

Isle of Man Ship Registry

Casualty Investigation Report No. CA 133

“Heather Maid”

Fire

on 23rd October 2018

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Summary

Between the hours of 17:00 to 23:30 on 23rd October 2018, the Isle of Man registered fishing vessel "Heather Maid" caught fire while alongside in Peel Harbour. The fire started in the area of the wooden bulkhead between the engine room and accommodation. There were no personnel on board. The fire was extinguished the following morning, however due to the amount of water used for firefighting the vessel lost its stability and sank. It was successfully re-floated the next day.

The Isle of Man Ship Registry in cooperation with the Isle of Man Fire Service, and Harbours Division of the Department of Infrastructure conducted the investigation and identified that:

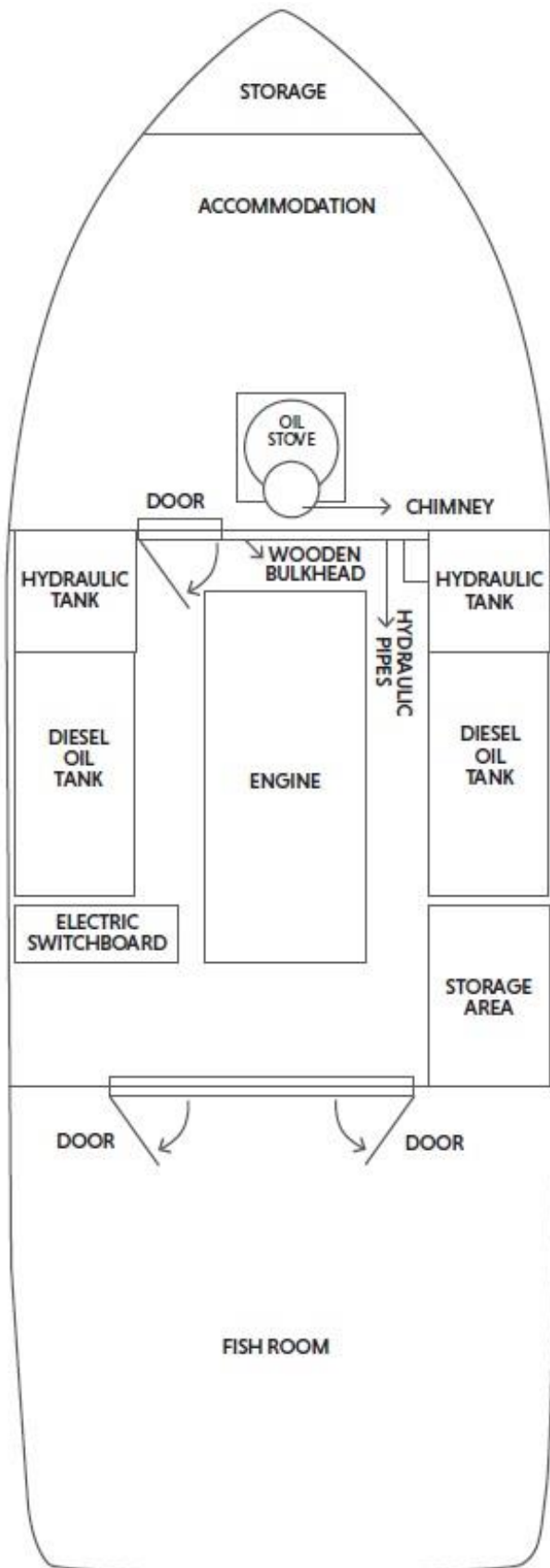
- Heat from the oil stove chimney sited in the accommodation was the most likely cause of fire. The chimney was in a close proximity to the wooden bulkhead and TV screen, where the fire is most likely to have started.
- The oil stove was not installed in accordance with manufacturer's instructions and was reportedly left switched on for at least 3 days prior to the evening the fire started.

Narrative of Events and Factual Information

On 23 October 2018, at approximately 16:00, the boat's Skipper came on board. He checked the boat's mooring lines were tight, that the automatic bilge pumps were operable, and that there was no water in the bilges. The oil stove was left switched on to keep the accommodation warm and comfortable as well as to keep the air dry – the idea being to protect navigation equipment and the computer from humidity. The Skipper explained that this is common practice on many fishing boats. The installed oil stove requires no electrical power to operate and the fuel oil is supplied from a diesel tank by gravity. No one, reportedly, stayed on the boat when it was alongside or permanently lived on board.

At approximately 23:30 the owner of the boat was informed that there might be a fire on board by a passing taxi driver who noticed smoke coming from the boat. The owner took the taxi to the "Heather Maid" and after realising the boat was really on fire, called the fire brigade. He also made a call to the skipper at the same time, who arrived almost immediately. The skipper went on board to investigate, but realised that it was too late for going inside the accommodation due to the thick smoke. He was then asked to leave the boat by the firemen, who had arrived at the scene.

Ship's plan and pictures



Starboard side



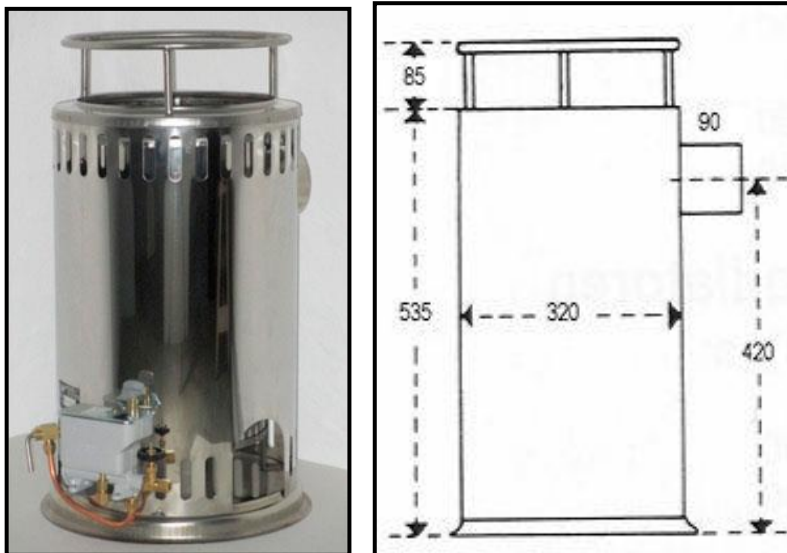
The oil stove, picture was taken in June 2018

The Oil Stove

The stove, model 60M, manufactured by "Refleks" in Denmark, was purchased new and installed on board in January 2015. The stove burns diesel oil which is delivered through a pipe by gravity from a diesel oil tank in the Engine room. The stove's output is adjusted manually by the regulator which controls the flow of diesel oil to the burner. According to manufacturer's instructions the chimney's temperature, when set at maximum, can reach up to **250°C**.

Their manufacturer's manual did not prohibit the continuous use of the stove and contained no advice for time and output restrictions.

The stove is fitted with a "heat safety fuel valve" which is designed to close automatically when the surrounding area temperature reaches 70°C. When the safety valve closes, fuel is not supplied to the burner and the stove stops. However this safeguard was not relevant to this fire as the fuel system was not the cause or contributing factor.

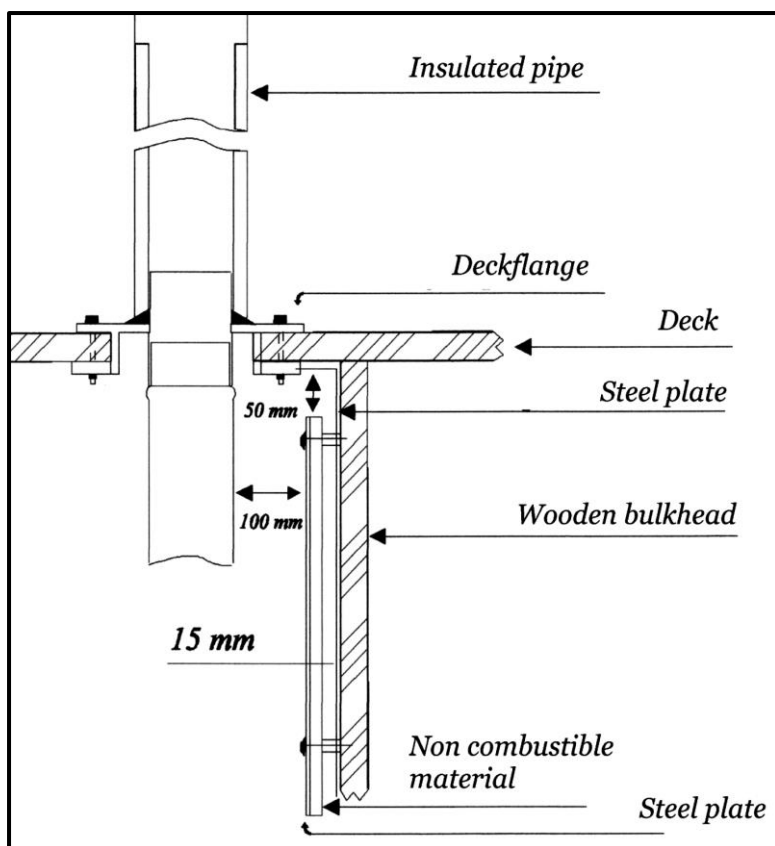


Installation on board

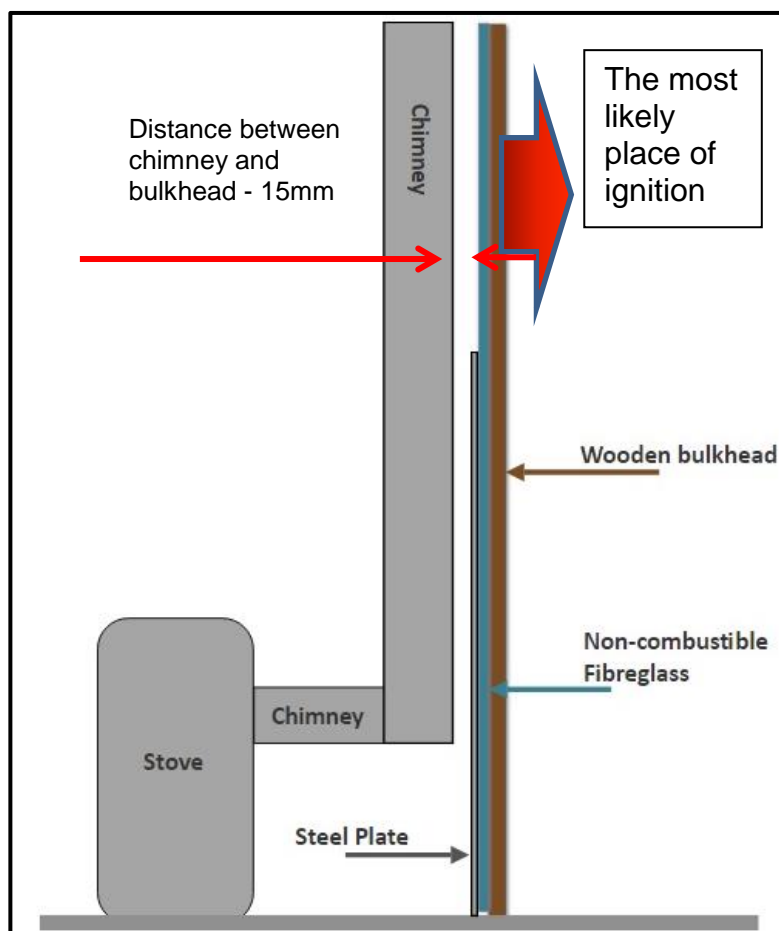
The new stove was installed as "one-for-one" replacement for the older stove of the same type.

The stove was installed in the accommodation (the compartment under the wheelhouse and adjacent to Engine Room). The stove's chimney was arranged such that it penetrated the main deck and was then led up through the wheelhouse, terminating in open air at the wheelhouse top.

The installation manual states that there shall be a minimum separation of 100mm between the chimney and any combustible material (e.g. deck or wooden bulkhead). In addition there shall be an insulation layer made of steel plate with an attached layer of non-combustible material. There shall be 15mm distance between this insulation layer (steel + non-combustible material) and the wooden bulkhead.



Picture 1. Manufacturer's instructions for installation



Picture 2. Actual arrangements onboard

Picture 1 illustrates the requirement to have a minimum distance of **100mm** between the chimney and steel plate in front of the wooden bulkhead.

It also shows that there shall be a layer of steel plate and a distance between it and the bulkhead of 15 mm.

The space between the steel plate and bulkhead is designed to allow an air circulation which should create a natural insulation.

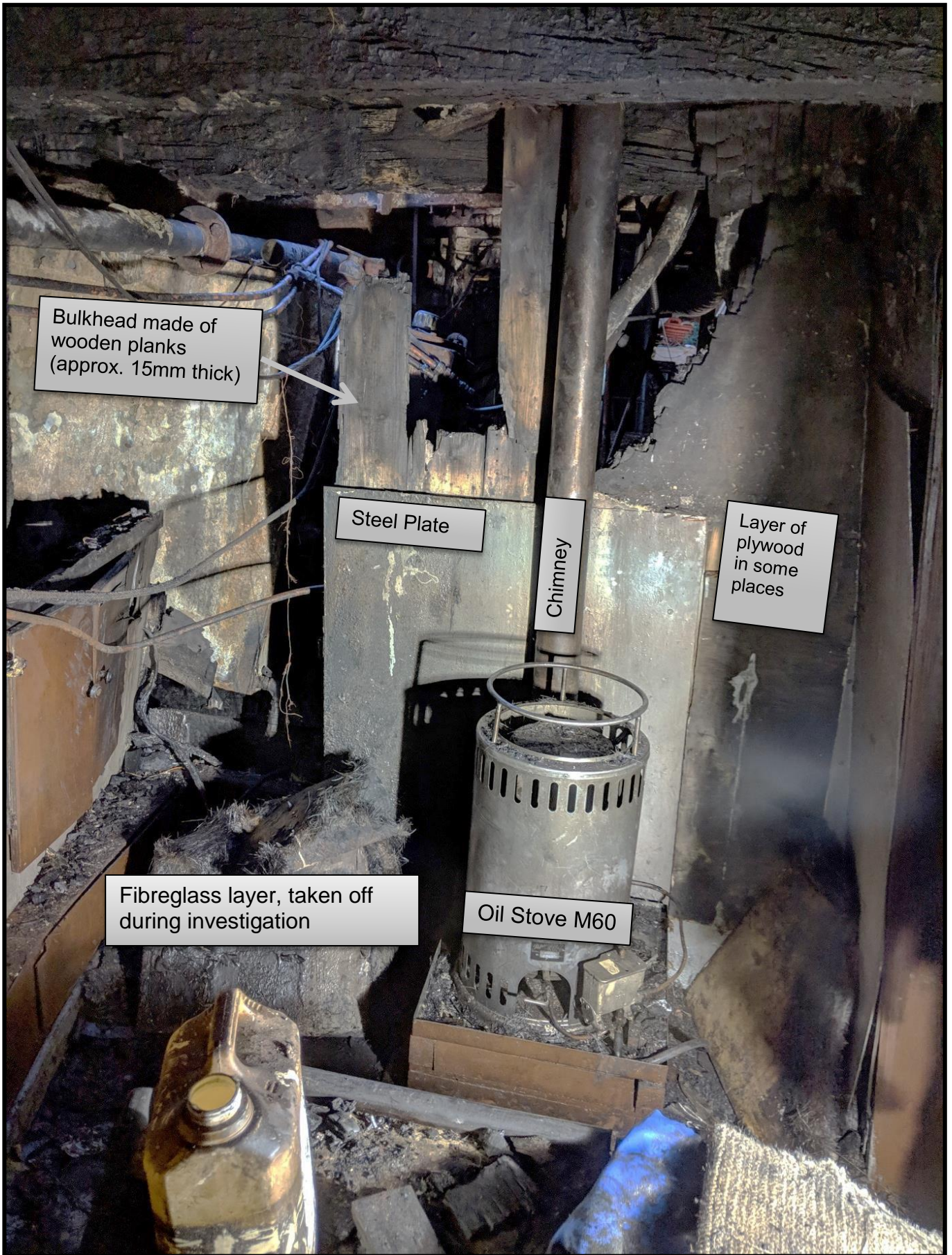
Picture 2 illustrates the actual arrangement which was onboard.

The steel plate was installed, but it was not covering the whole surface of the bulkhead (there plate was 1.6 m high, and the 75 cm of the bulkhead remained exposed).

The distance between the chimney and the bulkhead was around 15 mm (100mm is required).

There was a layer of fibreglass material, but its insulation and heat resistance quality is unknown. It was also reported that there was a diminution of resin in the top parts of the fibreglass layer.

There was no space between the steel plate and the bulkhead, as required by manufacturer's instructions.



Analysis

Source of fire

An examination of the fire damage was undertaken by Ship Registry Surveyors and officers of the Isle of Man Fire & Rescue Service. The fire patterns and affected materials indicated that the fire most likely started in the area of the bulkhead, adjacent to the top part of the chimney. The analysis of the manufacturer's manuals revealed that the surface of the chimney on maximum setting can reach 250°C. According to "*Kirk's Fire Investigation*" (7 ed., by John D. DeHaan and David J. Icove), the various contents of wood are subject to *pyrolysis** at the temperatures of 200°-500°C.

* - *Pyrolysis is the thermal decomposition of materials at elevated temperatures, when wood decomposes into charcoal.*

Wood discolours and chars relatively quickly at temperatures above 200°-250°C, but prolonged exposure to heating at temperatures of just 107°C will have the same effect. The research suggests that destructive pyrolysis can start very slowly at temperatures as low as 85°C.

Charred wood absorbs heat faster than normal wood due to darker colour and lower thermal inertia (speed of cooling down), so it heats up faster than in normal wood. Dry rot of the wood (natural organic decomposition), which was detected in some of the boat's elements, may have contributed to the lower ignition temperature.

According to "*Kirk's Fire Investigation*" (7 ed.), various research papers reported ignition or smouldering of wood can start with temperatures ranging 192°-393°C. The temperature depends on various factors such as moisture, source of oxygen, time of exposure to heat, density and contents of the wood (cellulose and resin). Furthermore, the same source refers to test results which showed that decomposed (rotted) wood can ignite or start smouldering at temperature of 150°C.

"If heat accumulated by the char is retained, and there is an adequate supply of oxygen, the temperature of the mass can rise to the point at which combustion can take place." – (*Kirk's Fire Investigation*" (7 ed.)).

It is not clear what was the temperature of the chimney (technically it could be up to 250°C according to manufacturer's manual), but it was evident that there was a prolonged wood exposure to the heat and that there was evidence of wood's decay due to rot.

It can be concluded that prolonged exposure to the heat most likely resulted in decay and charring of the wood and subsequently to smouldering/combustion of the wooden bulkhead.

The lack of insulation and close proximity of the chimney to the bulkhead most likely resulted in direct conducting of the heat to the wooden bulkhead.

It was also discovered during the investigation that electrical arrangements and wiring were in substandard condition and posed another risk of fire, although there is no evidence that electric fault was a cause of this fire.

Applicable standards and regulations

The commercially operated fishing boats on the Isle of Man including "Heather Maid" are regulated by the "Isle of Man Code of Safe Working Practice For the Construction and Use of 15 metre (LOA) to less than 24 metre (L) Fishing Vessels", effective for boats built after 01/04/2006. For convenience the above code will be further referred to as "the Code".

Due to the age of the vessel (built in 1965), the previous edition of the Code (1975) applies. Due to this fact, a limited number of regulations of the Code (2006) can be legally applied. As such, the fitting of fire-resistant bulkheads is recommended but not required.

However, the Code's Chapter V, Reg. 96 (Oil fuel installations (cooking ranges and heating appliances)) is applicable to all fishing vessels of lengths between 15-24m, regardless of their age. The regulation 96.6 (c) and 96.6 (d) can be applied to the oil stove.

96.6 (c) – The exhaust should be suitably lagged.

96.6 (d) – In all instances, the manufacturer's installation instructions must be followed.

The regulation 96.6, however, is not mandatory and is defined in the above provisions as "*strongly recommended*".

Regulation 89 (Fire Detection) requires installation of fire detection system.

"89.1 The fire detection system should be fit for its intended service and be capable of automatically indicating, in the wheelhouse, the presence of fire."

"89.3 The indicating system for the detection system should comprise of both an audible and visual alarm within the wheelhouse."

Analysis of the applicable regulations

It is a responsibility of the boat owner to ensure the Code is followed. The provisions of the regulations 96.6 which require to follow manufacturer's instructions to be followed and thermal insulations to be fitted, are strongly recommended and therefore can't be enforced by Administration surveyors.

It was established during the interview with the boat's skipper that he was not aware of the danger of pyrolysis and was not aware of manufacturer's instructions with respect to maintaining a specific distance between the chimney and any adjacent wooden bulkhead.

Regulation 89 requires the provision of a fire detection system (heat and smoke detectors in the accommodation) with visual and audible alarm in the wheelhouse. The boat's fire detection and alarm system was confirmed operational during the intermediate survey on 27th June 2018.

This requirement of the Code implies that the vessel is manned and that the fire/smoke alarm would alert the watchman in the wheelhouse. The Code does not have regulations for laid-up or unattended vessel.. Fishing boats are known to be routinely left unattended with some equipment running either from batteries or shore power. The "Heather Maid" was left unattended with oil stove and automatic bilge pumps running (which was explained to be a normal practice).

Most of the Code requirements and safeguards are thought to be effective when the vessel is at sea and utilised for intended purpose (in this instance - commercial fishing).

Fire prevention measures and fire detection systems required by the Code are only effective when the vessel is manned. Audible and visual indications of fire (and of flooding) on the wheelhouse has no practical purpose when the vessel is not manned.

There are no regulations or guidelines exist which would provide rules/guidelines for unmanned or laid up vessels.

Electrical safety on board

Faulty electrical arrangements were considered among possible causes of fire as it was evident from inspection post-fire, that electrical arrangements were not satisfactory. The electric cables and connections were installed, added and replaced by skippers (and previously employed personnel) over the decades. It was difficult, if possible at all, to identify the purpose of certain cables or to recreate the scheme of electric arrangements.

The Code states that electrical arrangements should minimise the risk of fire and electric shock and satisfy the requirements of the Marine Administration; the installation should also be designed and constructed to ensure the proper functioning of all equipment necessary to maintain the vessel in normal operational and living conditions without recourse to an emergency power supply.

The surveys carried out by the Administration include visual inspection of electrical equipment, checking for bare wires, that appropriate fuses are in place, and for signs of burning. However the more thorough evaluation of compliance with industry standards is not carried out as it is assumed the compliance has been satisfied on earlier stage of vessel's delivery, or verified by the third party service provider (qualified electrician).

Conclusions

- Heat from the oil stove chimney was the most likely cause of fire. The oil stove was reportedly left on for at least 3 days prior to the fire.
- The oil stove was not installed in accordance with manufacturer's instructions. The distance between the chimney and the wooden bulkhead was 15mm (manufacturer's state thus should be minimum 100mm). The thermal insulation was not installed correctly.
- It was revealed during investigation that electrical arrangements were not of an approved type and could have posed a fire hazard. There is no effective means of control of the electric installations on board the boats built before 2006, as standards of the Code in regards to electric installations are only applied to boats built after 2006. On this occasion, however, there was no evidence that electric failure contributed to fire.
- The provisions of the Isle of Man Code of Safe Working Practice for the Construction and Use of 15 metre (LOA) to less than 24 metre (L) Fishing Vessels", aimed to establish safeguards for vessels at sea and being manned. These regulations are not designed to ensure safety of the vessels which are not manned and moored alongside with some equipment running.
- The fire alarm, required by the Code and installed on the wheelhouse, could not be heard or seen outside of the wheelhouse by members of public or Peel harbours employees. The CCTV records obtained from the place and date of fire were of a very poor quality; - the details were blurry, with lots of noise. It was not possible to see the smoke or any significant details.

Recommendations

1. The results of this investigation are recommended to be released to boat owners and skippers urging that immediate actions shall be taken to ensure that heating appliances are installed in accordance with manufacturer's instructions.
2. Due to existing risks of similar fires, the Isle of Man Harbours (DOI) is recommended to initiate consultations on developing guidelines or regulations to ensure fire safety on unattended vessels within harbour limits. It is recommended to research whether modern CCTV applications for detection of fire/smoke are reasonable and efficient for installation in the harbours.
3. The Isle of Man Ship Registry is recommended to develop guidelines for effective inspection of the heating appliances and electric installations on all fishing vessels. These guidelines shall also apply to boats of less than 15 meters.
4. The Isle of Man Ship Registry is recommended to develop guidelines for effective inspection of the electric installations and verification of their compliance with applicable safety standards. Regulation 73 of the Code shall be taken into account. The guidelines are recommended to include instructions and references to applicable standards for 3rd party contractors and crew members, who may be making the installations.

Safety recommendations shall in no case create a presumption of blame or liability!