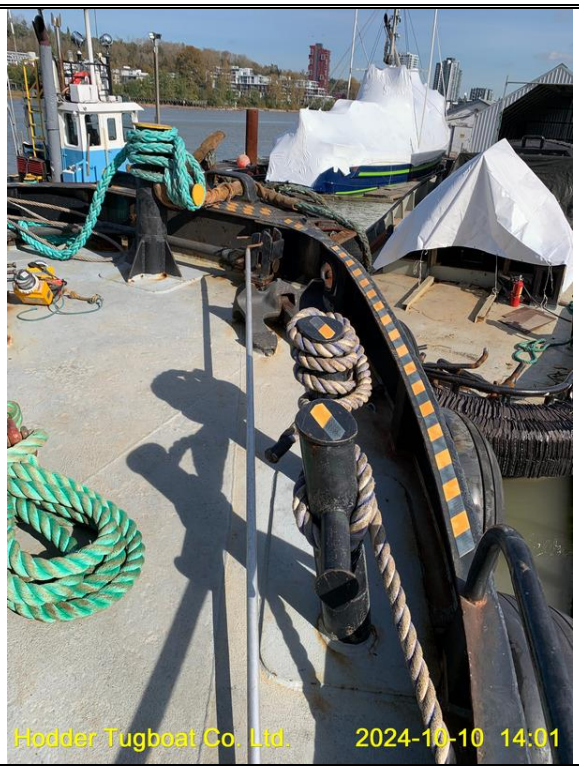

Engine room emergency exit


Navigators bridge windows with rain wipes

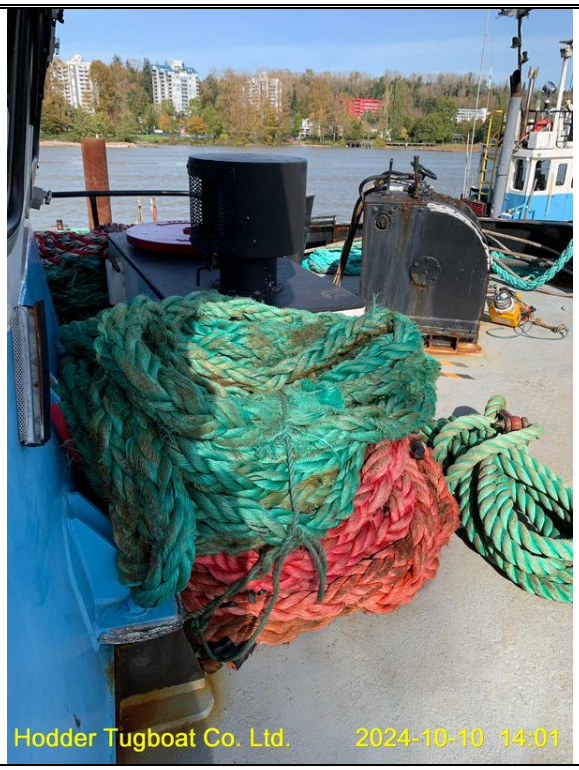

Light projector



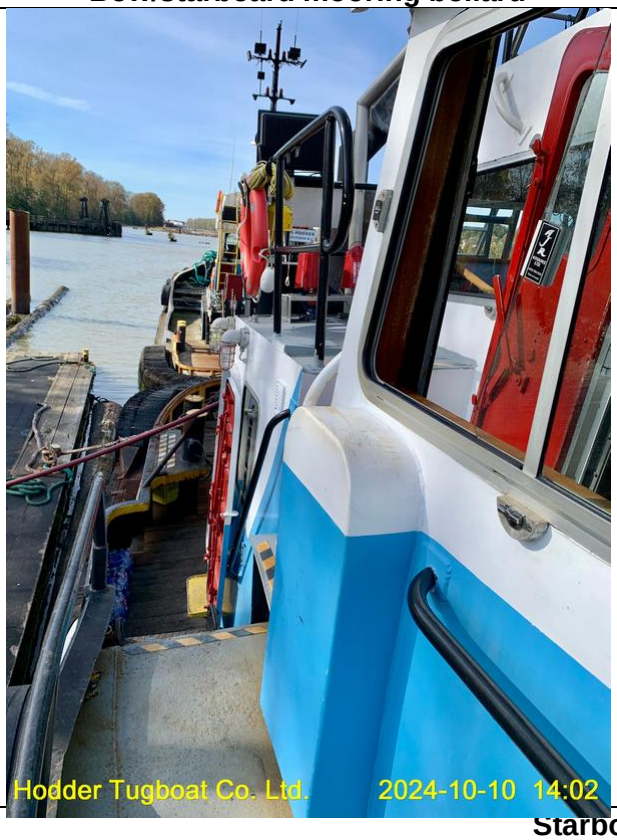

Radar equipment

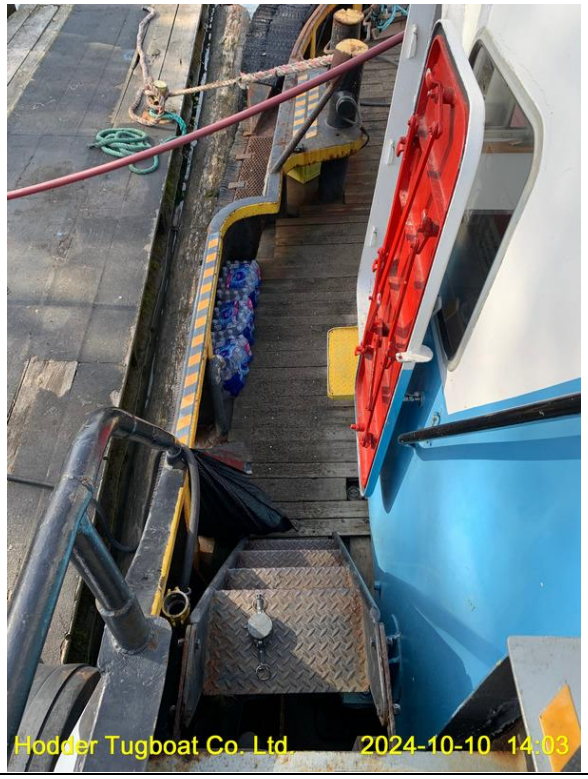



Bow/starboard mooring bollard



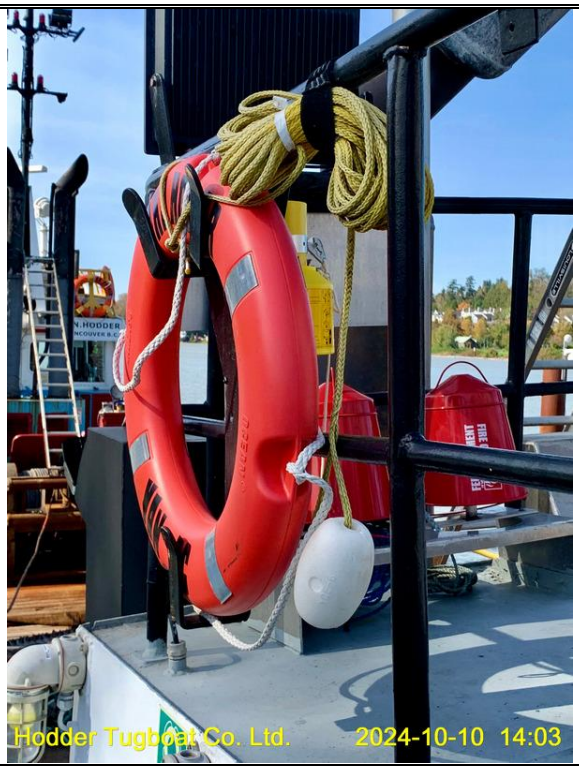

Mooring nylon ropes



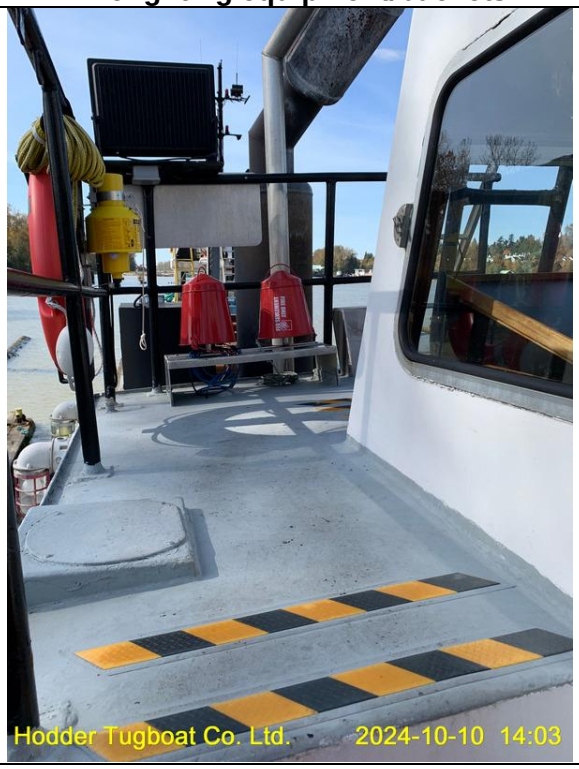




Starboard deck view


Firefighting equipment/buckets




Safety lifebuoy/STBR side

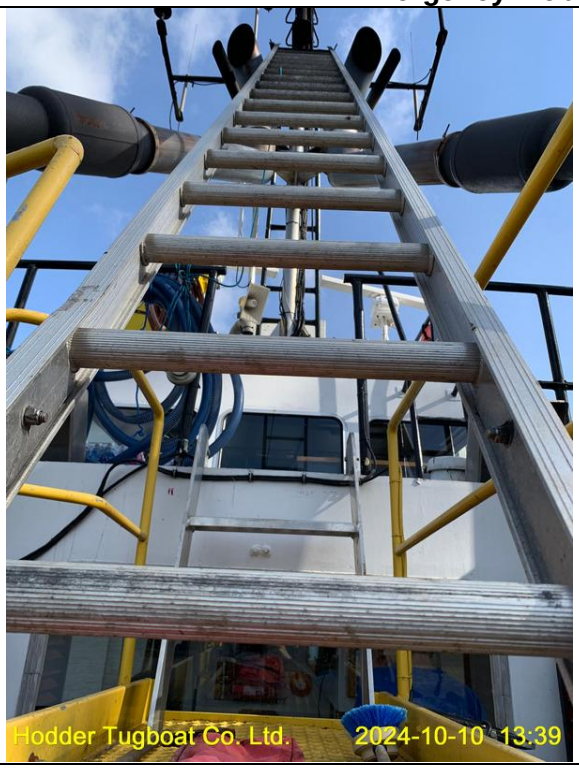



Upper deck view


Upper deck port view



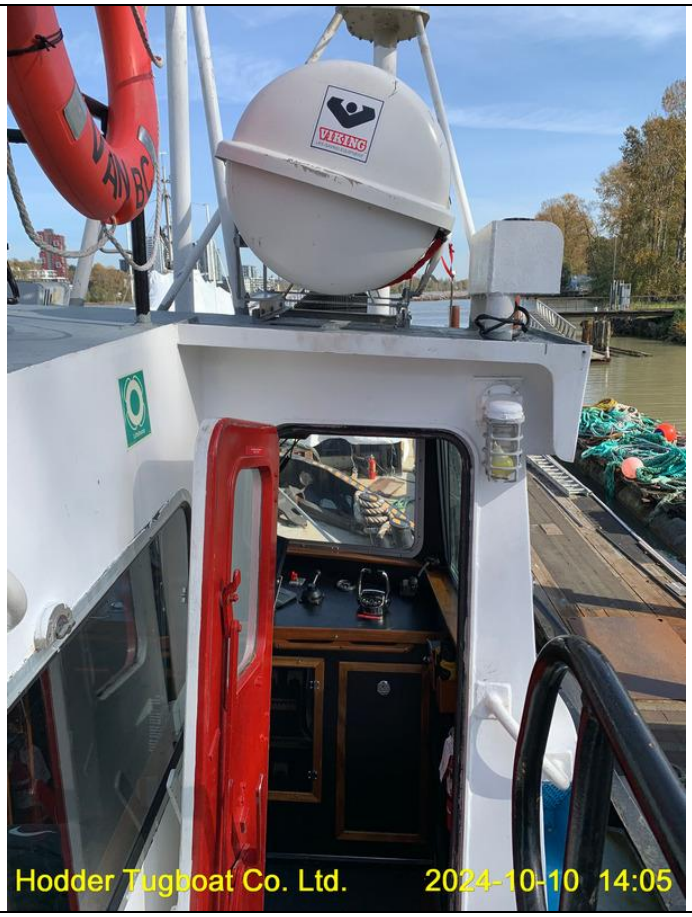
**Emergency lifebuoy, with proper expiry date**



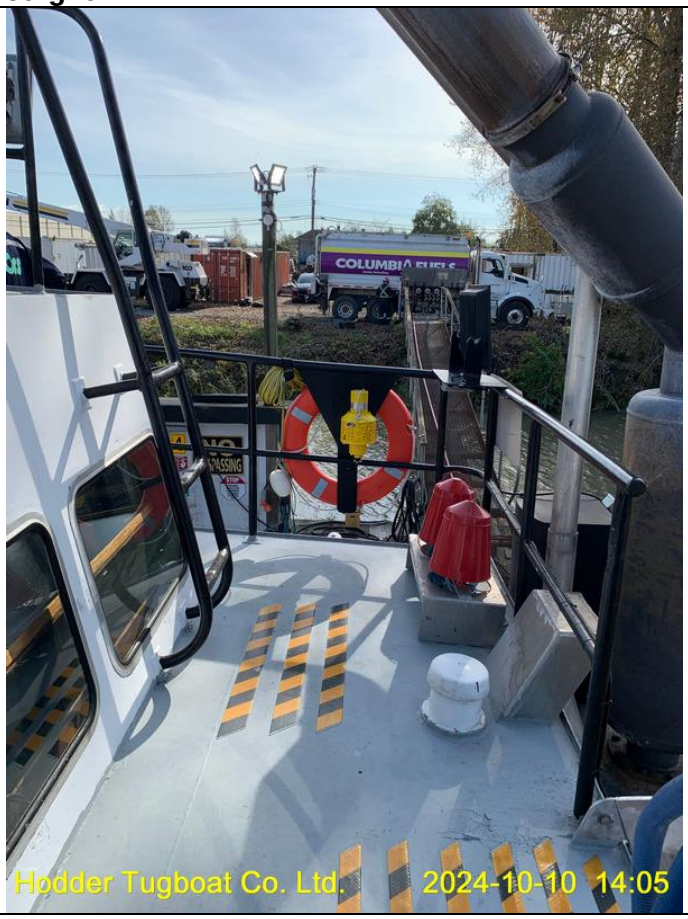

**Ladder for upper deck and mast access**


**Broken spotlight**

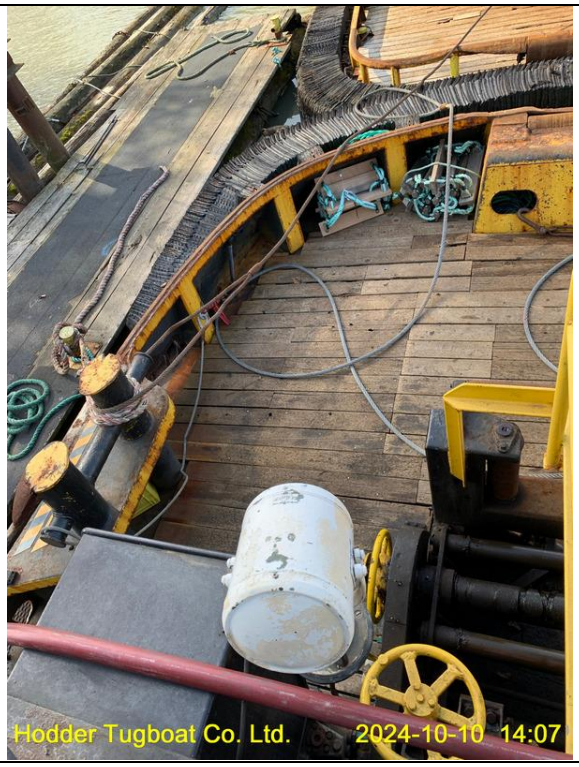
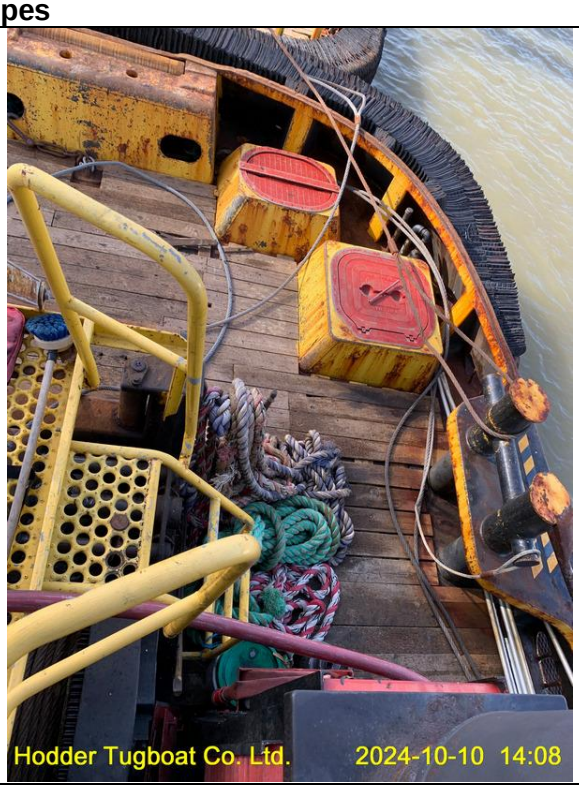

**Broken spotlight**

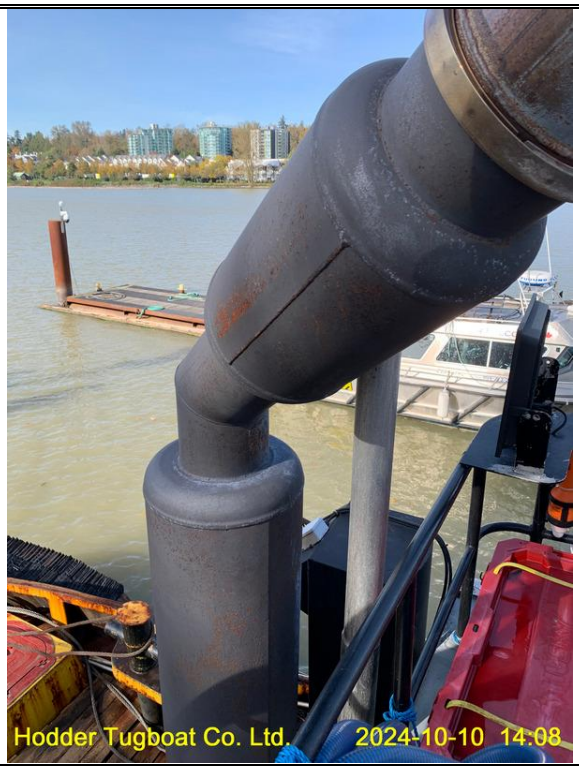



**Emergency inflatable raft**




**Upper deck starboard view**

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td colspan="2">Exhaust gas pipes</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Starboard/stern deck view</td><td>Port/stern deck view</td></tr>
</table>

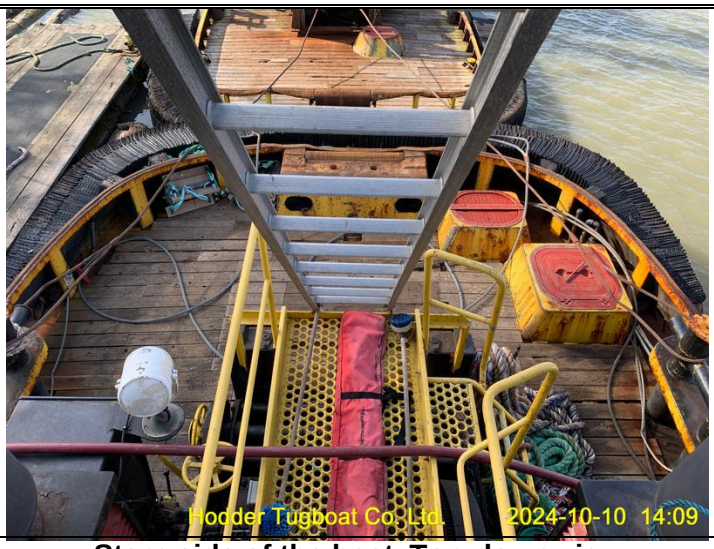




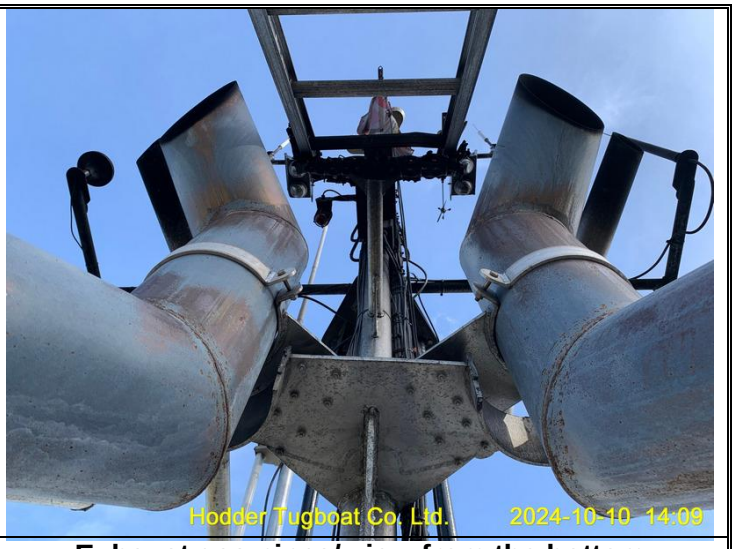
**Exhaust gas pipes with muffler**



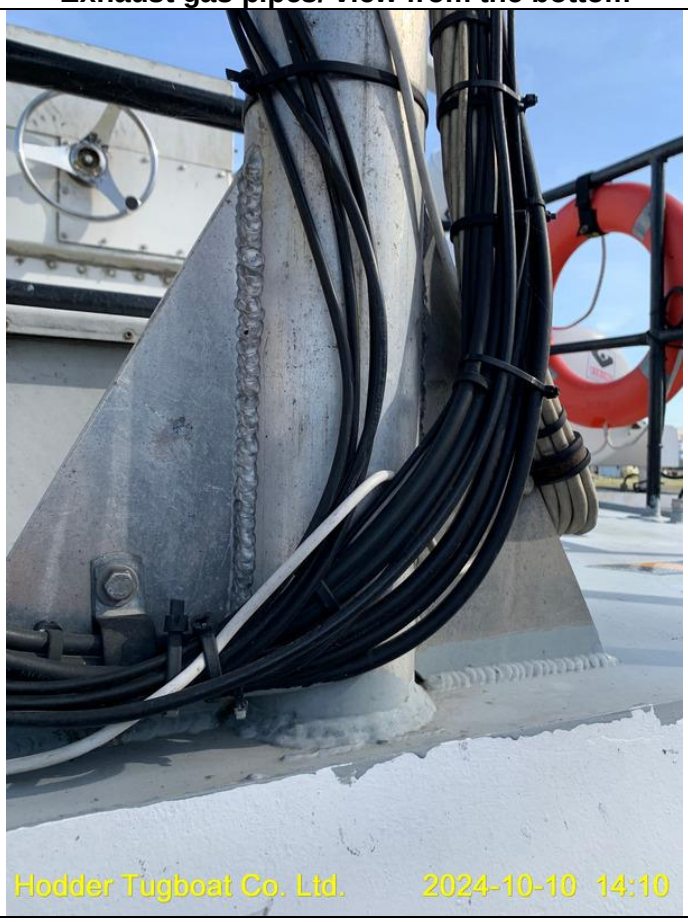
**Close-up rust on an exhaust pipe** | **Speaker**




Stern side of the boat, Top-down view




Exhaust gas pipes/ view from the bottom


Relatively new mast of the tugboat and cables


Organized wiring of the mast

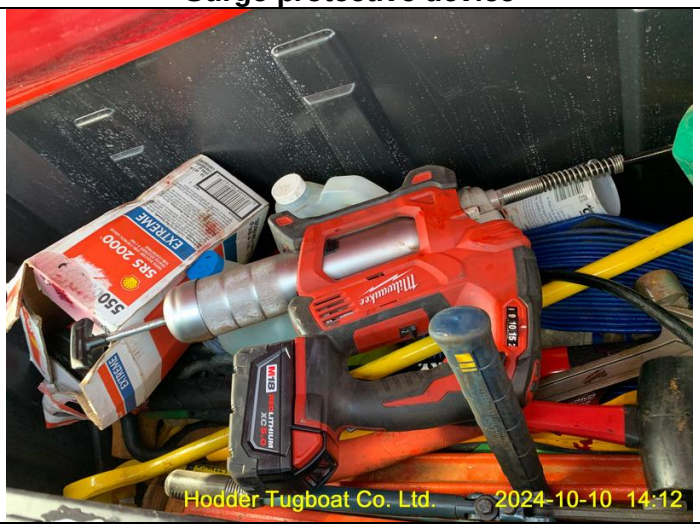

Relatively new spotlight



Grip equipped ladder


Spotlight, view from the back side


Surge protective device

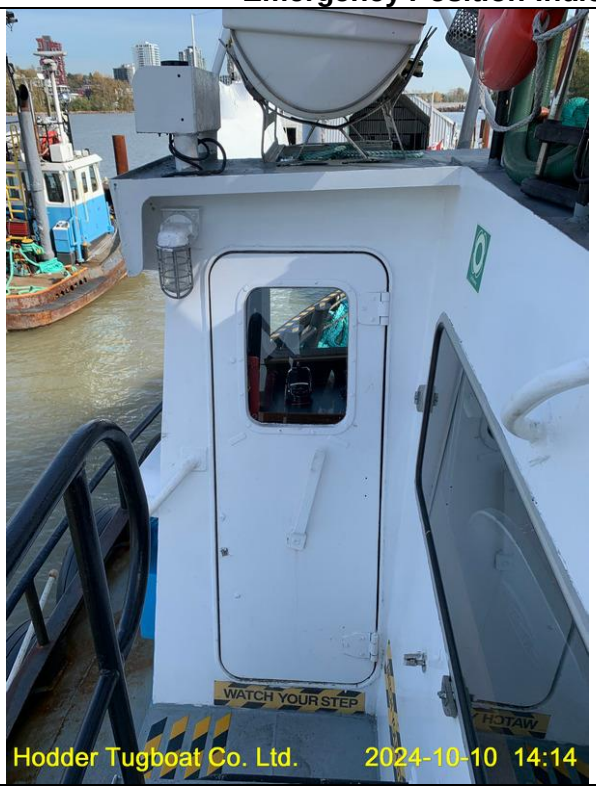

General maintenance equipment



Reserve water resistant grease for deck machinery/bearings



**Emergency Position-Indicating Radio Beacon (safety device)**




**Port side navigators bridge entrance door**

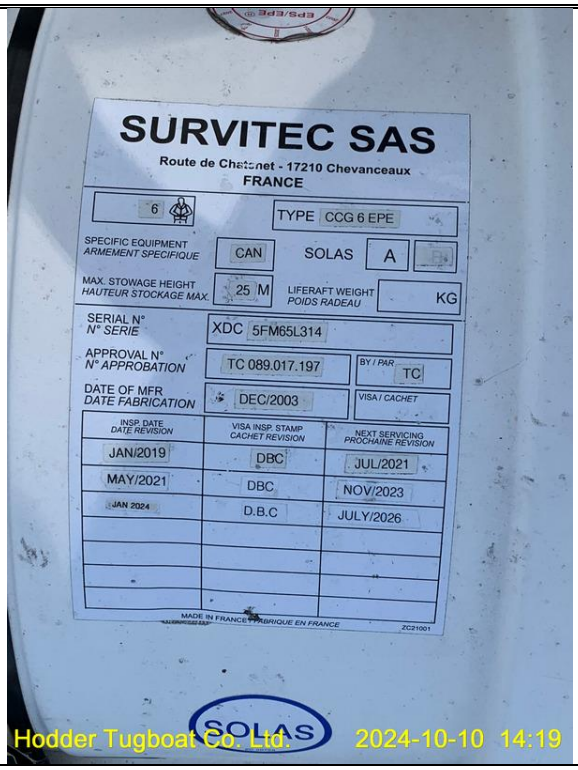

**Emergency spill kit**



**Oil spillage equipment in the plastic big bucket**



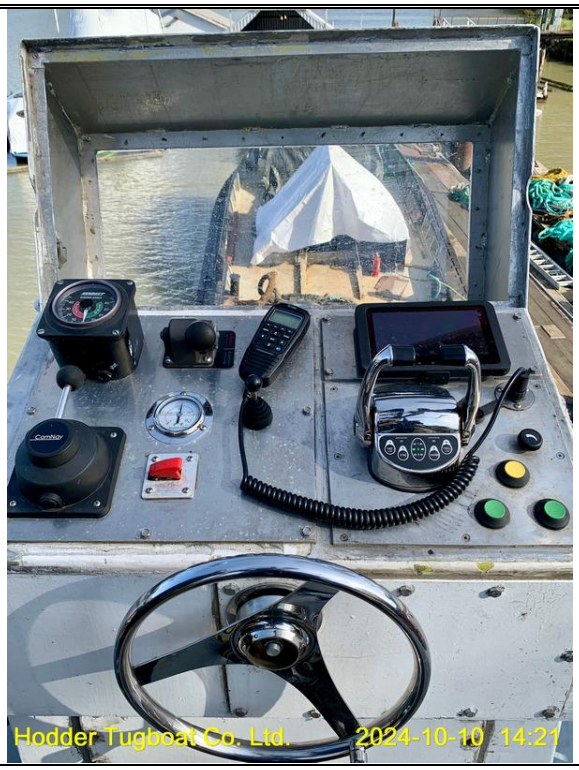
**Emergency life rafts on each side of the tug boat**


**Up-to-date servicing and maintenance of the rafts**

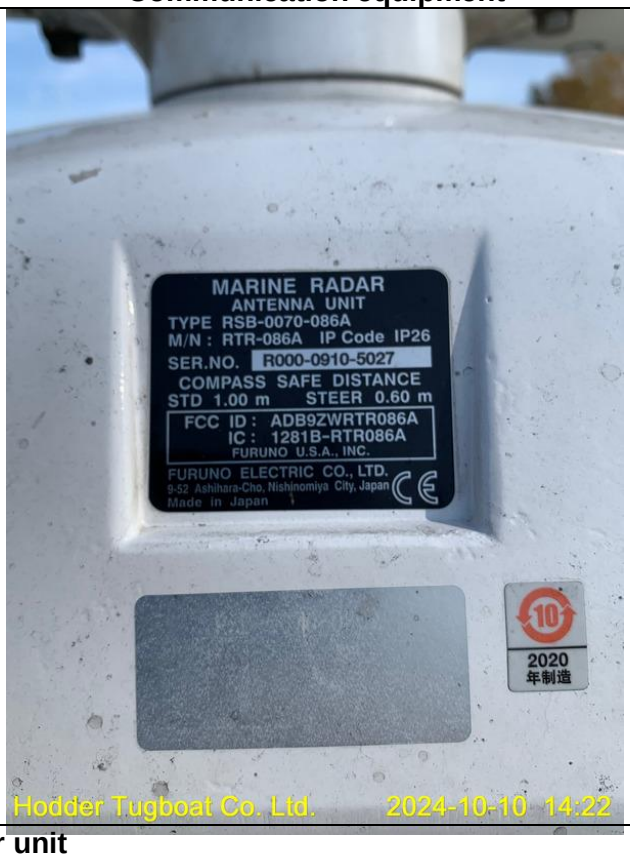

**Release mechanism for the life rafts**


**Top deck control console**

| | |
|---|---|
|   |   |
| **CISS Inspector by the console** | **General view of the controls** |
|   |   |
| **Steering wheel** | **Dual Engine throttle control** |


**Helm steering controls**


**Communication equipment**


**Marine radar unit**



**Marine searchlight**



**Air horn**

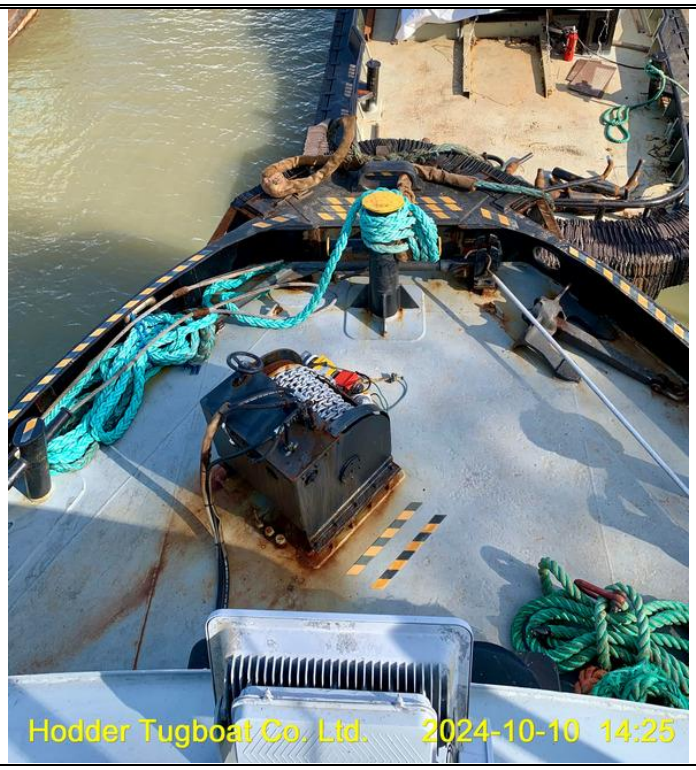


**Air horn measurements**


**Light bulb**


**Insulated electrical switch**


Navigational light



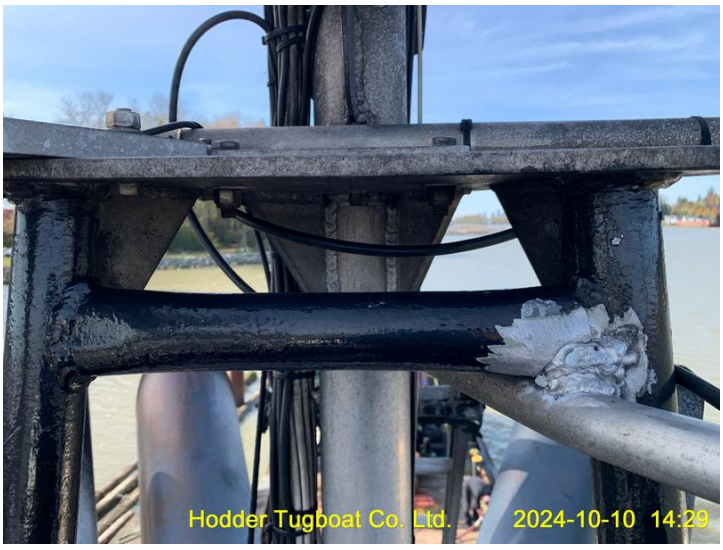

Bow deck, top-down view


Exhaust gas pipe mounts


Exhaust gas pipes view from the top deck



**Exhaust mounts**

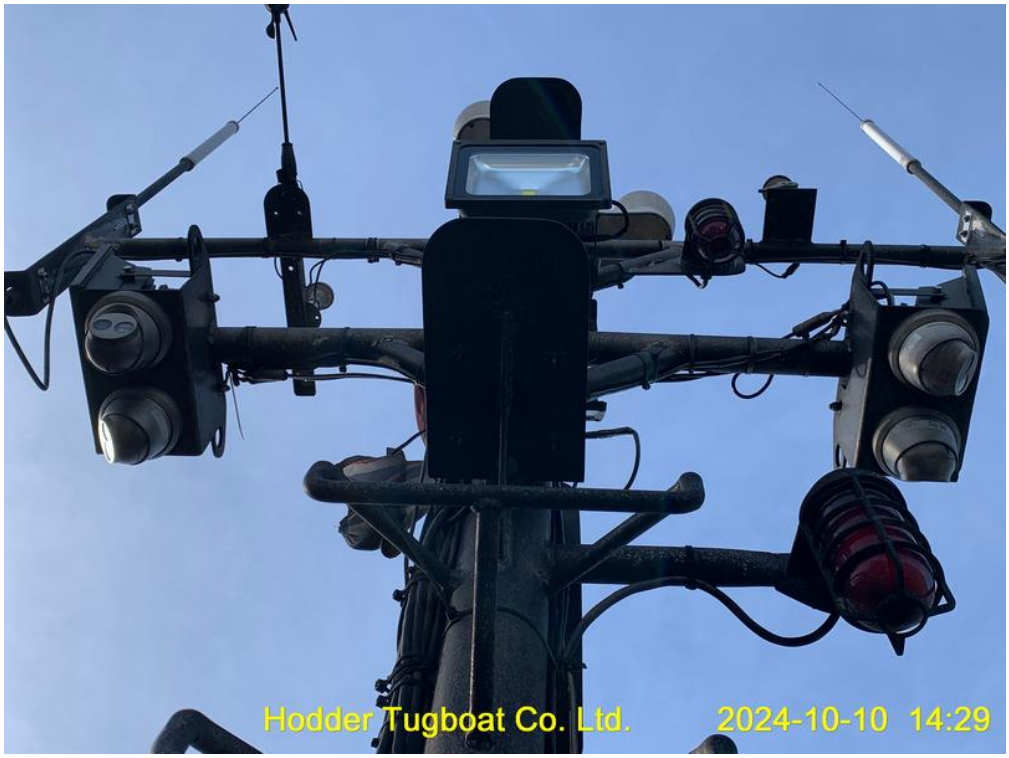




**Mast's welded mounts**



**Marine satellite antenna**



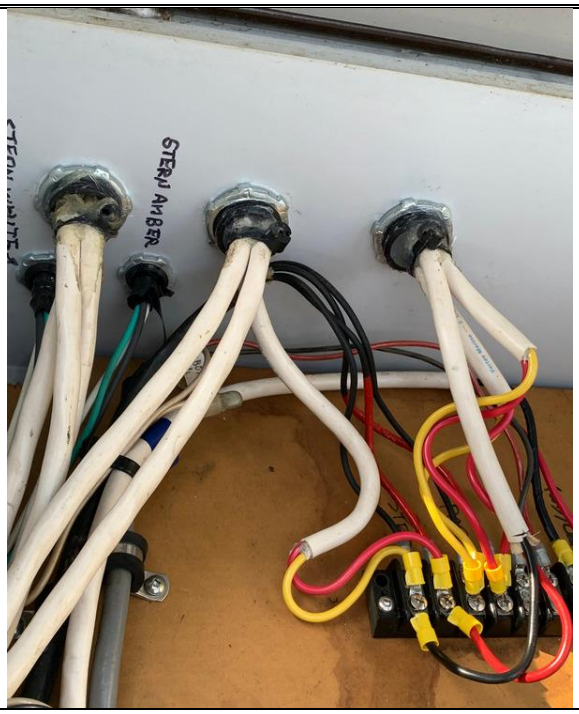

**Navigational aids, radio-antennas, video cameras/security devices and lamps**



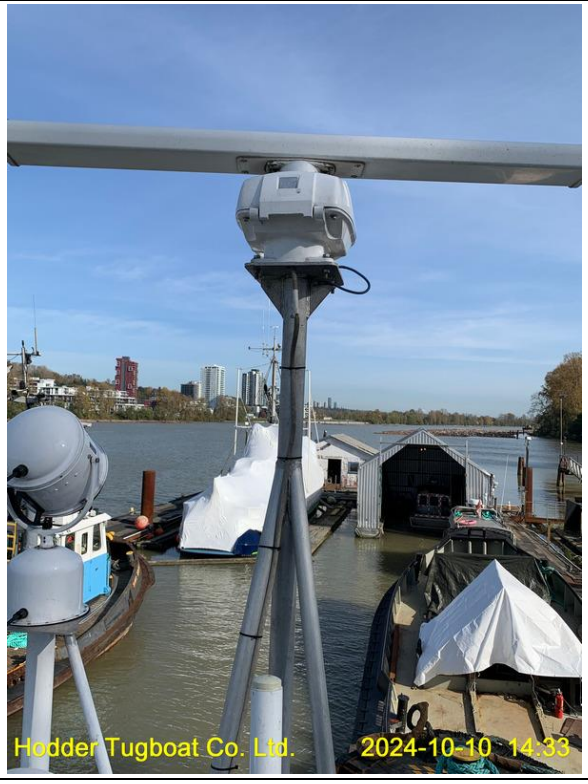
**Surveillance and monitoring equipment on the mast**



**Electrical box**

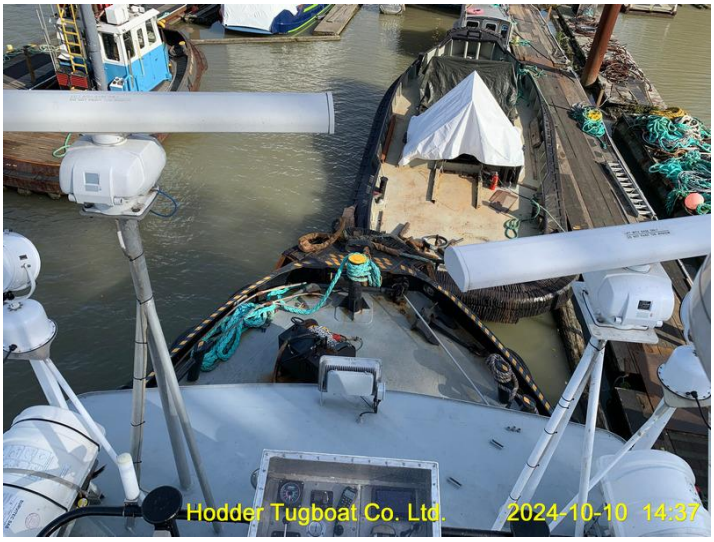



Water insulated wiring in electrical box





Second radar unit




Two radar units, view from the mast


Light bulb, not in order


Starboard navigational light


Port side navigational light

## II. Bridge devices and equipment.


General view of the bridge deck



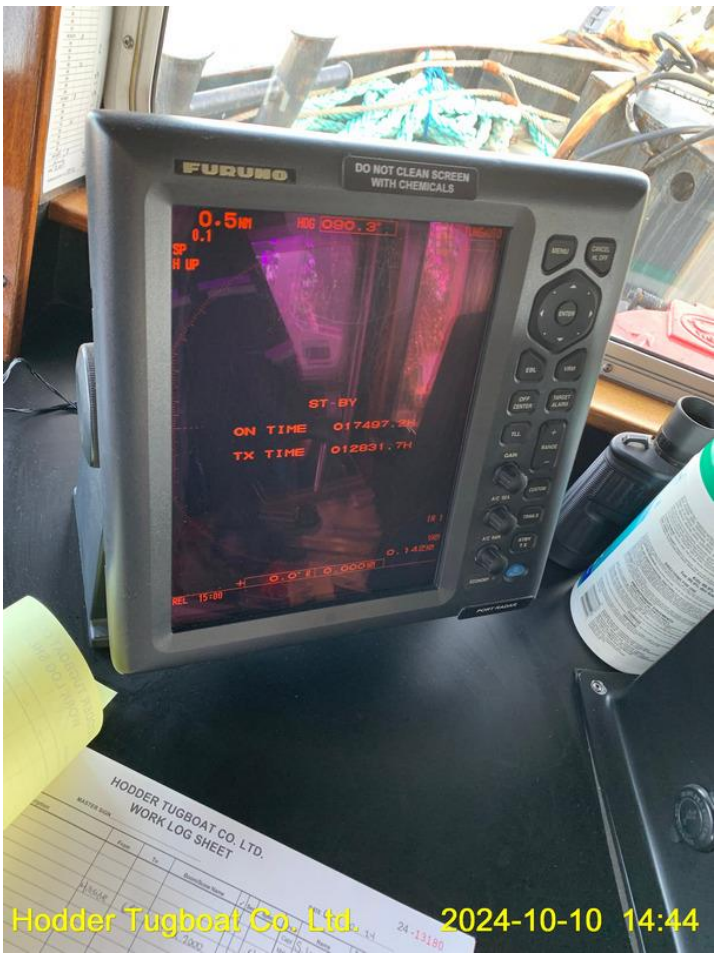
Vessel/engine dual throttle controls


Steering wheel


Searchlight controls/joystick



Helm steering controls





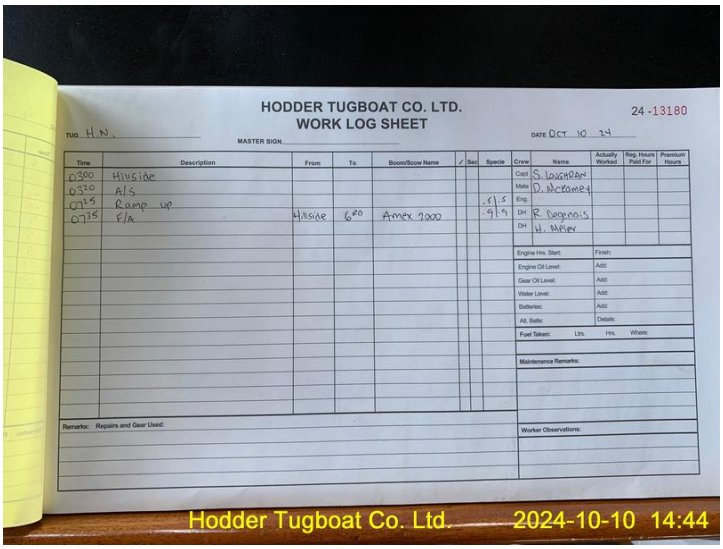
**Marine radar displays**

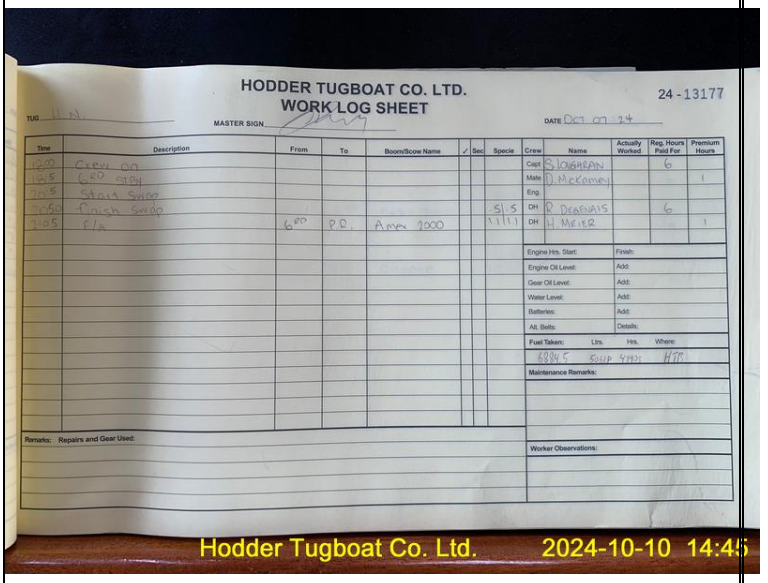

**ECDIS navigational system**


**Autopilot control system**

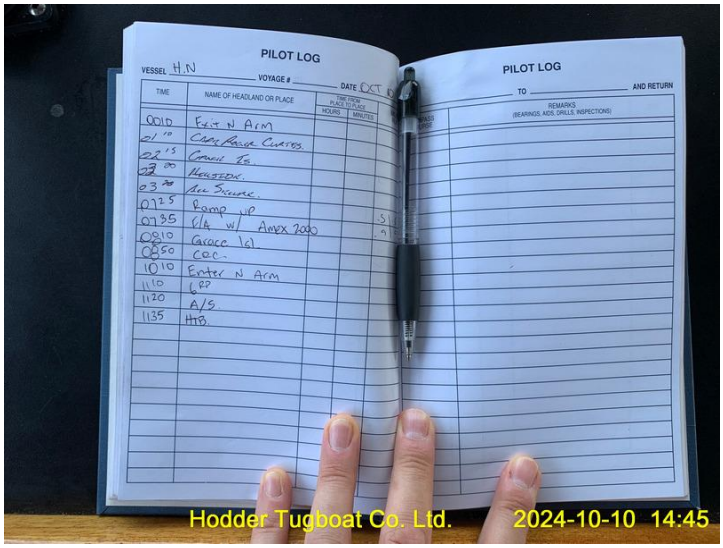

**Radio communication systems**

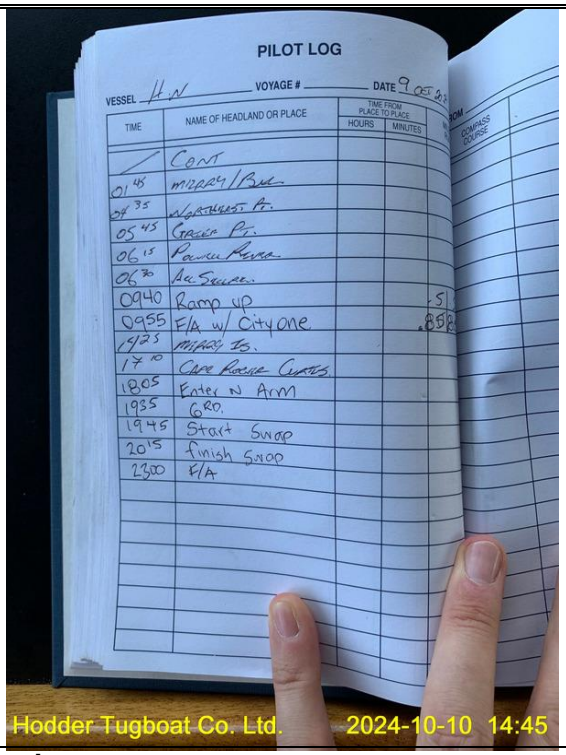

**Short-range emergency radio**



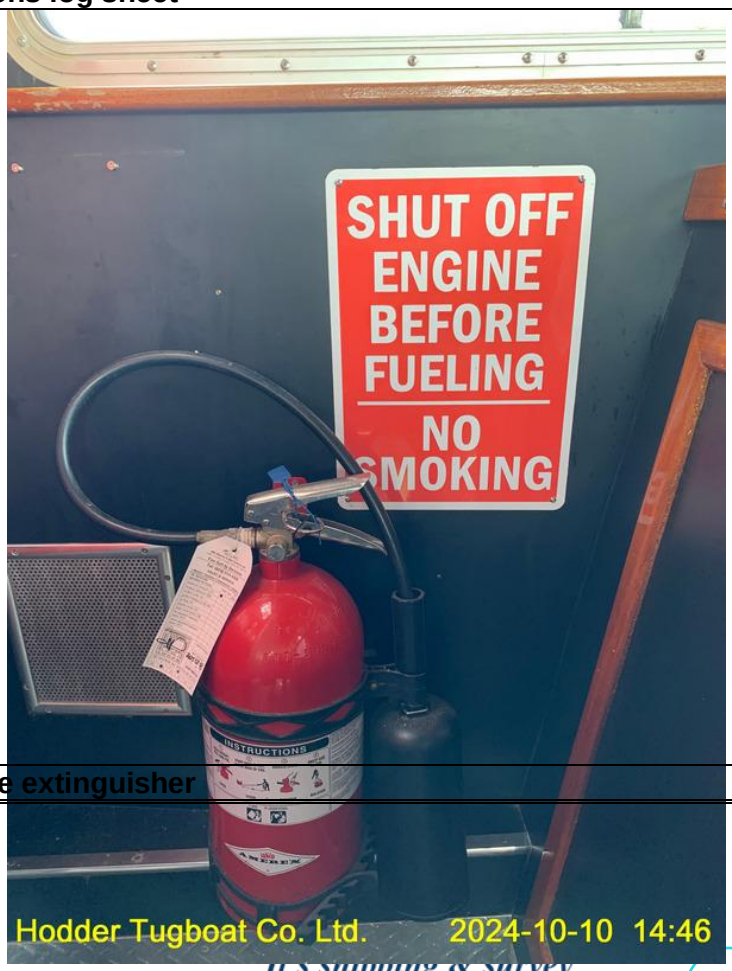




**Vessel work log sheet**




**Pilot operations log sheet**


**Emergency fire extinguisher**

Marine communication and navigation console


Alarm monitoring panel


Alarm panel close-up


Valve controls and safety essentials under the table



**Marine intercom systems**


**FURUNO/**
**Bridge Navigational Watch Alarm System - BNWAS**


**GPS display unit**



**Sailor communication radio units**

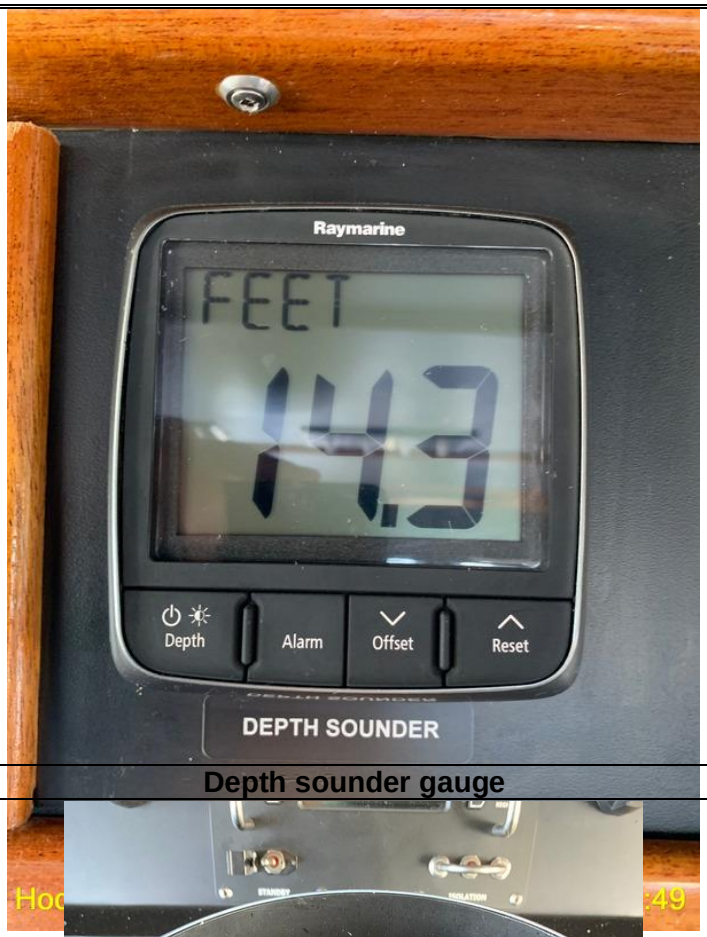

**Bridge navigational watch alarm system**


**JRC GPS compass**

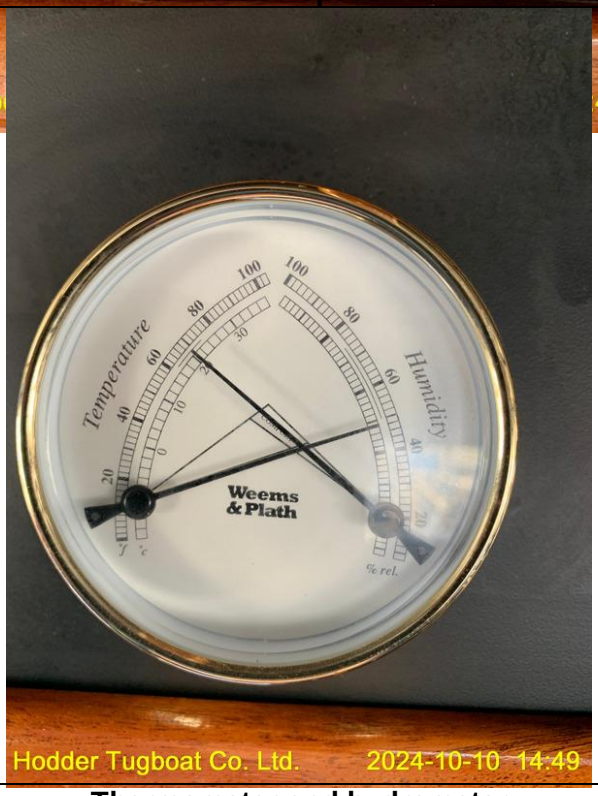

**Rear station radio**


**Autopilot navigation controls**


Wind/Direction speed indicator

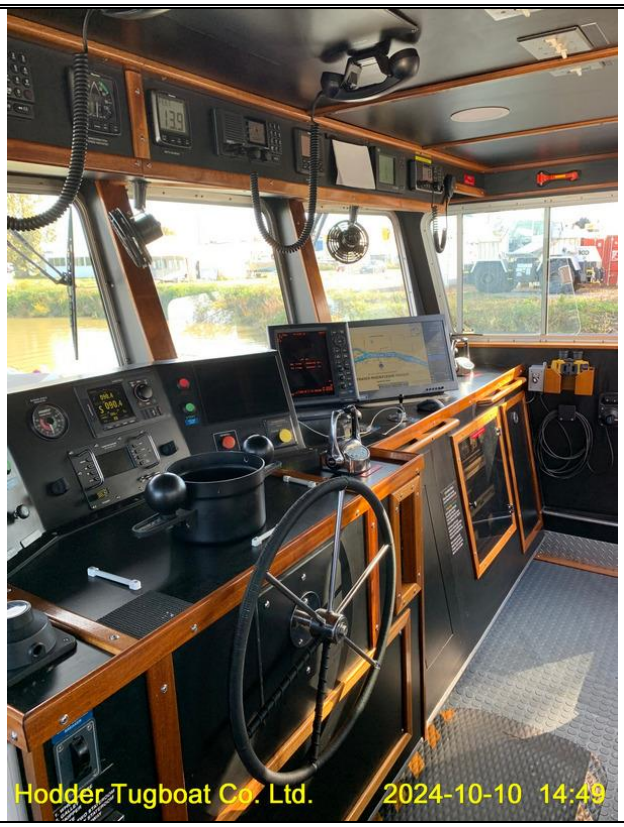


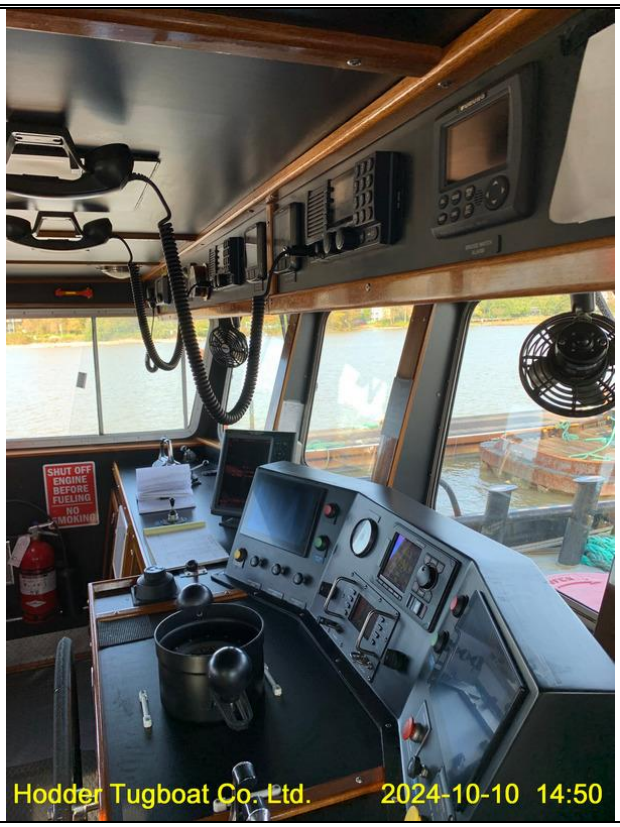

Depth sounder gauge




Thermometer and hydrometer


Magnetic compass

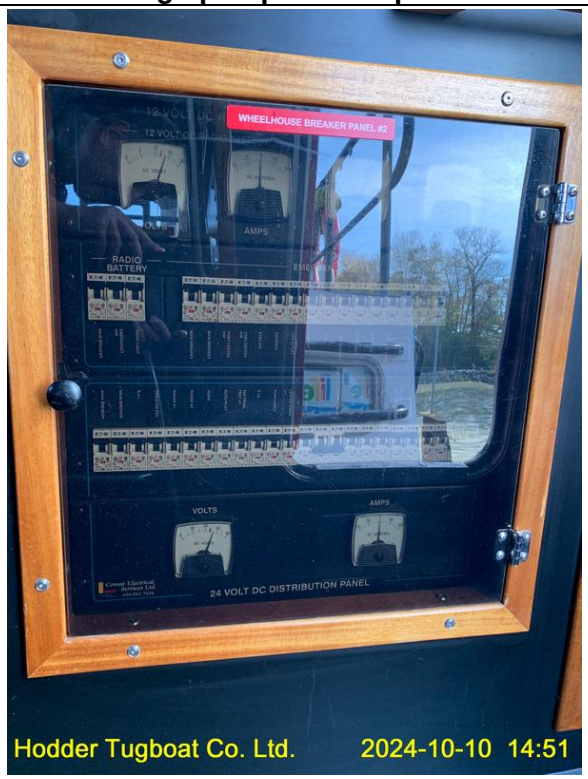



**Pilot's/navigational watchman cabin**

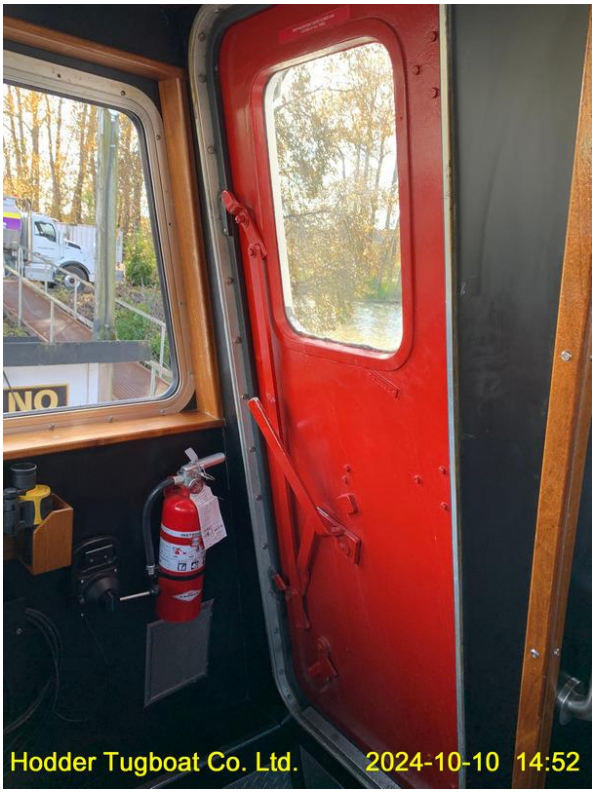


**Overhead operational and navigational equipment**

| | |
|---|---|
|  |  |
| **Bilge pump control panel** | **Pilot's cabin starboard side entrance** |
|  |  |
| **Circuit breaker control panel** | **Safety precaution sign** |



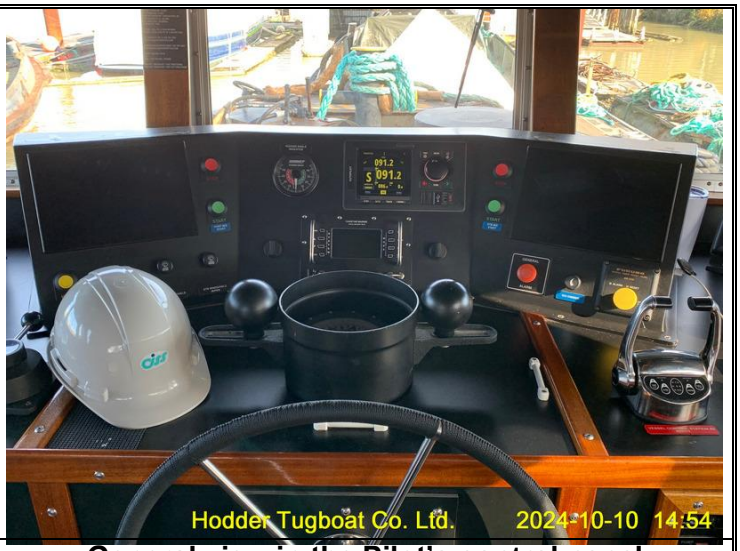
**Condition of the doorway panel into the upper cabin**




**Starboard door into the navigational cabin**


**Watertight doorway into the kitchen from Pilot's room**


The pilot's backside of the main steering equipment

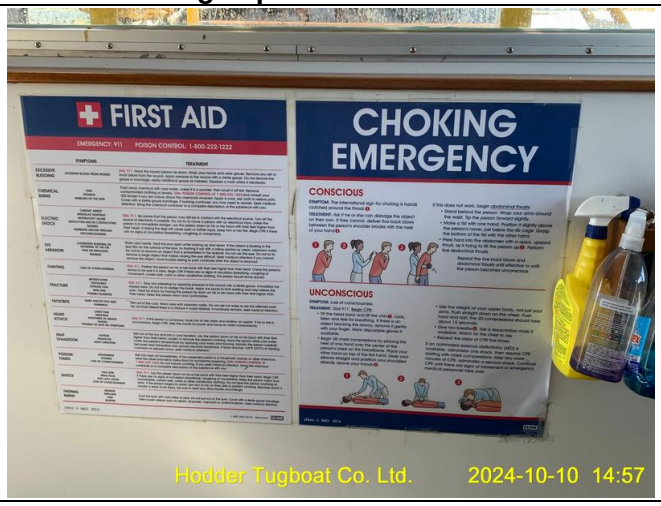



General view in the Pilot's control panel


Galley - dining area (mess room)


Storage space under the table


TV view from the dining table




Safety precaution signs and instructions

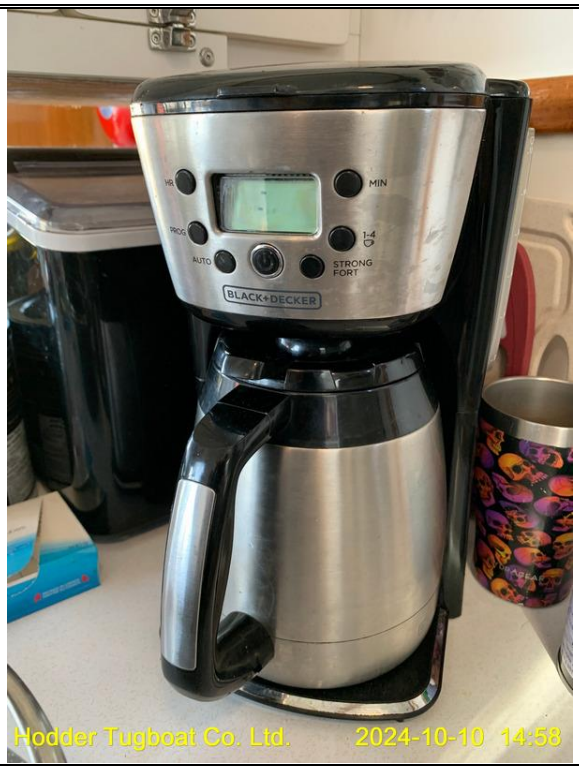

**The boat's crew cabins and engine room entrances**


**Galley equipment**


**Microwave oven "Panasonic"**


**Galley working area**

| | |
|---|---|
|   |   |
| **The stove and the oven** | **Galley bay** |
|   |   |
| **Cooking supplies** | **Organized magnetic strip knife storage** |

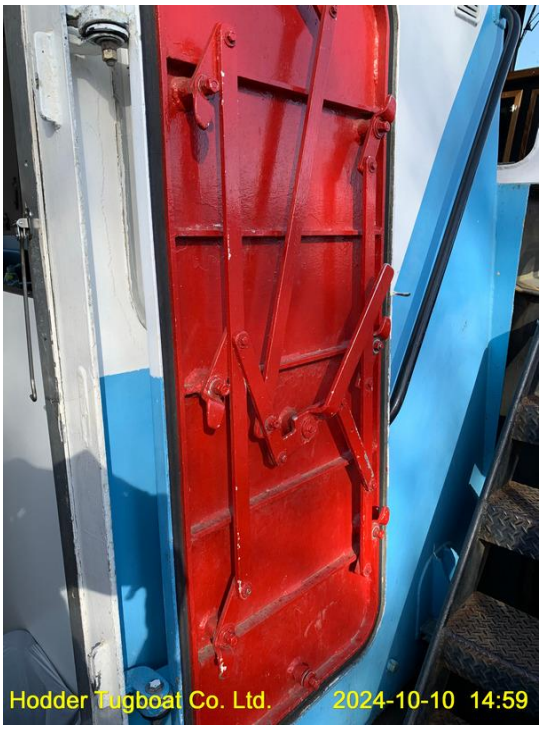
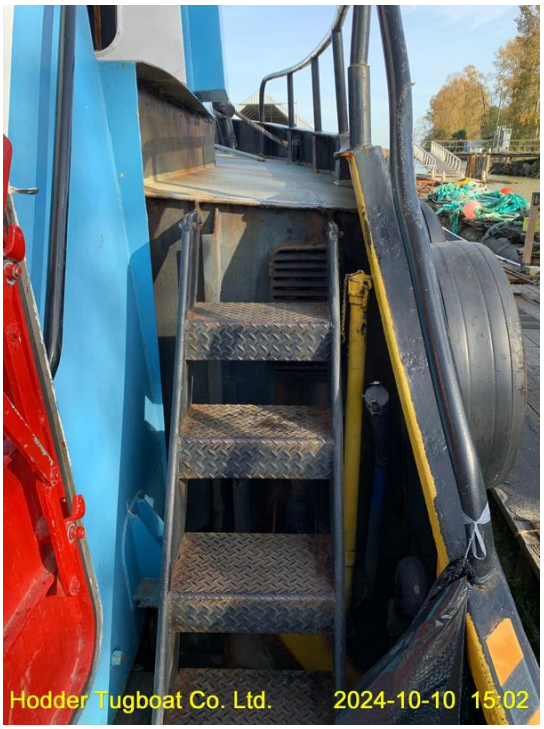
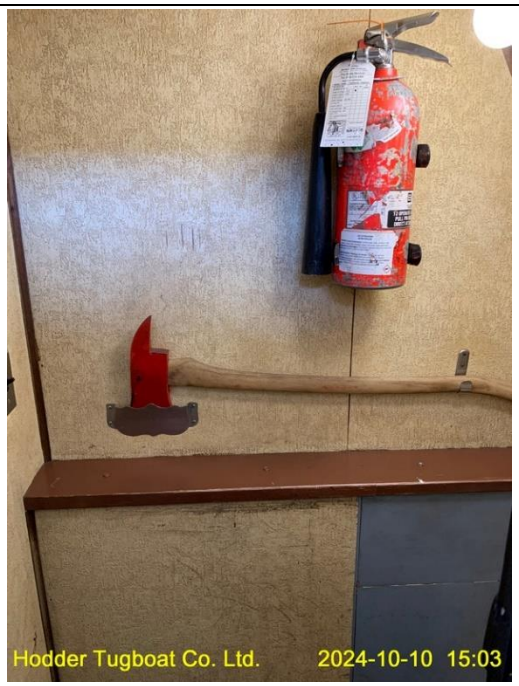
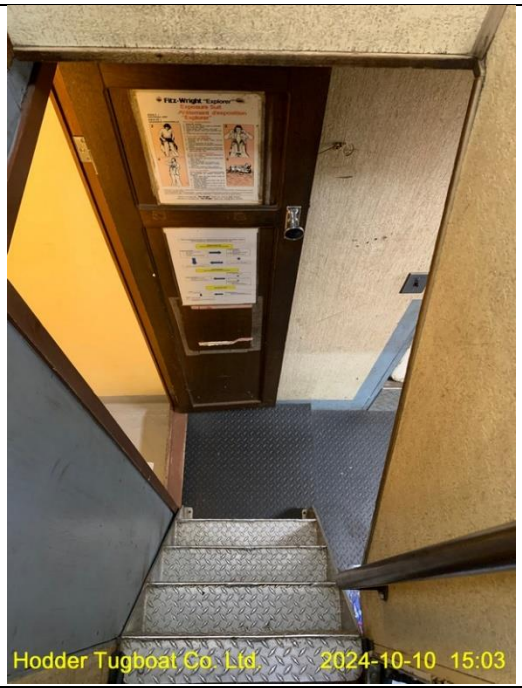



**Drip coffee maker**


**View into Pilot's cabin from the dining area (mess room)**

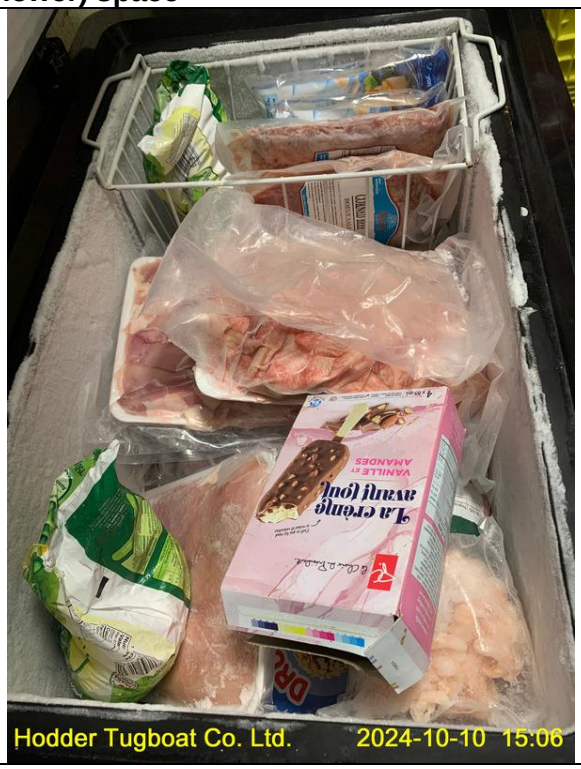

**Galley view from starboard entrance**


**General view from the dining area (port side)**

| | |
|---|---|
|   |   |
| **Starboard side entrance to the superstructure/galley area from the deck** | |
| **III. Engine room.** | |
|   |   |
| **Firefighting equipment at the entrance** | **Stair way towards engine room** |



**Washroom (toilet and shower) space**


**Food freezer**



**Washing machine and dryer**



**Emergency defibrillator and first aid kit**

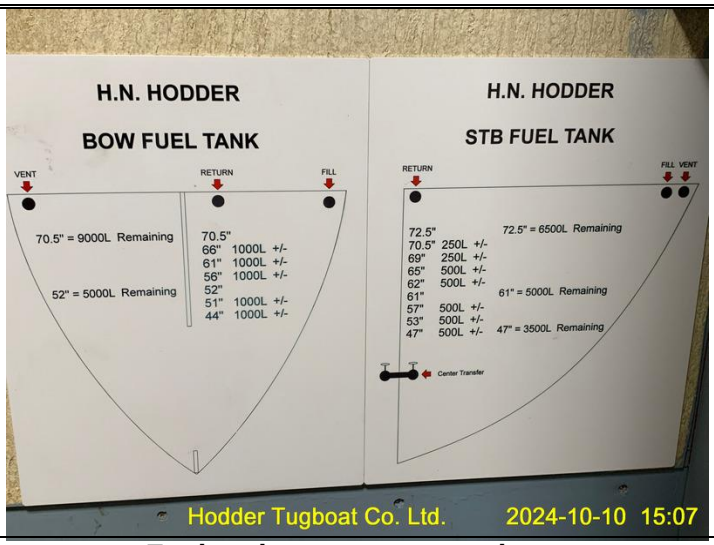

General view of the food storage area


Food storage

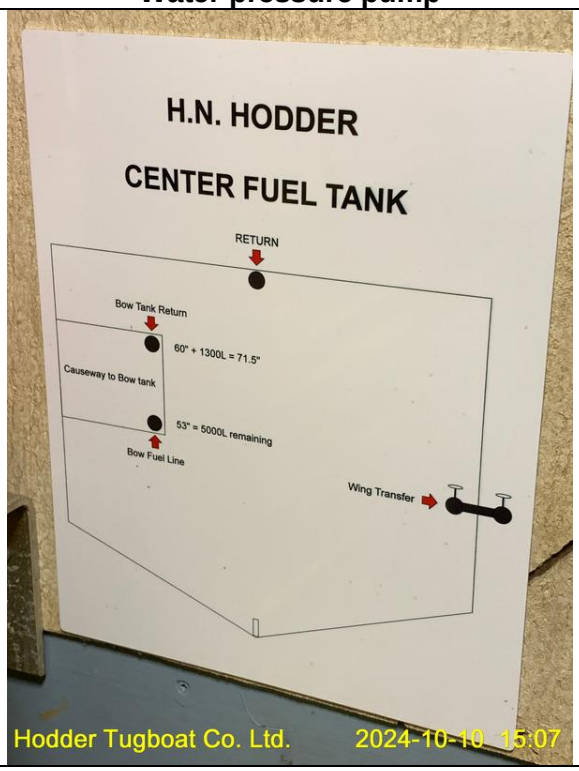


$CO_2$ firefighting system


**Water pressure pump**

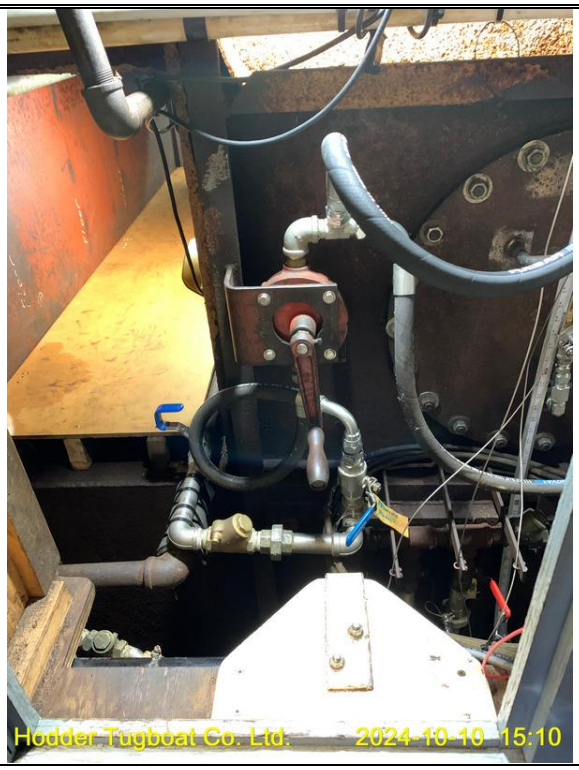


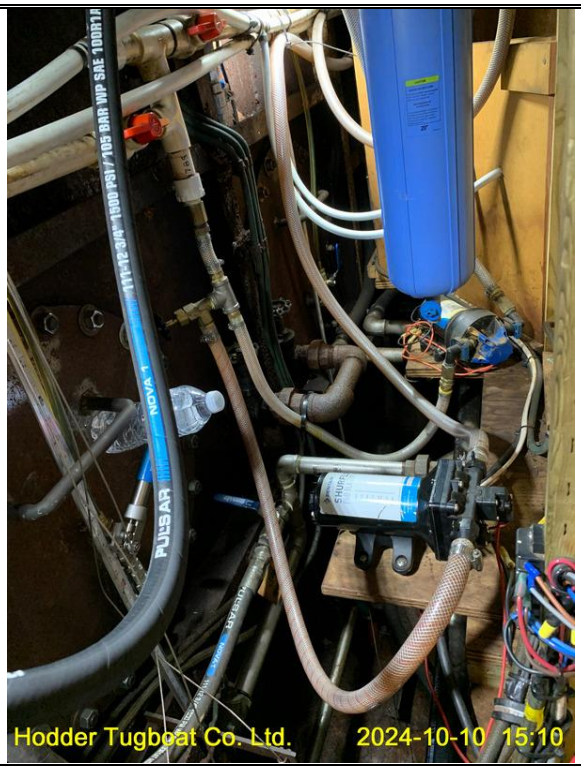

**Fuel tank measurement charts**



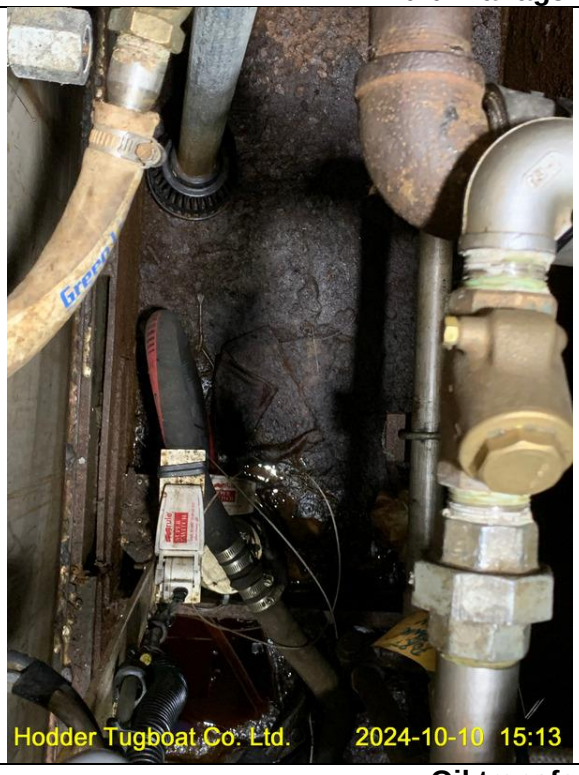

**Fuel tank measurement chart**

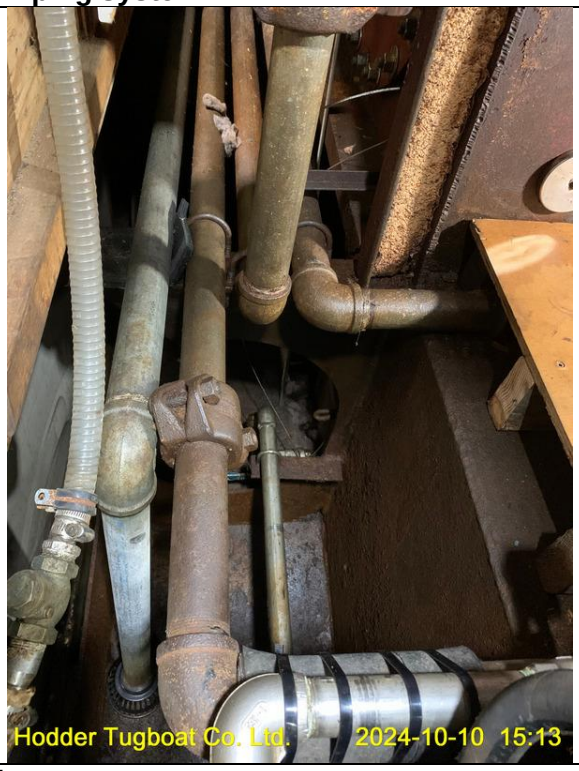

**Water filtration unit and intercom phone**



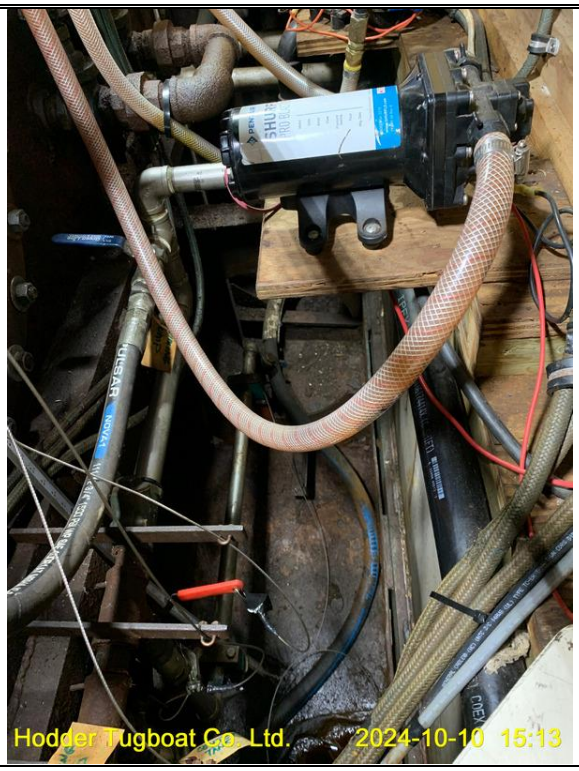




**Fluid management and pumping system**




**Oil transfer/ water piping system**

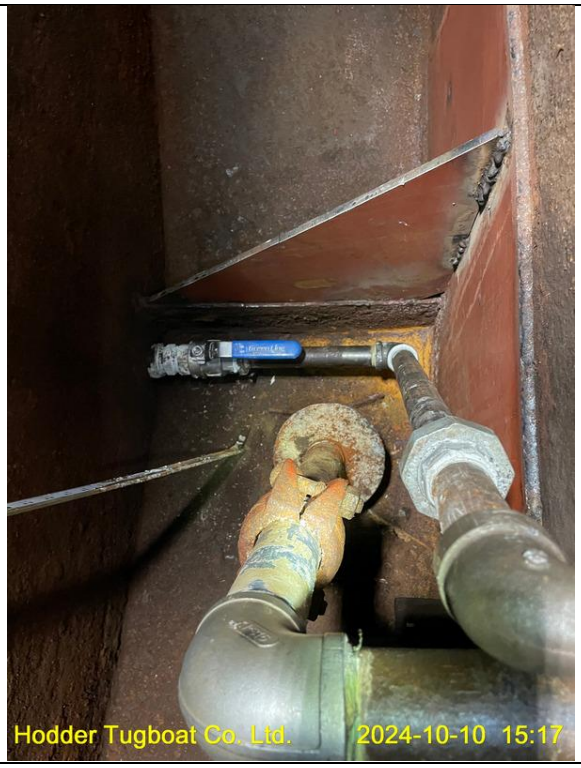

**Marine water pressure pump**



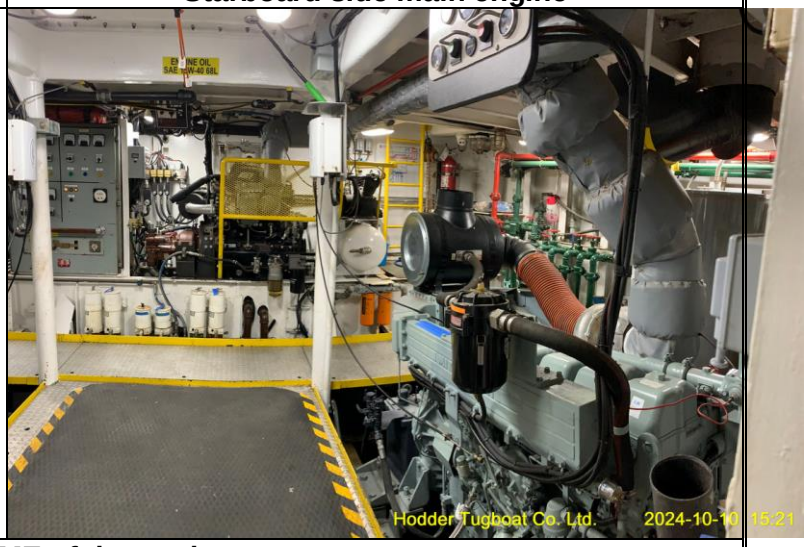
**Water system pump**


Fluid transfer systems

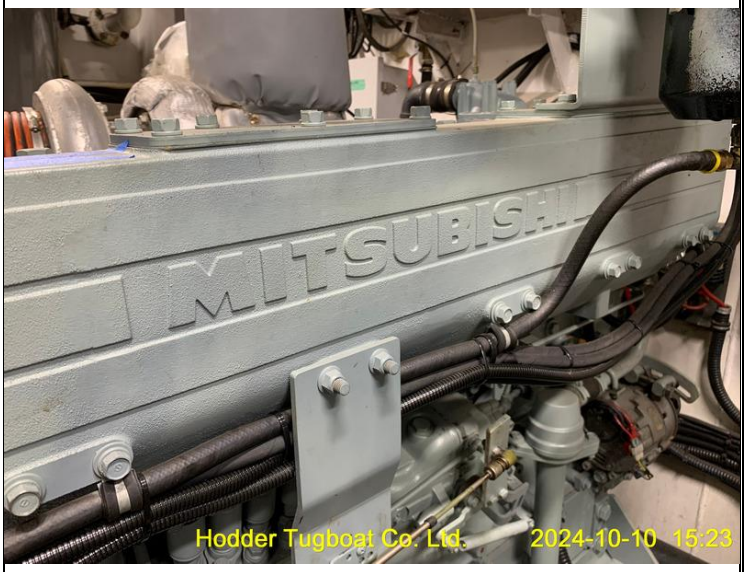

Overhead cable routing

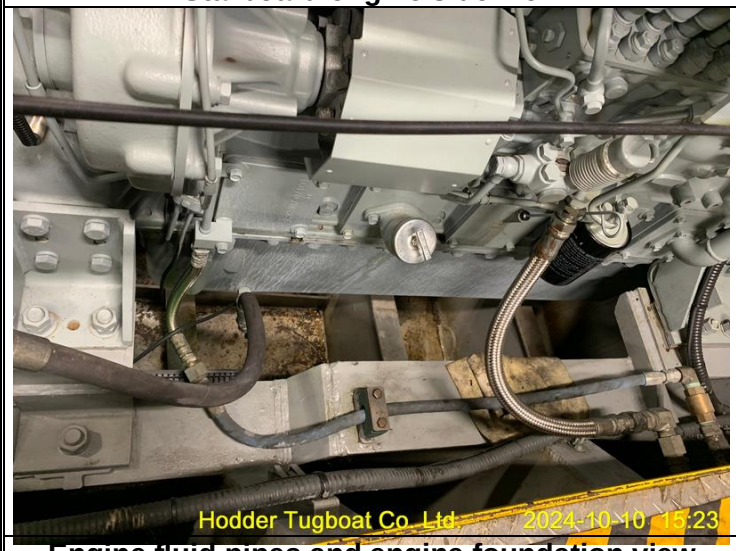

Cofferdam, fluid transfer systems

| Engine room entrance | Engine room, view from entrance door |
|---|---|
|   |   |
| **Port side main engine (ME)** | **Starboard side main engine** |
|   |   |
| **General view of both ME of the engine room** | |

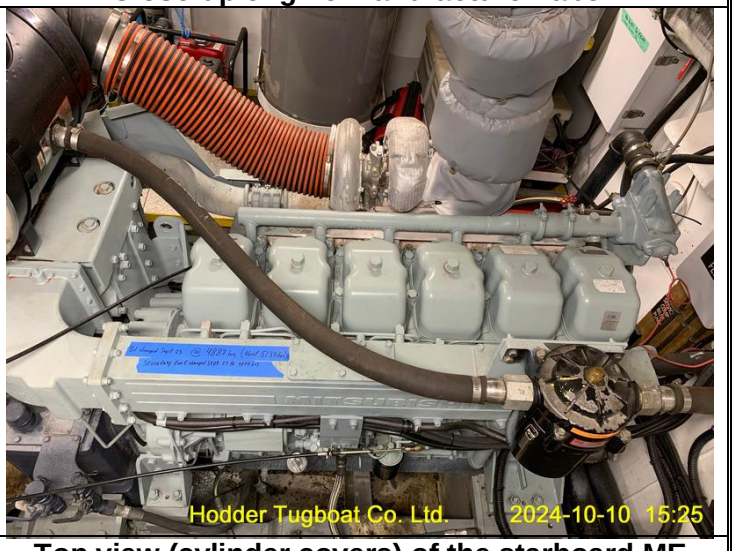

Starboard engine side view




Close-up engine manufacturer label



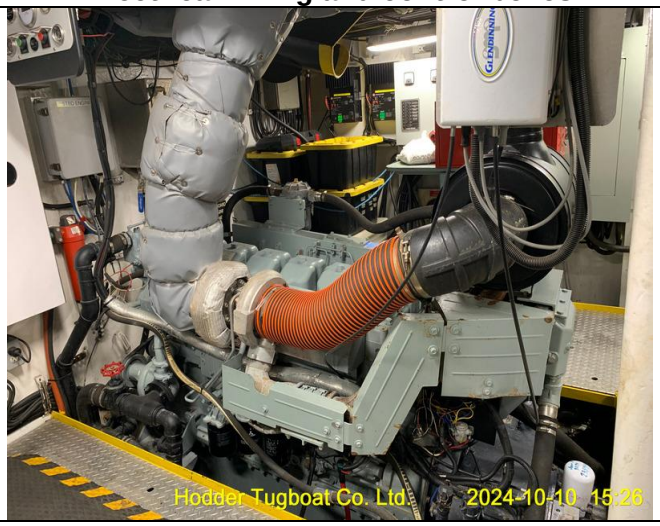

Engine fluid pipes and engine foundation view




Top view (cylinder covers) of the starboard ME


**Engine control panel**


**Electrical wiring and control boxes**

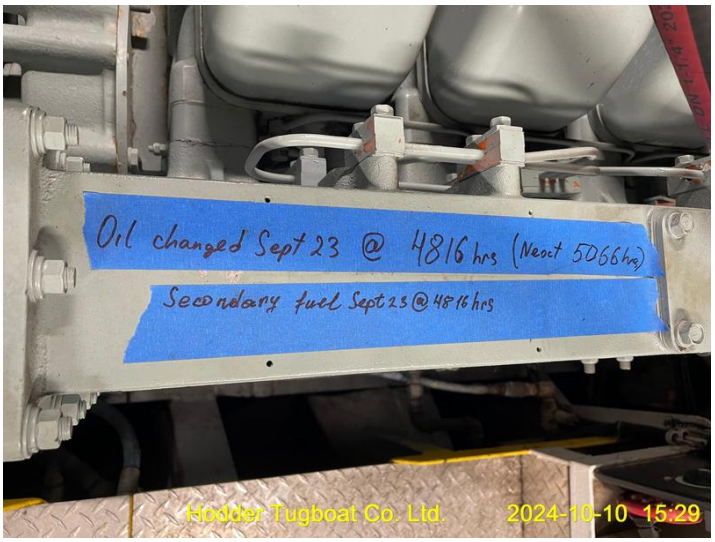
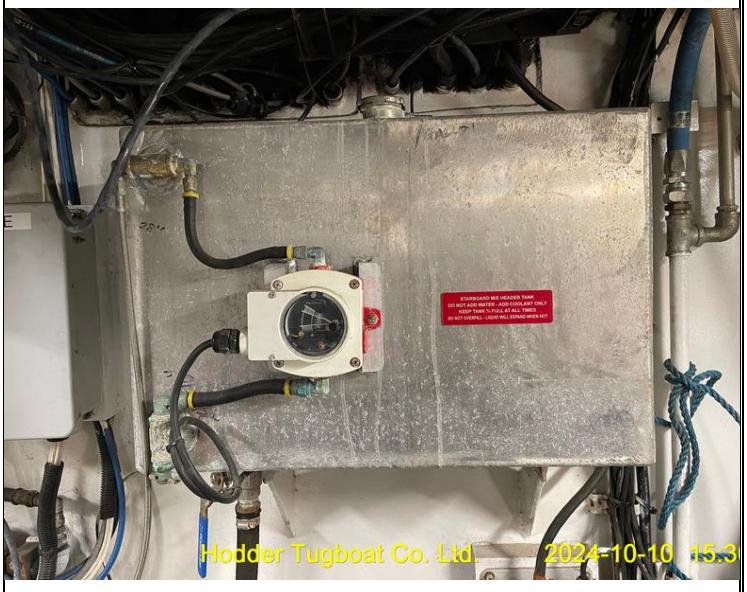

**Port ME / side view**


Twin disc lubrication specification plate


Central Electrical control panel



Electrical batteries (accumulators), electrical panels and work station

| | |
|---|---|
|  |  |
| **Marine diesel generator (auxiliary engine - AE)** | **Label showing the running hours of the engine** |
|  |  |
| **Engine fuel/oil filter** | **Header tank system (starboard ME)** |

<table>
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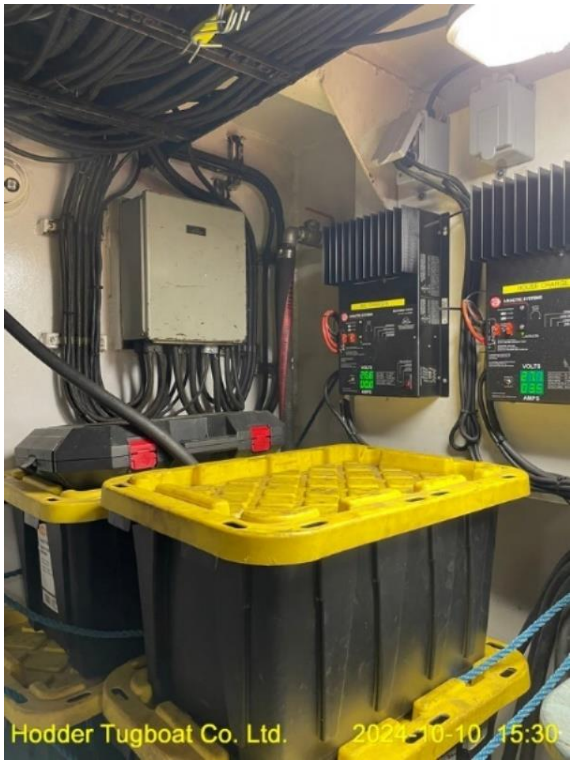
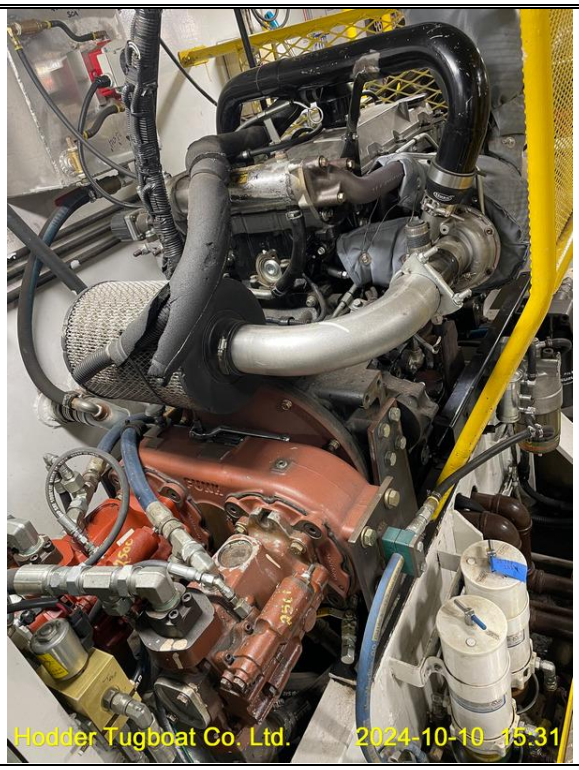
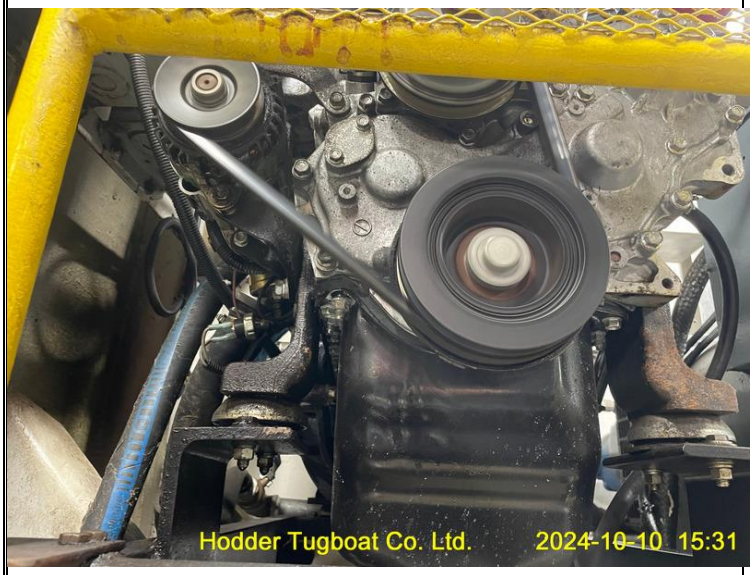
</td><td> 
</td></tr>
<tr><td>Battery chargers</td><td>Battery charging setup and it’s electrical cabling</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>STBD engine control box</td><td>Electrical distribution panel</td></tr>
</table>


**Battery charging system**




**Hydraulic lubrication pump**

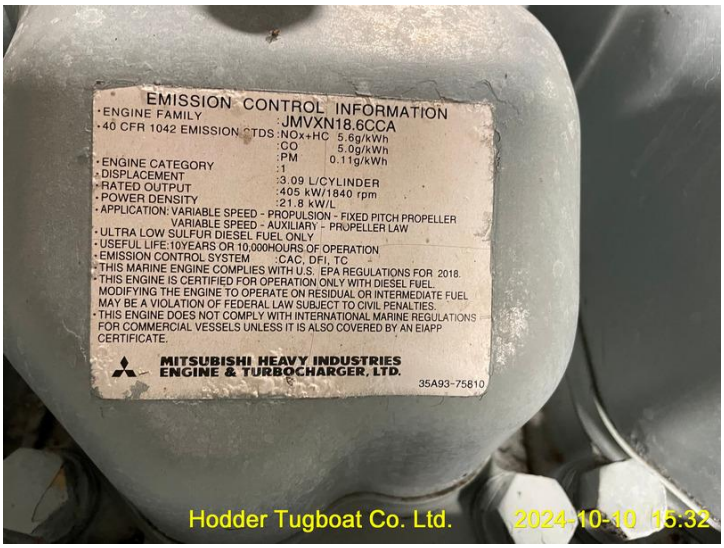



**Diesel generator pulley system**


**Pressure gauges and hydraulic control valves**

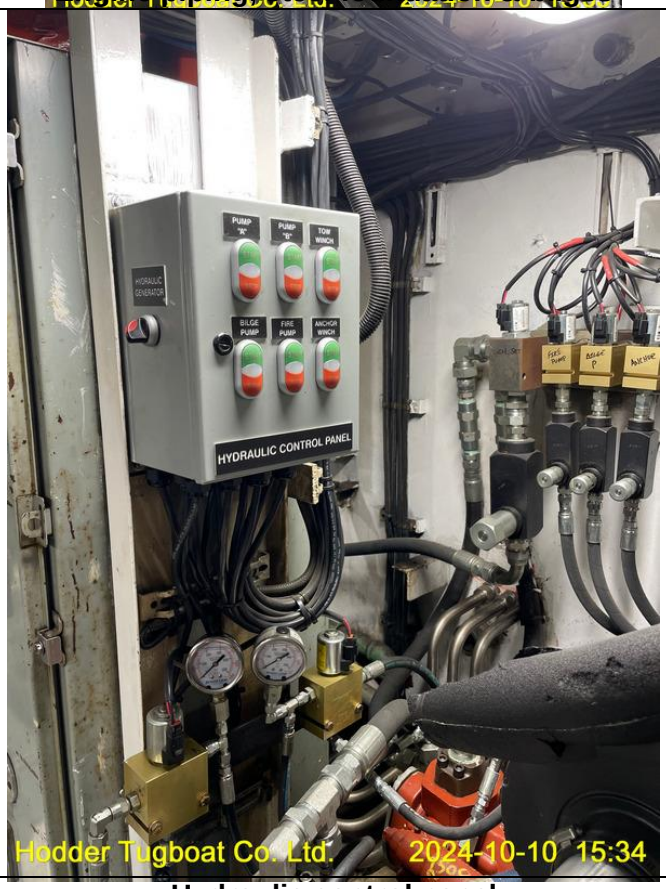
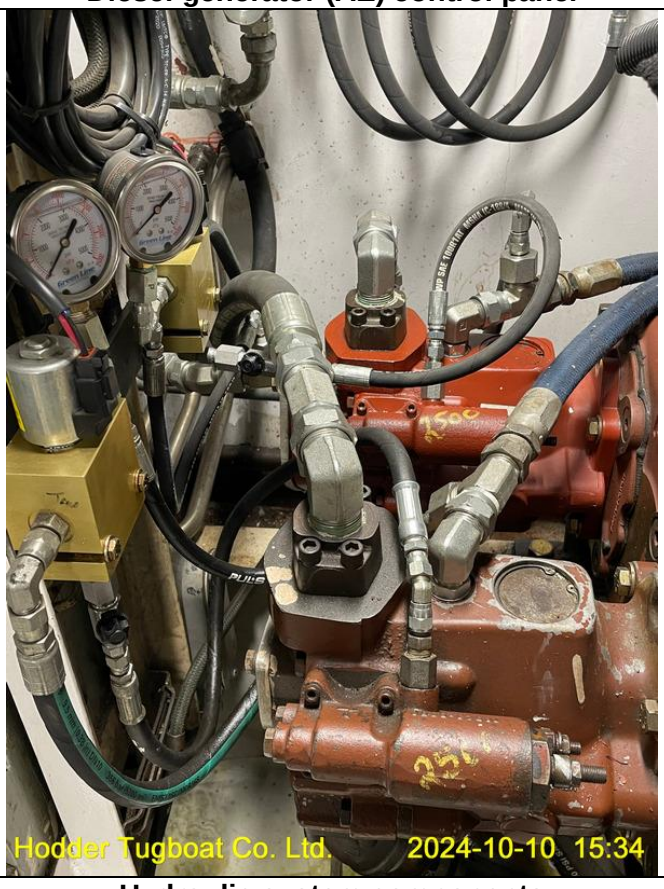


**Fluid separators**





**Main Engine emission control system (exhaust details)**

| | |
|---|---|
|  |  |
| Engine piping, steel foundation & bilges | Diesel generator (AE) control panel |
|  |  |
| Hydraulic control panel | Hydraulic system components |


Starboard engine general view

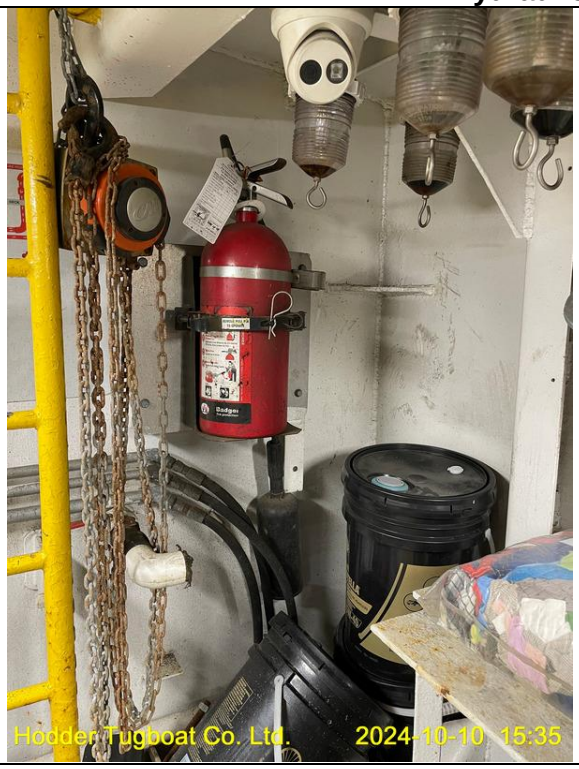

Firefighting valve control setup

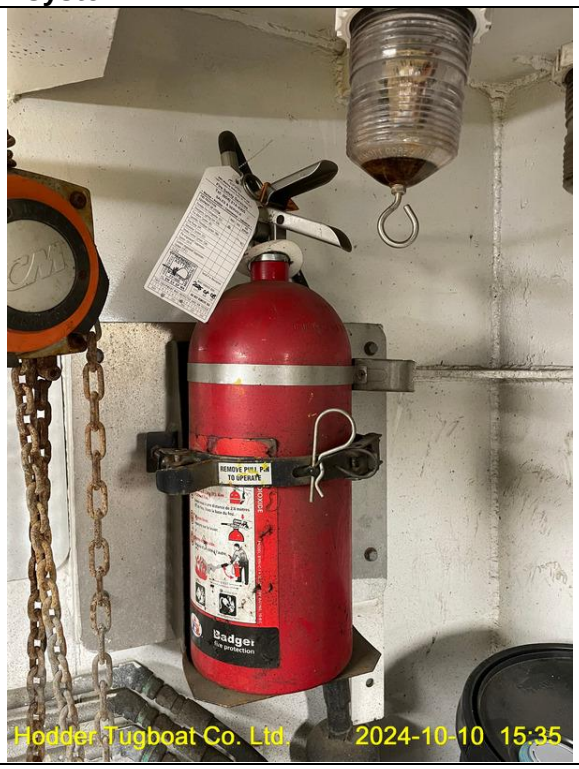

Close-up of the hydraulic pump


Emergency way out



**Hydraulic oil filtration system**




**Emergency, wall-mounted fire extinguisher**


**Well-maintained engines with insulated exhaust systems.**


**Boiler (water) tank**

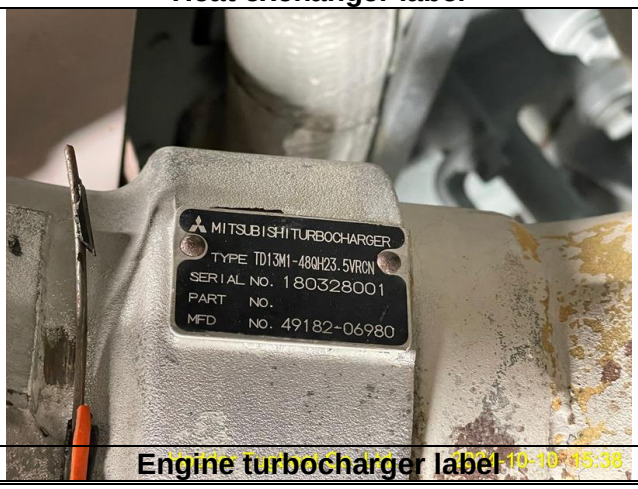

**Engine room fan/ventilation controls**


Engine fuel filters


Bilge space underneath the engine

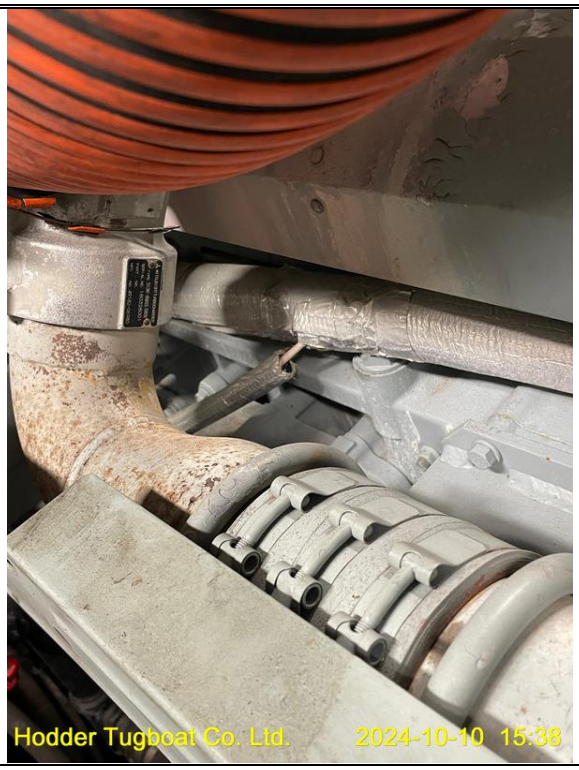

Heat exchanger label

Wiring compartment




Engine turbocharger label


Main electrical switches control panel




ME with exhaust manifold components


ME turbocharger



Condition of the propeller shaft and couplings

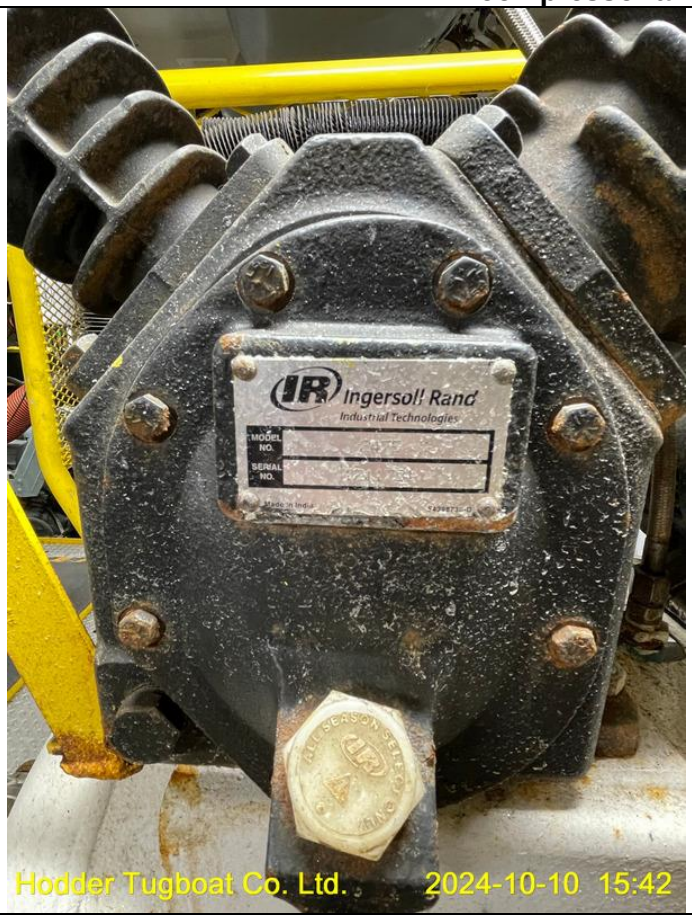


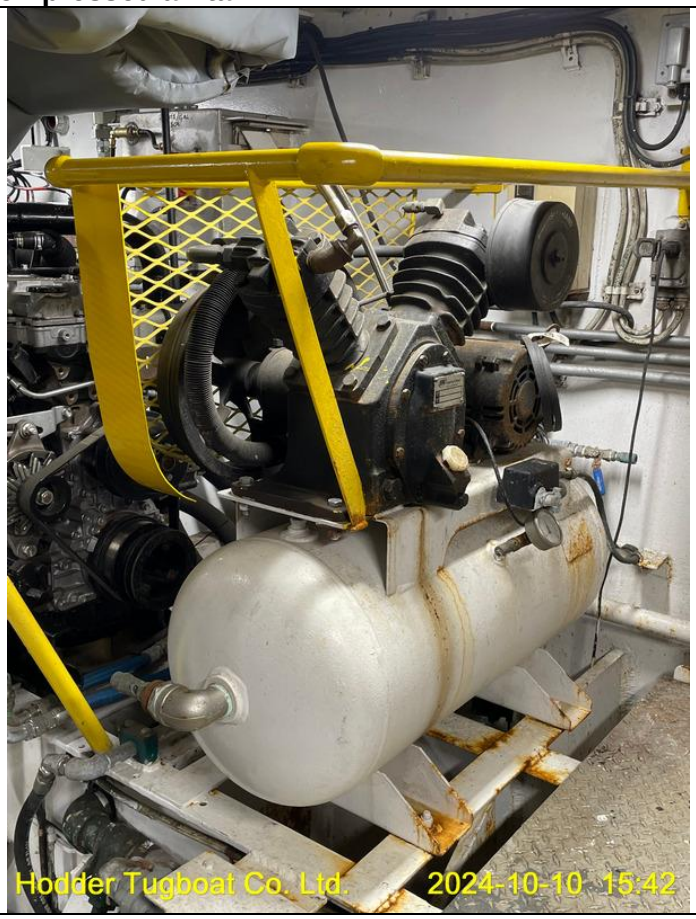
**Mitsubishi engine specifications/valve clearance and firing order**



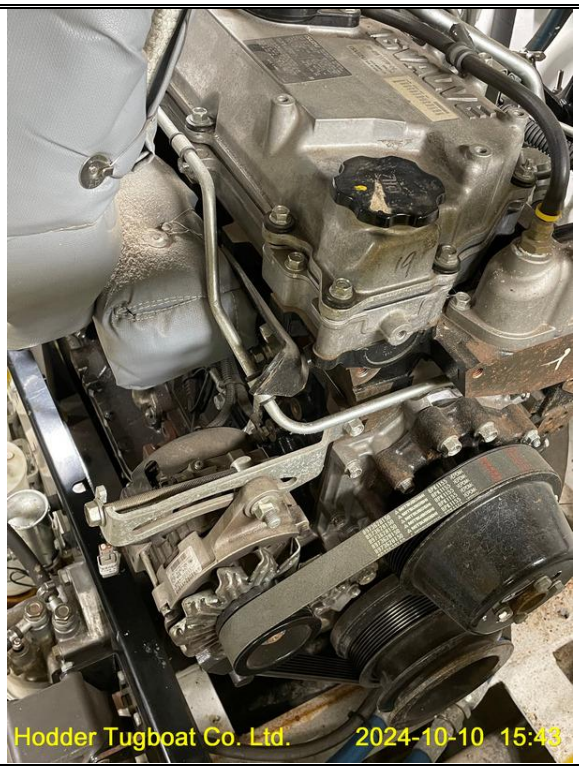
**ME air filter housing**


**Air compressor and compressed air tank**

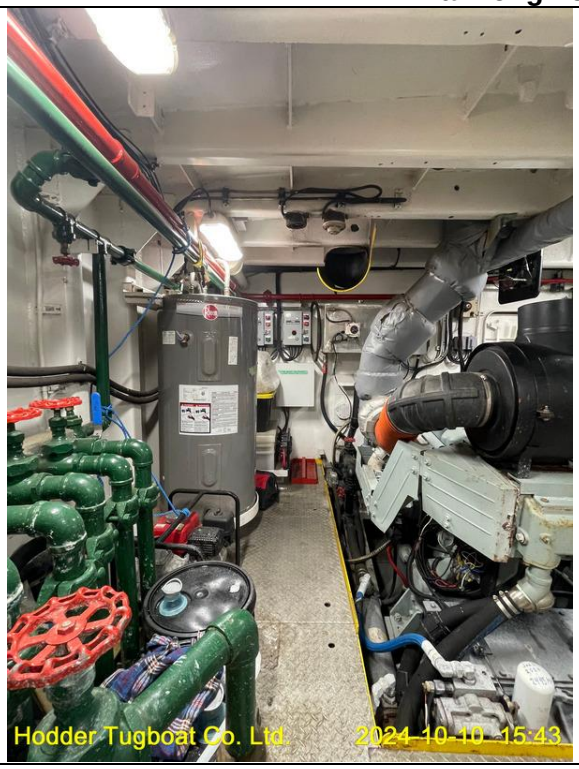


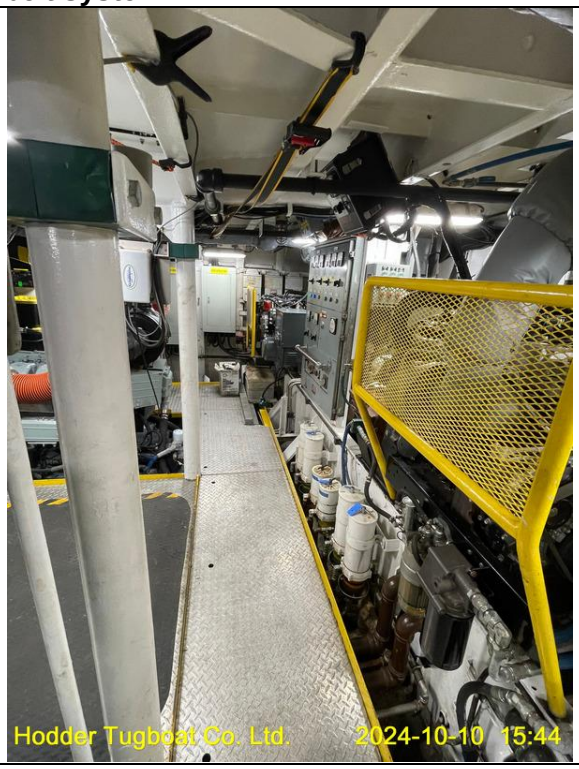

**Air compressor and compressed air tank**


**Main engine block and belt system**

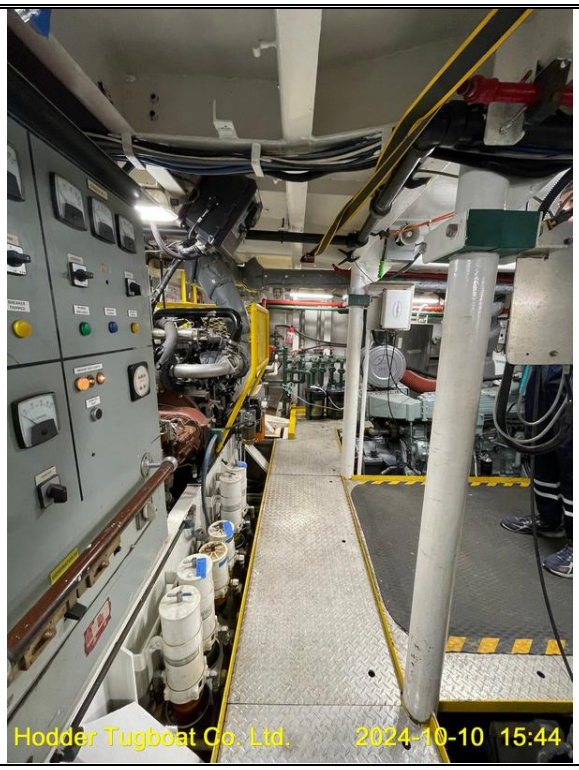



**The starboard side of the engine room, general view**




**View of the engine room along the width of the boat**

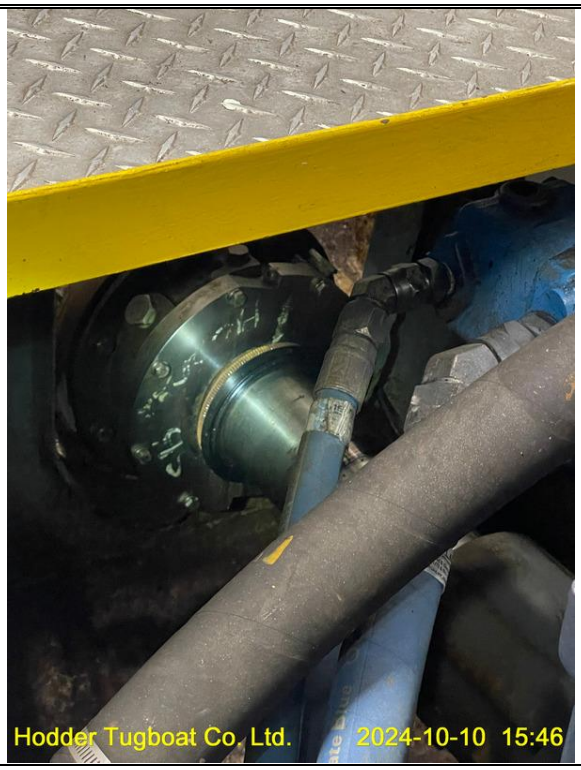
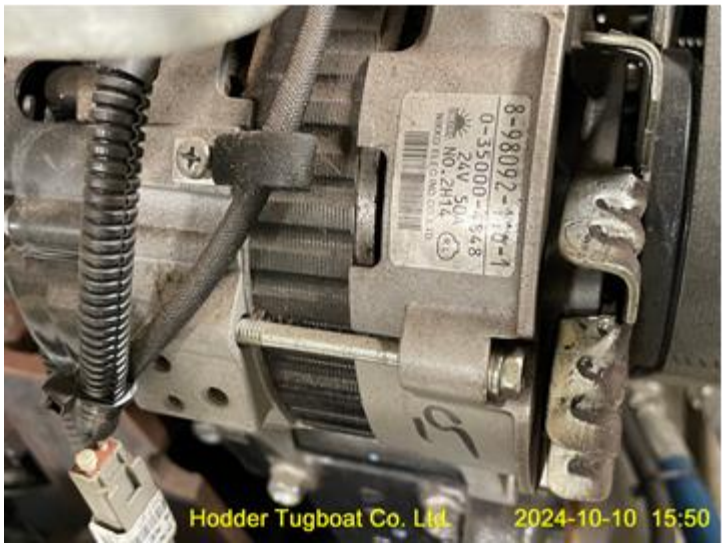

Organized bundles of electrical cables

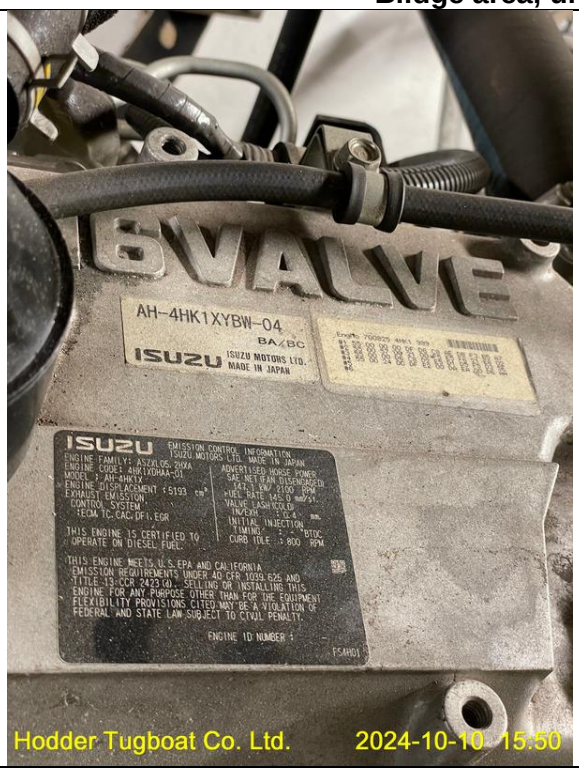



Engine room view from port side

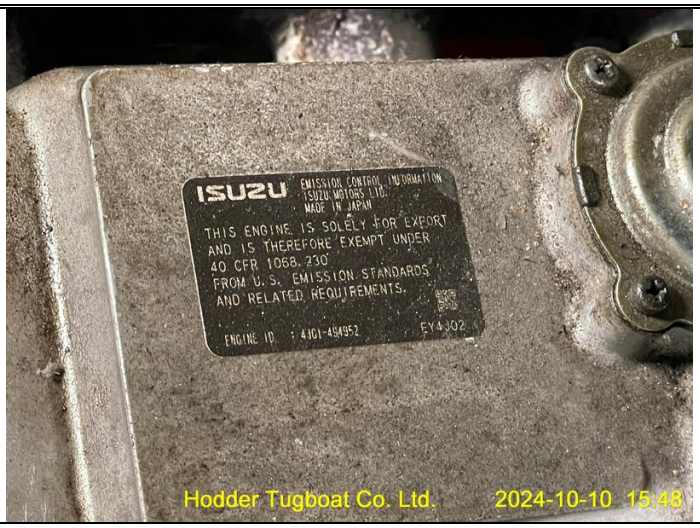


Fire sensor/transducer

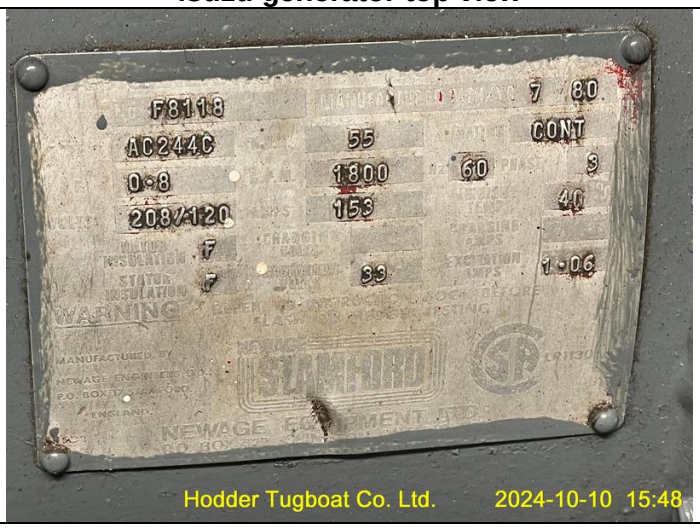
| | |
|---|---|
|   |   |
| **Port side engine's propeller shaft** | |
|   |   |
| **Rusty section of a hull** | **Technical specifications of a electrical generator** |

| | |
|---|---|
|   |   |
| **Bildge area, underneath the main engine** | |
|   |   |
| **6-cylinder Isuzu auxiliary engine block** | **Diesel generator (AE) side view** |


**Isuzu generator top view**



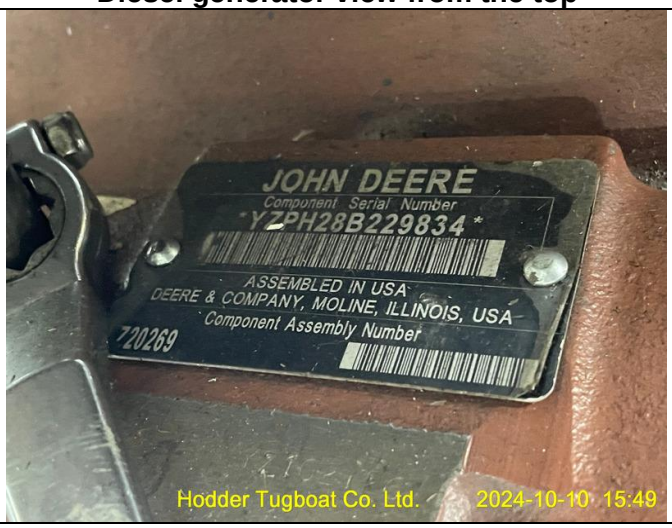

**Isuzu AE's label**



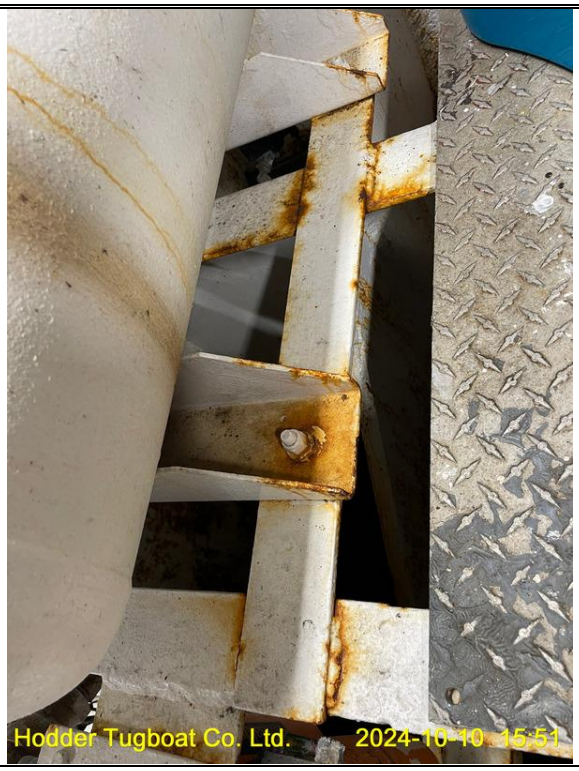

**Data plate for a Newage engine**

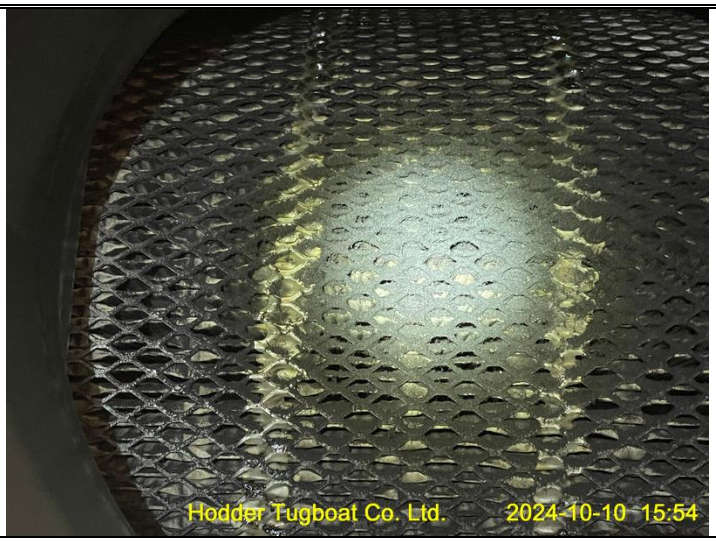

**Diesel generator view from the top**


**Zexel fuel pump**




**John Deere label**

| | |
|---|---|
|   |   |
| **Pressurized starting air tank, foundation condition** | **Boat's rusted hull** |
|   |   |
| **Portable diesel-generator** | **Vessel's piping, electrical batteries and storage bin** |




Main Engine inlet air filter


Mastercraft work tools box


ME's inlet air filter


Crew's work equipment



**General electric transformer boxes**

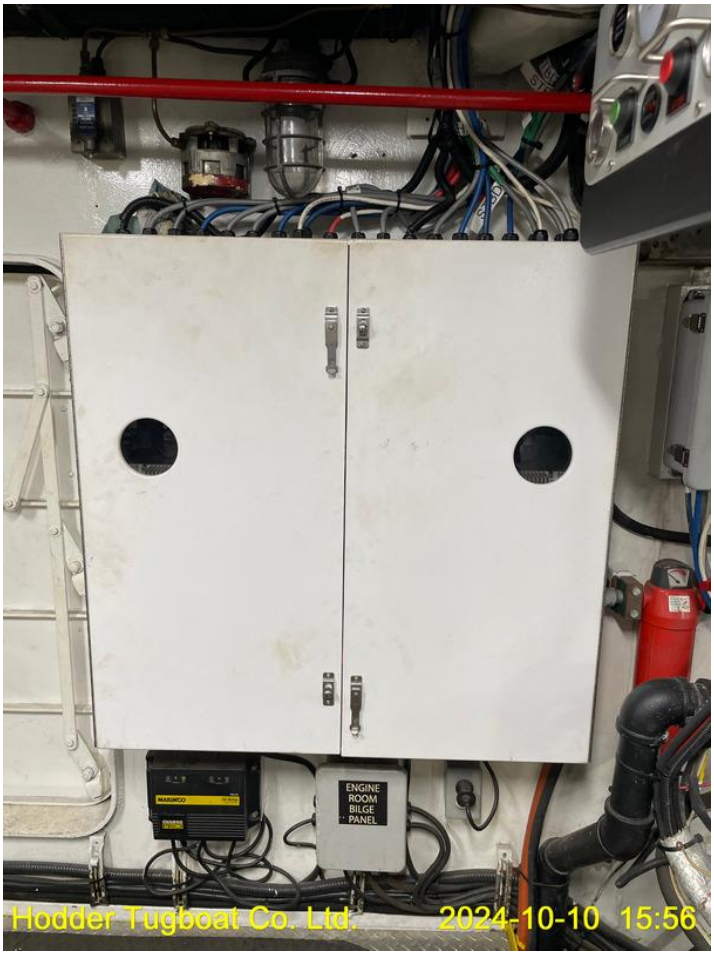


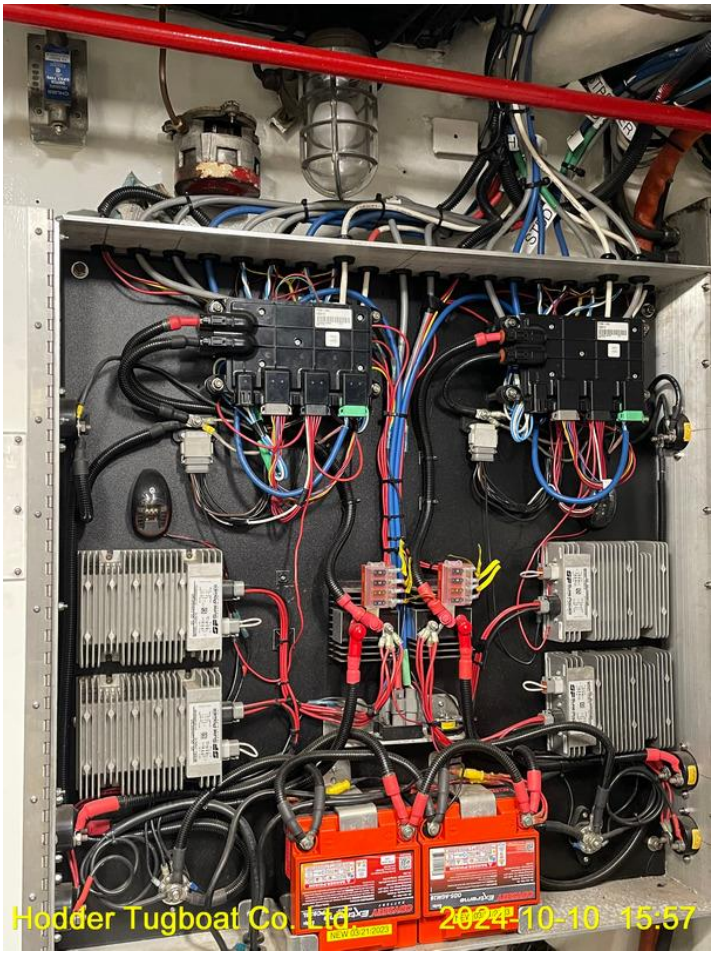
**Electric transformer label**

**Direct current converters**

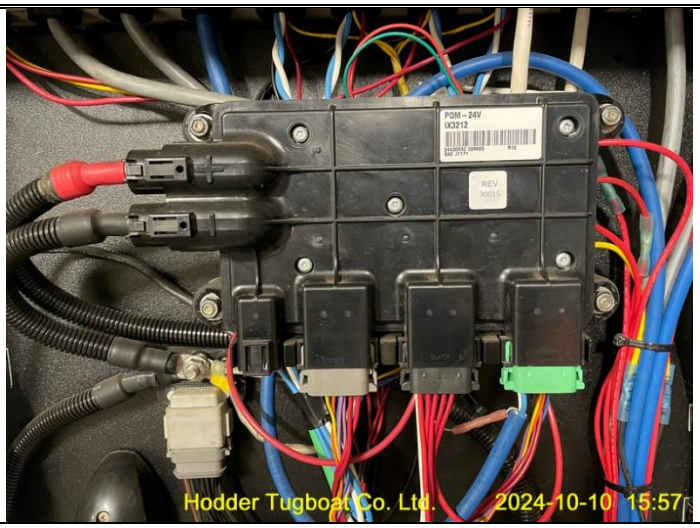


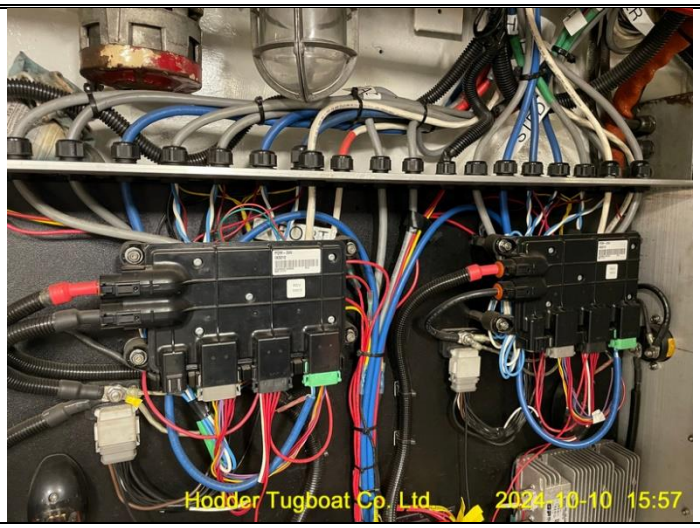
**Boat's hull number, gross tonnage**




**Main electrical panel**

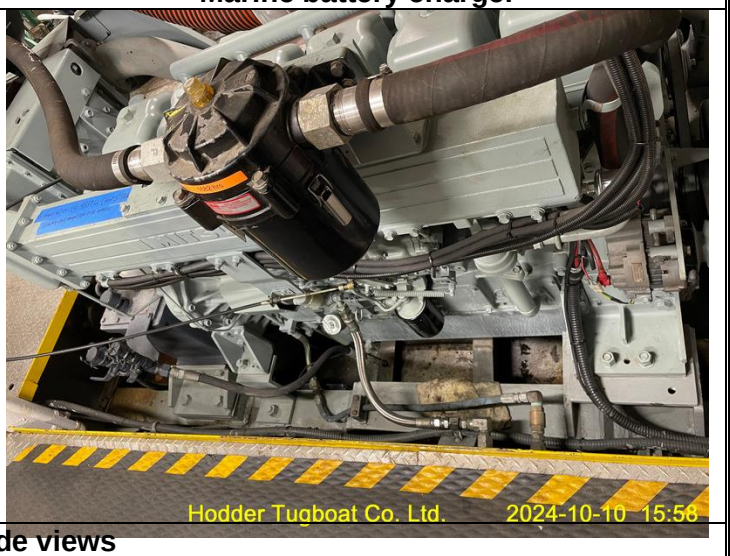


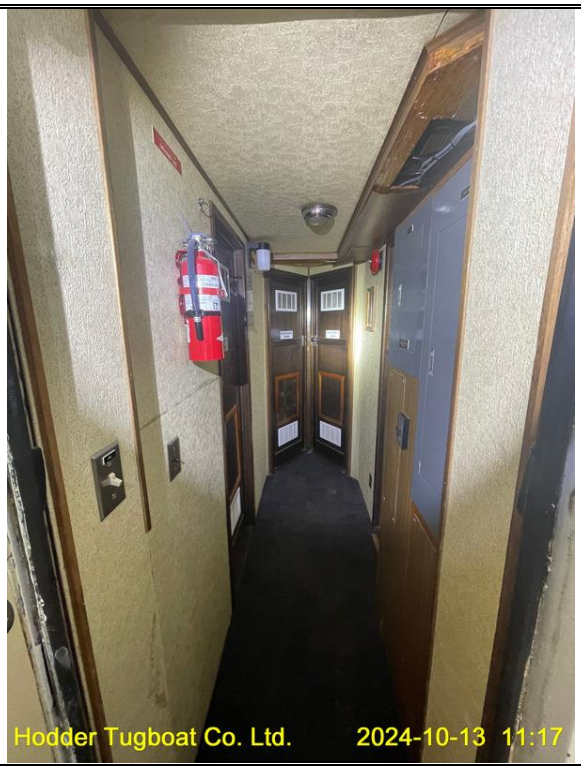

**Organized wiring**


**Batteries**


**Marine battery charger**


**Engine side views**

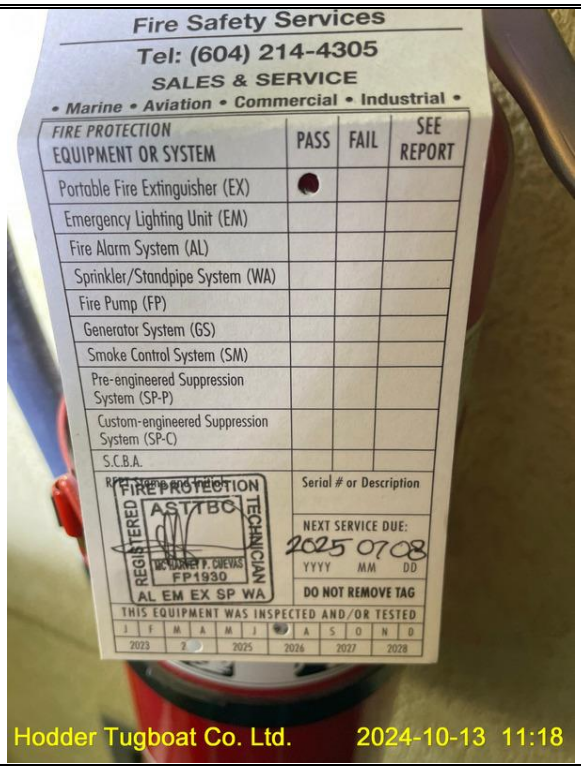



Sleeping crew cabins hallway


Cabin's electrical cable routing system



Electrical panels/switchboard in the cabins


**Fire extinguisher in the crew cabin**



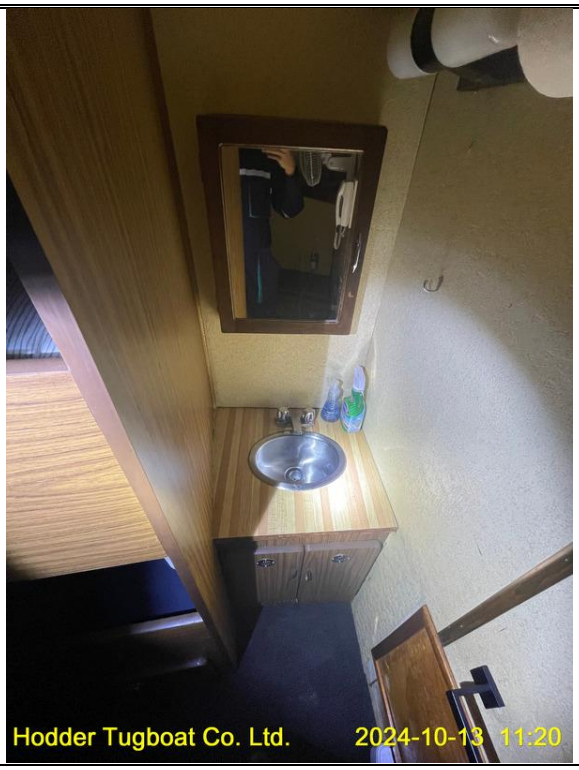
**Alarm bell and light**


**Light bulb**


**Mate's cabin door**


**Mate's general room view from the entrance**


**Mate's general room view from the door**

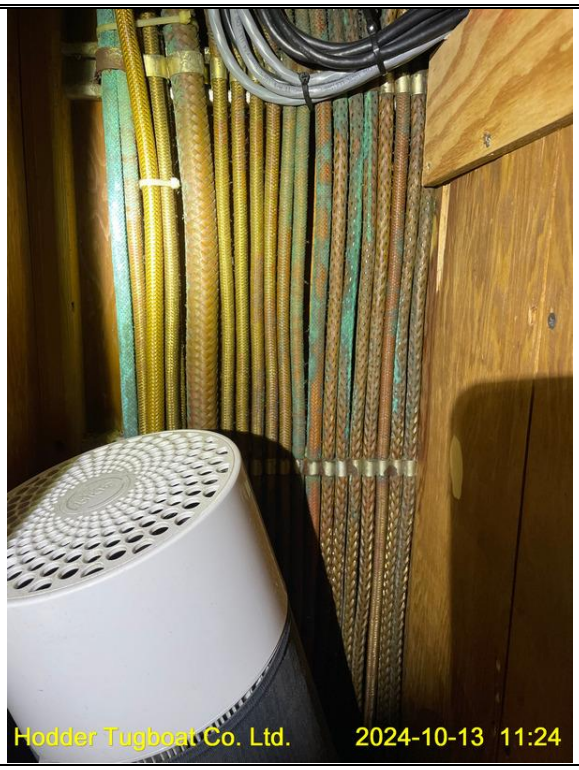
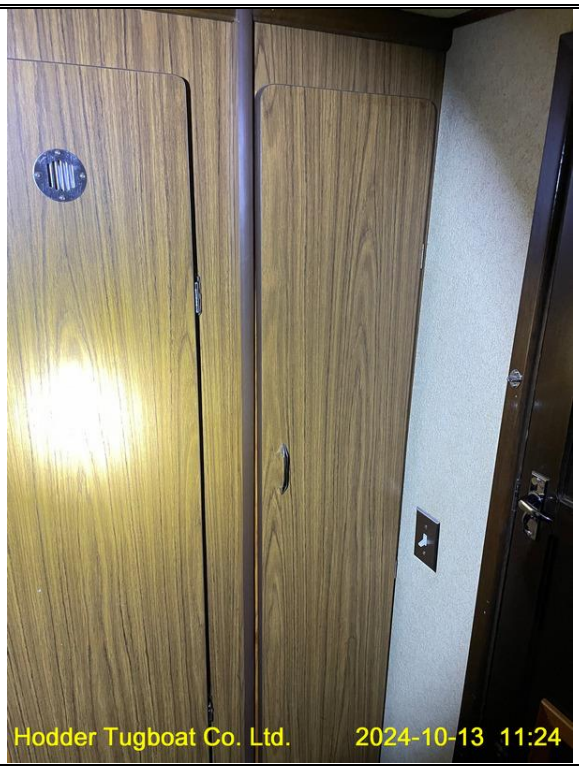
| | |
|---|---|
|  |  |
| **Cabin sink with mirror** | **Communication device** |
|  |  |
| **Safety life jackets** | **Fan in the room** |

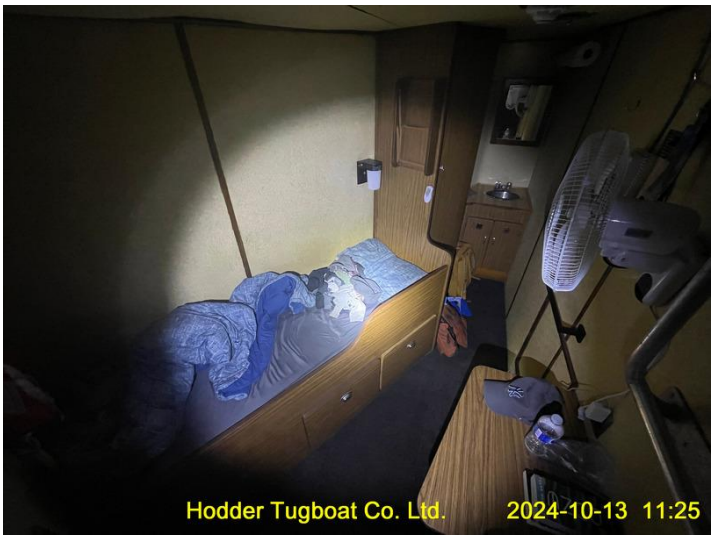

Captain's cabin door


Cabin sink area with mirror

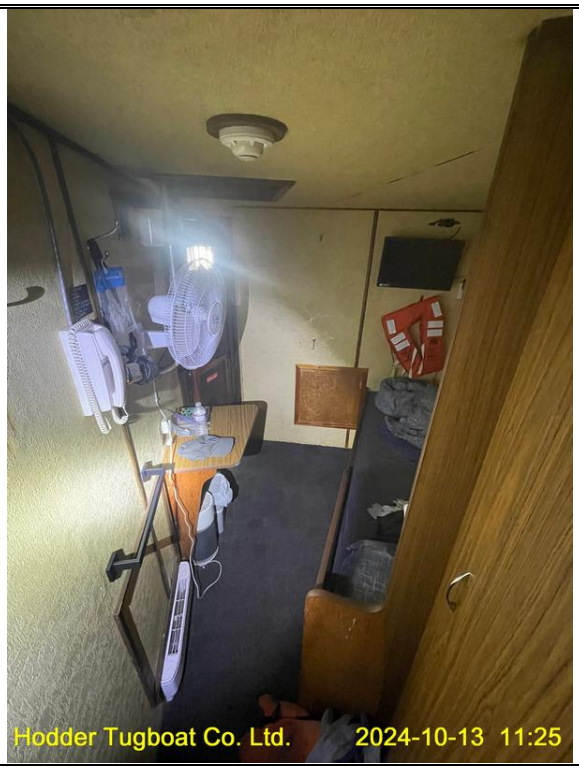

Captain's general view of the cabin

| | |
|---|---|
|   |   |
| **Fan** | **Personal Flotation Emergency Jacket** |
|   |   |
| **Communications phone** | **Bridge Navigational Watch Alarm System/in cabin** |

| | |
|---|---|
|   |   |
| **Organized electrical cable management system** | **Captain's wardrobe** |
|   |   |
| **Fan speed controls** | **Deckhand's cabin entrance door** |

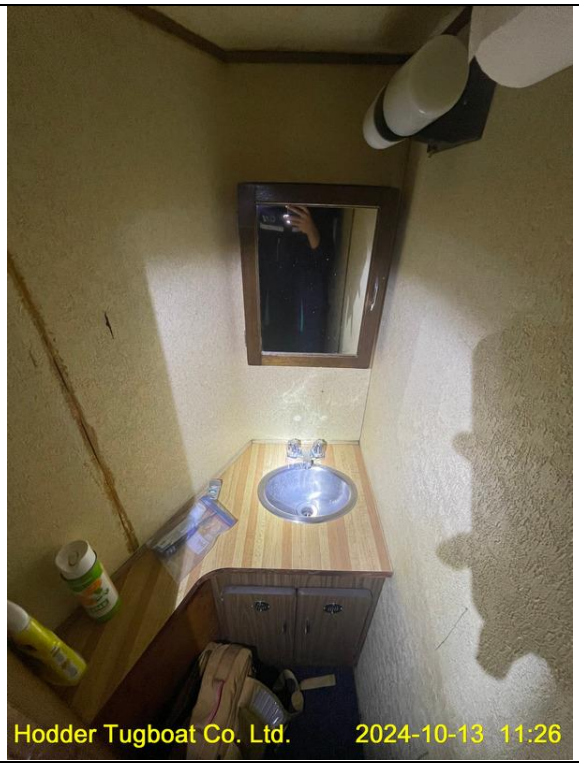



General view of the room

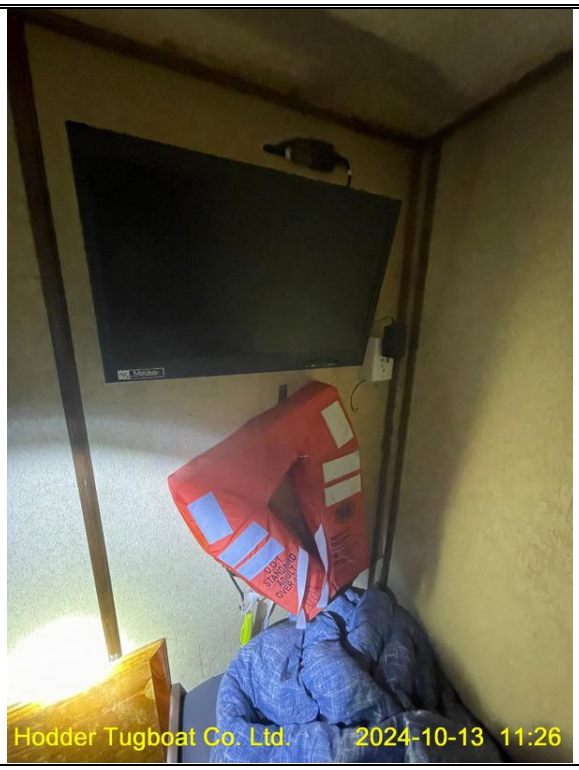



View from sink area


Sink plumbing system




Cabin sink area

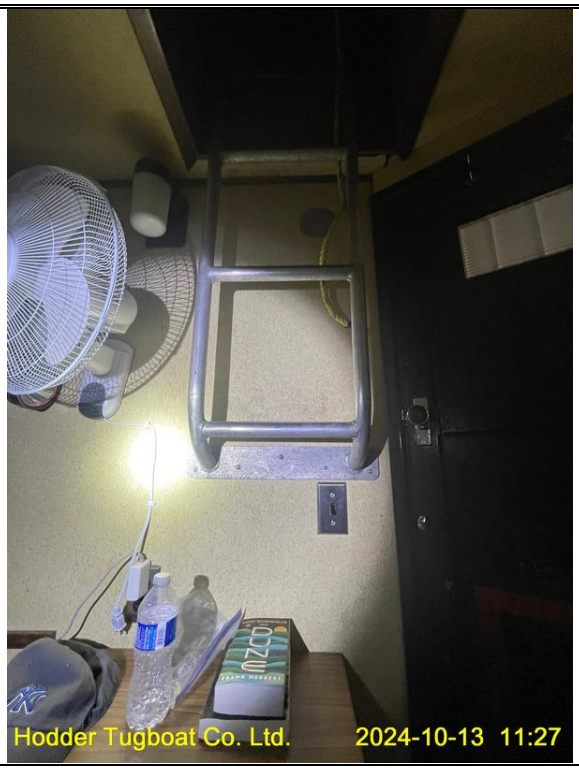



Life jacket


TV screen/monitor


Communications device


Rechargeable Searchlight

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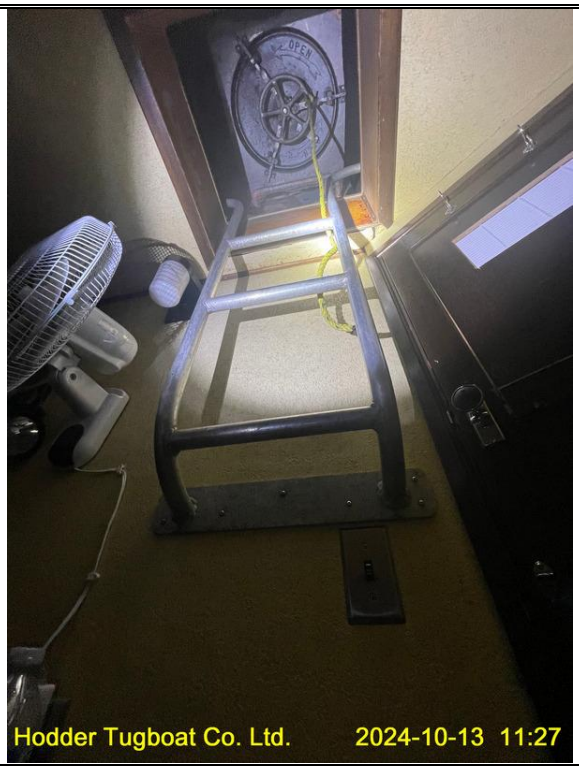
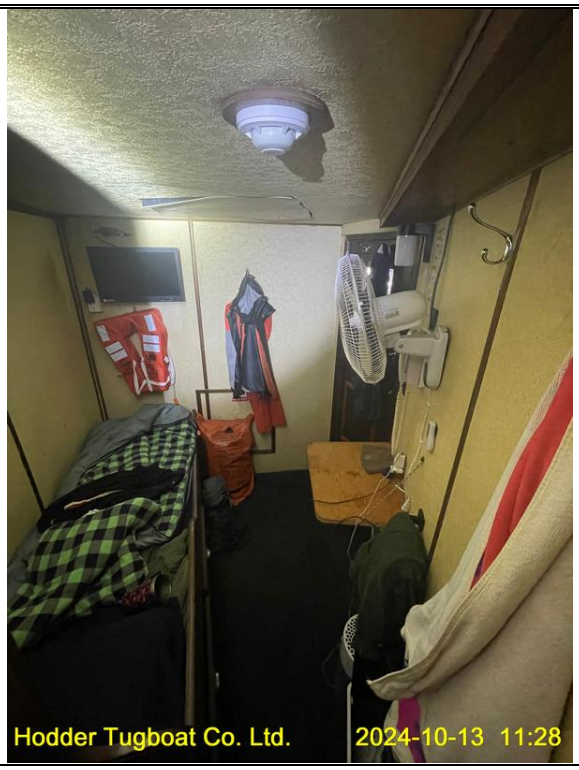
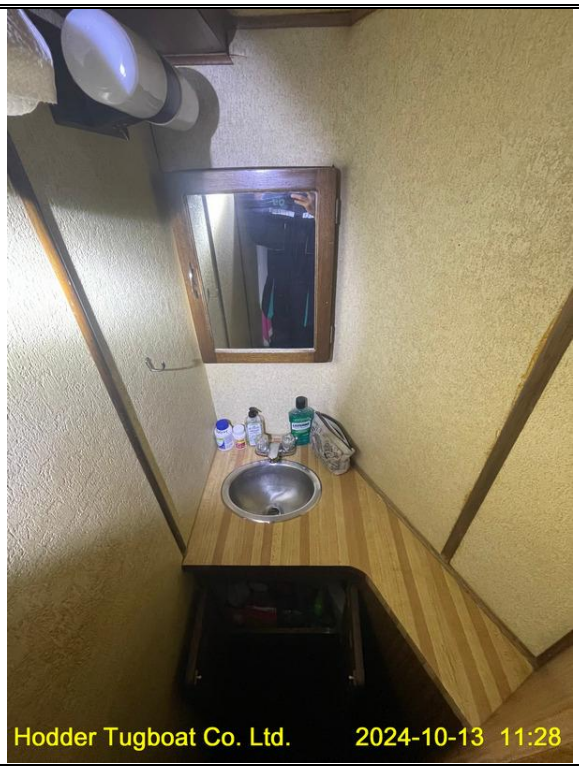
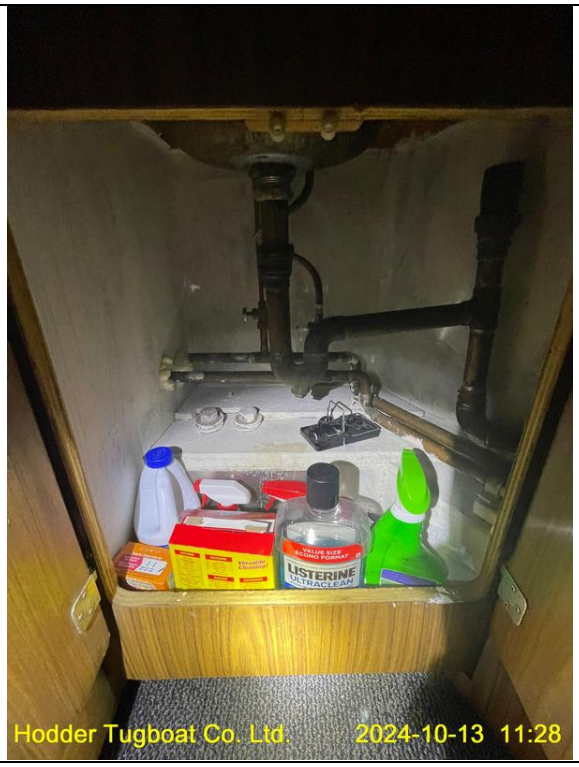
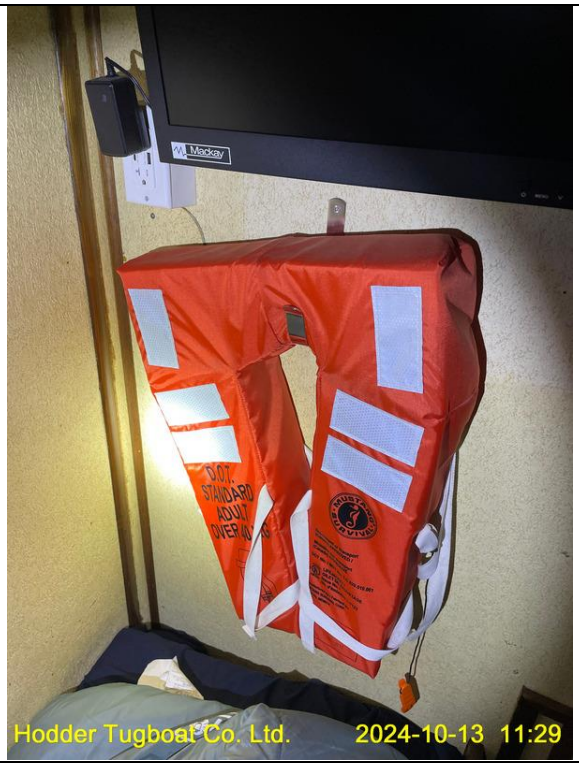
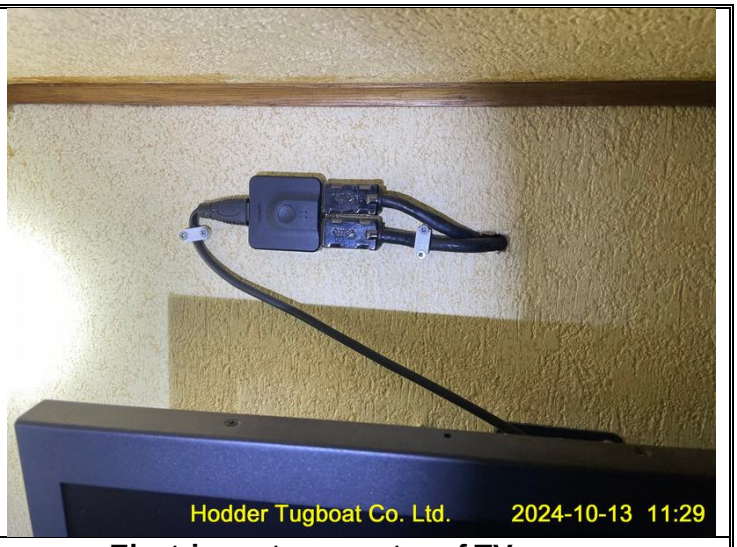


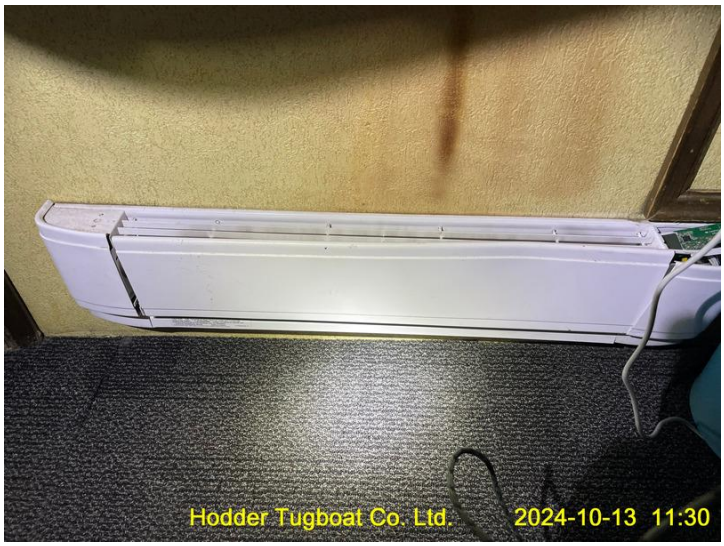

Emergency exit from the Deckhand's cabin


Second deckhand's cabin


General view of the second deckhand's cabin

| | |
|---|---|
|   |   |
| **General view from the sink area** | **Cabin's sink area with the mirror** |
|   |   |
| **Plumbing system** | **Life jacket** |

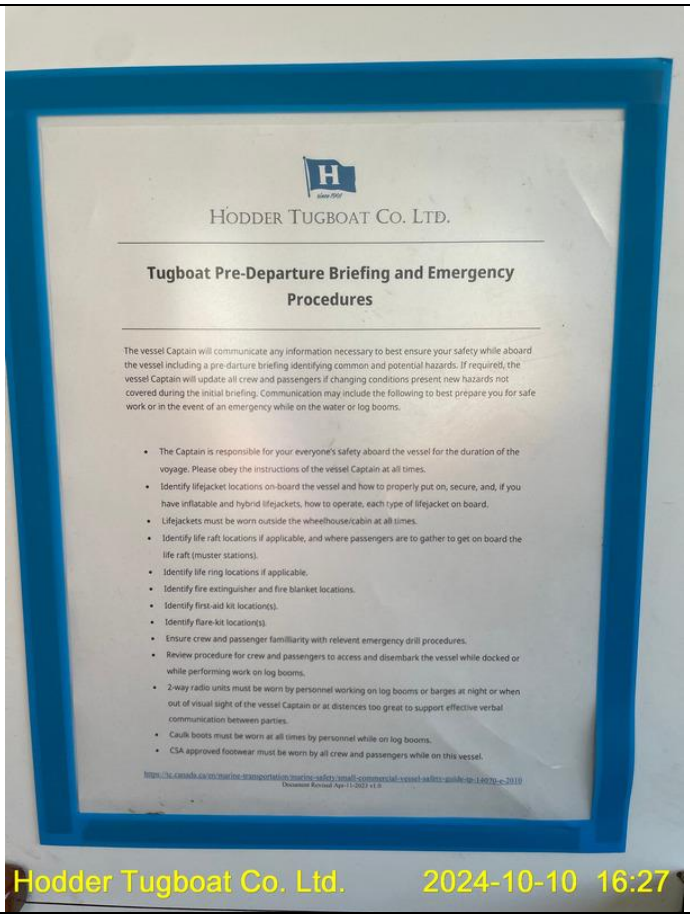
| | |
|---|---|
|   |   |
| **TV screen/monitor** | **Electric port connector of TV screen** |
|   |   |
| **Fan** | **Fire sensor** |

| | |
|---|---|
|  |  |
| **Safety equipment/immersion suit** | **Electrical heating system in the cabin** |
|  |  |
| **Wooden ladder from kitchen area to Pilot's cabin** | **Main navigational room backside** |


**Work laptop and WI-FI networking equipment**


**TV satellite antenna control unit**


**Barometer**




**The company's standard emergency procedures**



**Ship's unique board**

# Useful/Remaining Service Life of a Tugboat Hull

The lifespan of a tugboat hull largely depends on factors such as the quality of construction, materials used, maintenance practices, and operating conditions. Here's an approximate breakdown:

1. **Steel Hulls**: Steel is the most common material for tugboat hulls due to its durability. With regular maintenance, steel hulls can last **25 to 50 years** or more. Key maintenance includes managing rust and corrosion, especially for vessels operating in saltwater.

2. **Aluminum Hulls**: Aluminum hulls are less common but are valued for being lighter and resistant to corrosion. However, they may be less durable in heavy-duty applications and may have a **20 to 40-year lifespan** depending on wear and tear.

3. **Maintenance Impact**: Regular inspection, coating, and repairs can significantly extend a hull's life. Without proper upkeep, even high-quality steel hulls may face structural issues within **15 to 20 years**.

4. **Environmental Factors**: Saltwater environments can accelerate corrosion, so tugboats working in such conditions may require more intensive maintenance to achieve the higher end of their potential lifespan.
5. In practice, the average lifespan of a well-maintained tugboat hull often ranges around 30 to **40 years**.

The tugboat hulls can last beyond the average service life if constructed from high-quality steel and kept in ideal condition. In some cases, steel hulls may have a lifespan of 50–60 years or even longer.

Key factors that support achieving such extended durability include:

1. **Professional Maintenance**: Regular preventive inspections, anti-corrosion treatments, and timely repairs are essential.

2. **Quality Upgrades**: Replacing outdated parts and upgrading equipment can significantly extend the hull's service life.

3. **Freshwater Operations**: Freshwater significantly slows corrosion compared to saltwater, positively impacting hull longevity.

4. Examples of these long-lasting hulls are found when vessels operate in favorable conditions and undergo consistent modernization.

To calculate the wear and remaining service life of a tugboat's hull, the following methods and indicators are typically used:

**1. Physical Wear Assessment:**

- **Inspection and Diagnostics:** This includes a visual inspection for corrosion, dents, cracks, and other damage. Technicians usually perform ultrasonic scans and thickness measurements to gauge the hull's wear.

- **Non-Destructive Testing (NDT):** Techniques such as ultrasonic testing and magnetic particle inspection determine the thickness of the hull walls and reveal hidden flaws.

**2. Remaining Useful Life Calculation (RUL Method)**

- **Metal Wear:** The current thickness of the hull is compared to the original design thickness. Using the corrosion rate data, the remaining structural life of the hull under normal operating conditions can be estimated.
- **Corrosion Rate:** If the annual corrosion rate is known, it can be used for estimation. For example, if the metal thickness decreases by 0.5 mm per year, and there are 5 mm remaining to the minimum allowable thickness, then the remaining service life could be around 10 years.

**3. Remaining Life Calculation Formula:**

$$T\ residual = \frac{Tcurrent - Tmin}{Rcorrosion}$$

where:

- $T_{residual}$ - is the remaining service life;
- $T_{current}$ - is the current hull thickness;
- $T_{min}$ - is the minimum allowable thickness (set by classification standards);
- $R_{corrosion}$ - is the average annual corrosion rate.

**4. Considering Operating and Maintenance Conditions:**

- **Operating Environment:** Corrosion occurs faster in saltwater than in freshwater environments.

- **Maintenance Frequency and Quality:** More frequent and effective maintenance (e.g., anti-corrosion treatment, repainting) slows wear.

**5. Service Life Estimation with Market Value Consideration:**

An essential factor is the economic feasibility of continued operation. Even if the hull can last another 10-15 years, equipment wear and outdated standards may reduce the vessel's market attractiveness.
Using these methods allows for a comprehensive assessment of the hull's remaining service life and helps determine whether continued operation or modernization is feasible.

In hull wear calculations, metal fatigue is often not included due to the complexity of accurately modeling this process and the lack of data on the stresses applied to the hull over its operational life. However, metal fatigue significantly impacts hull longevity, especially under cyclic loads from harsh conditions like storms and heavy structural stress.

**Why Metal Fatigue is Not Always Considered:**

1. **Predictive Complexity:** Fatigue damage occurs based on various factors like intensity, frequency, and amplitude of loads on the hull. Modeling these factors requires complex data, which is often hard to gather over the vessel's entire lifespan.

2. **Lack of Cyclic Load Data:** Accurate fatigue assessment requires detailed records of the forces acting on the hull (e.g., wave loads, engine vibrations). Such data are typically not collected and thus aren't included in general calculations.

3. **Maintenance Effects:** During operations, repairs and replacement of damaged metal parts mitigate the impact of fatigue, potentially delaying the formation of fatigue cracks.

4. **Focus on Thickness and Corrosion:** In shipbuilding standards, residual life calculations often rely on minimum thickness values, which are easier to measure and monitor. Thus, corrosion and physical wear are more commonly factored in than fatigue.

**When Metal Fatigue is Considered:**

Metal fatigue is assessed in specialized surveys and situations where the vessel operates under high loads, such as transporting heavy cargo or navigating icy conditions. In these cases, numerical modeling and fatigue life evaluation methods may be used, including:

- **The Linear Damage Accumulation Method (e.g., Palmgren-Miner Rule);**

- **Fatigue crack analysis using non-destructive testing (NDT);**

- **Strain gauge studies and regular hull stress measurements.**

Thus, while metal fatigue is an essential factor, addressing it requires specialized studies and ongoing monitoring, which goes beyond standard wear and residual life evaluations.

**Fatigue in Tugboat Engine Room Metal Due to Vibration from the Engine, Propeller Shaft, and Propeller**

Fatigue wear in a tugboat's engine room is critical, largely due to constant vibrations generated by the main engine, propeller shaft, and propeller. These vibrations cause cyclic stresses on metal components, leading to fatigue damage over time, especially in areas like joints, fittings, and weld seams. Below are the primary aspects of fatigue wear in the engine room and methods for monitoring it:

**1. Engine Vibrations**

- **Vibration Characteristics:** The main engine produces regular, high-amplitude vibrations, especially when speed changes or the engine operates under heavy load. These vibrations transfer to supporting structures, mounts, and frames.

- **Crack Formation Risk:** Continuous cyclic loads create micro-cracks that may gradually propagate, leading to metal fatigue cracks.

**2. Impact of Propeller Shaft and Propeller Vibrations**

- **Center of Gravity Shift:** The propeller shaft, connected to the propeller, creates significant lateral loads during rotation, particularly in adverse weather or while maneuvering. This results in bending and torsional vibrations, impacting the metal.

- **Loaded Areas:** The points where the shaft connects to the hull, bearings, and other fastenings endure the highest fatigue stress and require regular inspection.

**3. Fatigue Wear Control Methods in the Engine Room**

- **Non-Destructive Testing (NDT):** Techniques like ultrasonic flaw detection, radiography, and magnetic particle inspection help detect hidden cracks and other defects at an early stage.

- **Regular Vibration Diagnostics:** Evaluating vibrations on engine mounts, the shaft, and other components helps identify deviations that may signal the onset of fatigue damage.

- **Monitoring Welds and Connections:** Fatigue damage frequently appears at welds and joints, making their inspection with NDT critical for regular maintenance.

**4. Preventive Measures**

- **Adjustment and Balancing:** Regular balancing of the propeller and propeller shaft reduces vibration levels.

- **Use of Damping Materials:** Installing dampers and anti-vibration mounts on the engine and shaft minimizes vibration impact.

- **Replacement of Worn Components:** Timely replacement of bearings and other fatigue-prone parts extends structural service life.

- Thus, managing metal fatigue in the engine room requires a comprehensive approach involving diagnostics and preventive maintenance. Effective fatigue wear management reduces risks and ensures the reliability of a tugboat's primary structures.

**Metal Fatigue in the Tugboat's Main Deck from Towing Winch and Equipment Loads**

Metal fatigue in a tugboat's main deck develops due to cyclic loads experienced during the operation of the towing winch and other deck machinery. These loads result in stress on the deck structure, especially at attachment points for the winch, anchors, and other elements involved in towing and securing.

**Key Factors Affecting Deck Fatigue**

1. **Cyclic Stress:** Each time the towing winch is in use, cyclic loads are transmitted to the deck, caused by changes in towing force. These forces lead to micro-cracks that can gradually grow, causing fatigue damage in the metal.

2. **Attachment Points and Connections:** Stress concentration occurs at points where the towing winch, blocks, and other machinery are secured. These areas are prone to fatigue damage from constant load changes, especially when operating in adverse weather or handling heavy objects.

3. **Dynamic and Vibrational Effects:** In addition to static loads, the deck is also subject to vibrations from machinery and external forces, such as wave loads. The combination of these factors increases the likelihood of fatigue cracks forming in the metal.

**Diagnostic and Monitoring Methods for Fatigue Damage**

- **Non-Destructive Testing (NDT):** Regular inspections of welds and attachment points using ultrasonic or magnetic particle methods help detect fatigue cracks at an early stage.

- **Residual Metal Life Assessment:** Measuring deck thickness at critical points and estimating possible service life based on fatigue characteristics.

- **Monitoring Condition of Fastenings:** Systematic checks of fasteners, bolts, and rivets for loosening or deformation help prevent structural failures.

### Preventive Measures

- **Strengthening Attachment Points:** Using reinforced plates at points where the towing winch and other machinery are attached reduces fatigue loads.
- **Anti-Vibration Inserts:** Installing anti-vibration dampers between the deck and equipment lowers vibration levels transmitted to the deck.
- **Regular Maintenance:** Timely corrosion removal and deck coating restoration extend the metal's lifespan.

Accounting for metal fatigue in the main deck during tugboat operations can extend service life and reduce the risk of unexpected breakdowns, ensuring vessel reliability in towing operations.

### Recommended Fatigue Wear Rates in Tugboat Service Life Calculation Model

Estimating fatigue wear due to the operation of propulsion systems, towing winches, and associated mechanisms depends on factors such as usage intensity, load cycles, and maintenance quality. For a preliminary calculation model of a tugboat's remaining service life, the following average fatigue wear values can be applied:

1. **Propulsion Mechanisms** (propeller shaft, propeller, engine): Depending on the vessel's age and operating conditions, fatigue wear in these components may account for 5-15% of the overall hull wear. Vibrations and cyclic loads from the engine and shaft are key contributors to this wear.
2. **Towing Winches and Anchor Points:** These mechanisms experience significant loads during towing operations, especially in rough weather conditions or when handling heavy objects. Fatigue wear from towing winch operations may contribute **10-20% of the total deck structure wear.**
3. **Additional Structures** (brackets, welds, supports): These elements are also subject to fatigue from vibration and cyclic loading, potentially adding another 5-10% to the overall structural wear.

### Overall Estimate

For a vessel regularly operating under heavy conditions, total cumulative fatigue wear can be estimated at **15-30% of the total structural wear**. A comprehensive assessment using operational conditions and non-destructive testing (NDT) for critical points is recommended for a more accurate evaluation.