Circular

What are the hazards of hot work?

Fire is one of the biggest risks ships face, whether they are under construction, in service, or being repaired. There are often enclosed spaces on ships that are packed with electronics, insulation materials, combustible equipment and fittings. Fires can therefore spread rapidly on board ships, and controlling or extinguishing them can be challenging.

Over the past decades, we have faced several fires on board a wide variety of ships in service, under construction, or being repaired. Fishing vessels, LPG tankers and superyachts have been particularly affected, often resulting in extensive damage and major claims. In addition, we learned lessons from hundreds of Loss Prevention (JH143) surveys of yards around the world. We would like to use the aforementioned experiences to share the most relevant details about preventing fire caused by hot work.

MS Amlin | Marine

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What is hot work?

IMO MSC circular 1084 contains the following description of hot work: “hot work means any work requiring the use of electric arc or gas welding equipment, cutting burner equipment or other forms of naked flame, as well as heating or spark generating tools, regardless of where it is carried out on board a ship”. Hot work is therefore work that uses heat or produces heat to remove, cut or bond materials.

Some examples of hot work are:

- Gas or electric welding
- Soldering, hot melt gluing
- Pre-heating objects before installation
- Thermal cutting
- Grinding or abrasive cutting
- Manual work involving fire hazards

Preventing hot work from causing a fire

Fire requires oxygen, heat, and fuel to spread. The elements fuel and heat can be controlled by hot work procedures and preventive measures.

Each hot work task requires a risk assessment to be conducted before the work is approved. These risk assessments must show that combustible materials are at a safe distance from heat or flame sources. Designated fire watches equipped with suitable fire extinguishing appliances must be deployed.

It should be noted that the fire risk is not only present in the area where the hot work is carried out, but could also be adjacent, above or below this area.

Hot work procedures, protocols and permits provide the rules for safely carrying out hot work. These rules apply to everyone on board the ship, including suppliers, contractors and subcontractors. It is vital that everyone working on board is given a proper safety instruction. The procedures must specify at least the following conditions:

- Safe gas-free environment.
- Clean environment, free of debris.
- Containment of area by fire doors or other openings.
- Removal of combustible materials. As a rule of thumb, at least 1 m vertically, 2 m horizontally, and to the next steel or fire resisting deck.
- Combustible materials should remain at a safe distance covered with fire blankets (horizontally and vertically).
- Cooling of structure.
- Fire watch or buddy, trained in firefighting and present with certified fire extinguishers at all times, including breaks.
- Where removal of materials is not practical (e.g. cable trays in the proximity of hot works) these to be adequately covered with fire blankets.
- Fire watch, equipped with means of direct communication and alert firefighting squad organisation in place.
- Easy access to pressurised fire hose.
- Disconnection of fire alarms in area of hot work.
- Hot work to be completed before end of the shift, and fire watch to remain on station until at least 1 hour after the work is completed. The fire watch must also sign off with name and time when the environment is considered safe.
- After completion of the hot works all fire and smoke alarms are to be switched on.

All preventive measures required to prevent the risk of fire caused by hot works are included in a hot work permit. This permit allows the workers to carry out the hot works and stipulates the required preventive measures which have been taken. Issuance and approval of the permit is done by an officer outside of the production or hot work department such to safeguard independence. This is further outlined in the next paragraphs.

A hot work permit can only be issued if all of the aforementioned conditions have been met.

Specific considerations for ships in operation and being repaired

The safety management system on board ships must include adequate guidance on managing hot work.

IMO MSC circular 1084 mentions the following precautions:

- The master or designated safety officer is responsible for deciding whether hot work is justified and whether it can be conducted safely.
- A permit-to-work system must be used.
- Hot work procedures must take account national laws or regulations, and other national safety and health rules.
- A responsible officer, not involved in the hot work, must be designated to ensure that safe procedures are followed.
- A written plan for the work must be agreed by all those with responsibilities in connection with the hot work.
- The work area must be carefully prepared and isolated before hot work starts.
- Fire safety precautions must be reviewed, including fire equipment preparations, setting up a fire watch in adjacent compartments and areas, and fire-extinguishing measures.
- Isolation of the work area and fire precautions must be continued until the risk of fire no longer exists.

In addition to the IMO's last point, the fire risk can be considered to have ended if during one hour after completion of hot works, no abnormalities have been observed.

In our experience, the most important factors are as follows:

- Which party will carry out the hot work and who is responsible? If this is a shipyard, it needs to be established whether the yard has taken out Ship Repairer's Liability insurance.
- Clear identification of hot work.
- Explicit agreement on whether the yard or ship hot work protocol applies, and which side is responsible for approving the hot work permit. If required, bridging agreements on matters of safety should be concluded, taking the yard and ship safety regulations in account.
- Agreement on who delivers designated and independent fire watches.
- Toolbox meetings on board and in the yard, making sure everyone is aware of the hot work.
- Permits are valid for one shift or up to one day, after which the situation has to be reassessed. Concluding the fire watch and a final check after the completion of the works is therefore important.

Specific considerations for new constructions

For new constructions, the fire risk arises as soon as combustible materials arrive on board. This includes machinery, cables, switchboards, insulation, plywood floors and bulkheads, packing materials. As soon as the stage of construction with a fire risk starts, hot work procedures are required such to prevent the risk of fire. The stage of construction with a fire risk can already arise during section building if sections are pre-fitted with combustible materials.

Our experience learns that the necessary precautionary measures are similar to those of ships in service, with the following additional considerations:

- Subcontractors must be aware of and follow hot work procedures. They require clear safety instruction and diligent oversight from the shipyard safety officers, and have to sign to confirm receipt of and agreement with procedures.
- No hot work is allowed before a hot work permit is signed off.
- Approval of hot work and issuance of permits is the responsibility of safety officers outside of production, to safeguard independence and prudence.
- Designated fire watches are required, preferably in a buddy system with the employees carrying out the hot work. The buddy and welder perform the work and keep the fire watch as a team.

- Continuously pressurised hydrant manifolds need to be present on the ship's main decks with sufficient hose lengths to reach all areas of the vessel. These are required as soon as the stage of construction with a fire risk begins.
- All areas on board that contain combustible materials need to be identified and all hot works are to be plotted on a general arrangement at the main entrance of the ship under construction.

Best practices

Below we note some specific best practices concerning hot work fire prevention:

- Every worker carrying out hot work must have a hot work permit with them. A copy must be retained in the office, away from the work, and the permit must have a unique number. Demonstration of a robust permit system can be of vital importance in case of disputes, injuries or claims.
- The maximum validity of a hot work permit must be one day or one shift. The identification of the people involved should be clear, and the approval process must be "watertight".
- A relatively new development is to equip fire watches with 'fire grenades'. These condensed aerosol fire extinguishers work best in an enclosed environment and prevent oxygen reacting with fuel, yet let people breathe at the same time. These extinguishers can supress or extinguish a fire in its early stages and buy time.
- The approval process of hot work must always take into account escape routes for attending staff as well as access for firefighters.
- All workers are to be instructed on understanding of an acting upon various ship's alarms (general, fire, evacuation).
- Special consideration needs to be given to the application of sprayed polyurethane insulation foams, used on LPG tankers, reefer vessels and fishing vessels (mostly trawlers). During application, these materials can undergo exothermic chemical reactions, and have been shown to act as a source of fire.
- Hot work on board a yacht in its outfitting phase should be avoided in general.
- Ensure work with grinding and cutting tools and acetylene and oxygen lines is safe, with appropriate gas clamps (not water hose clamps).
- Particularly for large-size (refit) projects, it may be considered, at an early stage, to invite local fire brigades to familiarize themselves with the vessel.

Attached is an example of a suitable hot work permit. Please note that this is just an example of a hot work permit and that no rights can be derived from this example. The suitability, scope and content of a hot work permit depends on the circumstances involved and the work carried out. In case of any questions, please contact your MS Amlin Marine underwriter.

Conclusion

We hope this circular has provided sufficient guidance on the risks surrounding hot work. Robust procedures and disciplined adherence to them can significantly reduce fire risks. Although systems and procedures may be in place, it's important to remember that people carry out this work, so mistakes may occur at any time. Common sense, understanding of each worker's role on board and an advanced safety culture are as important as procedures.

If you have any further questions or wish to discuss specific loss prevention matters in response to this circular, please contact your MS Amlin Marine Underwriter or our **Loss Prevention Services Department** at survey@msamlin.com.

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References

IMO MSC Circ. 1084 Principles for Hot Work on board all types of ships.

Appendix - Example of hot work permit

Unique number		DATE:	
The client	Company/community	Contact person and phone number	
The hot work operator(s)	Company/contractor (name)	THE SINGLE EMERGENCY NUMBER 112 When calling from the company's in house number:	
	Names of the hot work operators: o The issuer of the hot work permit has verified the validity of the hot work licence of all persons participating in the hot work		
Hot work plan	The hot work plan of o the client o the contractor will be followed		
Object of work	Company/building/unit/area		
	Addres of the hot work site		
Hot work	o Grinding and abrasive cutting of metals o Electric welding o Gas soldering and welding o Flame cutting o Gouging heat gun/Solder gun o Other, please specify:		
Identification and assessment of the hazards associated with hot work		YES Precautions are needed	NO There are no hazards
	Are inflammable dust, fine-grained substances or combustible waste present at the work site?	o	o
	Are inflammable materials present at the hot work site?	o	o
	Are there walls, ceilings, or floor surfaces or structures near the hot work site that can ignite (on either side)?	o	o
	Has insulation been removed over a safe distance of at least 0.5 m, and fire blankets used to protect from heat sources?	o	o
	Are there cables or cable trays at the hot work site?	o	o
	Does the object of hot work contain inflammable materials?	o	o
	Do the structures limiting the hot work site have openings or holes that facilitate the transmission of sparks or spatter into the wall, ceiling, or floor structures or the surrounding environment?	o	o
	Do sparks from grinding or abrasive cutting of metals pose a hazard in a wide area extending beyond the hot work site?	o	o
	Is flame cutting used, during which spatter can be spread across a wide area?	o	o
	Will hot work carried out at height, which can cause spatter to spread across a wide area?	o	o
	Can heat generated during hot work be spread to wall, ceiling, or floor structures?	o	o
	Are inflammable gases or steam present, or can they be formed at the hot work site?	o	o
	Are other hazards present? For example, heat guns, solder guns.	o	o
Hot work safety precautions	The client The contractor o The hot work site must be cleaned. o Material generated during work must be removed. o Inflammable materials must be removed from the hot work site or covered with fire resistant covers. o Protections must be placed close to the work area so that sparks/spatters created during the work cannot be transported into the environment. o A separate protective structure is required. o Any openings in the walls, ceiling, and floor must be covered. o Cables, cable trays, machinery, equipment, and inflammable structures and similar must be protected. o The work area must be watered. o The object of work must be cooled continually. o The concentration of gases must be measured, and the work area ventilated if necessary. o Surrounding areas must be guarded with a fire watch. o Containment to be considered/doors closed avoid unnecessary draft.		

Extinguishing equipment, fire alarm, springkler system	The extinguishing equipment required at the hot work site is acquired by: o The client o The contractor o ---------- hand extinguisher(s) (powder) o ---------- CO2 extinguisher(s) (electric areas) o ---------- AFFF extinguishers o A hose reel o A pressurised fire hose with sufficient length of reels o Air pressurised water extinguisher o Special fire extinguishing equipment o Fire extinguishing blanket First-aid and extinguishing equipment at the hot work site must include at least two designated hand extinguishers. Depending on the type of location, one of these can be replaced with a hose reel or pressurised fire hose. Fire alarms must be disconnected during work if required. Systems may only be connected and disconnected by the person in charge of them. The sprinkler system must not be disconnected. If required, the sprinkler nozzles can be covered during hot work. This should be agreed with the person in charge of the equipment and the Safety Officer. Name and phone number of the person managing the fire alarm/sprinkler system: Mobile smoke detectors to be installed on strategic positions inside the vessel: • at least one in the engine room • when other areas are in the fire-risk stage, place mobile smoke detectors immediately after the hot work has been carried out	
Hot work fire watch	The client The contractor o Hot work fire watch during hot work and breaks: o Hot work fire watch for -------- hours (minimum of 1 hour) after completion of hot work*	
Validity of hot work permit	Starts on: Ends on:	The permit is valid daily from ……. to ……. (max one day)
The issuer of the hot work permit	Date	Signature, name in block letters and phone number
Hot work area* Sign off all safe	Date Hour	Signature, name in block letters and phone number
Mobile smoke detector back in place	Date Hour	Signature, name in block letters and phone number
Sprinkler system protection removed and back in use	Date Hour	Signature, name in block letters and phone number
Person carrying out the hot works	Date Hour	Signature, name in block letters and phone number

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