

ANALYSIS OF HOT WORK PROCEDURES APPLIED ON BOARD SEA GOING VESSELS REQUIRED BY SAFETY MANAGEMENT SYSTEM

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Purpose: reasons for writing the paper is to present, the optimal procedure to manage specific critical job as hot work on board sea going vessels.

Design/methodology/approach: an analysis of various shipping companies safety management systems and requirements demanded to perform hot works.

Findings: found that safety management systems and demands to perform hot works are varied between shipping companies.

Research limitations/implications: management of specific high risk job as hot work to be unified.

Practical implications: suggestion is given to unify procedures of hot work management

Social implications: reduction of risk to happen undesired events and mitigations of hazards associated with hot work.

Originality/value: recommendation to shipping companies for modification of safety management system where is necessary to improve safety on board.

Keywords: safety management system, hot work, hot work management.

Category of the paper: research and viewpoint paper.

1. Introduction

The International Safety Management Code (ISM) in its current form was adopted in 1993 by resolution A.741(18) and was made mandatory with the entry into force, on 1 July 1998. In the 1994 to the SOLAS Convention has been amended and introduced a new chapter IX into the Convention. The ISM Code provides an international standard for the safe management and operation of ships at sea (Konwencja SOLAS..., 1998; Lloyds Register of Shipping..., 2006; ISM Code IMO, 1998). The requirements of the ISM Code may be applied to all commercial ships over 500 GT. The ISM Code is a chapter in SOLAS. If SOLAS does not apply then ISM is not mandatory. Compliance with ISM Code is sometimes required by vessel client regardless

of Gross Tonnage (GT). The purpose of the ISM Code is **to ensure safety at sea and prevent damage to property, personnel and environment** (ISM Code IMO, 1998).

In order to comply with the ISM Code, the Company operating the vessel has to be audited first after they submit their Safety Management System Manual (SMS) and is approved by Flag Administration or Recognized Organization as Classification Society. Once a Company is Audited, the Document of Compliance (DOC) will be issued (validity 5 years). Every Company is subject to auditing every year (three months before and after anniversary date and before DOC expiration date). Upon issuing DOC to Company (or Managing Company) each vessel can be audited to verify vessel compliance with ISM Code. Each vessel will be issued SMC (Safety Management Certificate) valid for 5 years and subject to verification of Compliance with ISM Code between second and third years of certificate validity (Lloyds Register of Shipping..., 2006).

Safety Management System Manuals consist of the following elements (Konwencja SOLAS..., 1998; ISM Code IMO, 1998):

- Commitment from top management.
- A top tier policy manual.
- A procedures manual that documents what is done on board the ship, during normal operations and in emergency situations.
- Procedures for conducting both internal and external audits to ensure the ship is doing what is documented in the procedures manual.
- A designated person ashore to serve as the link between the ships and shore staff and to verify the SMS implementation.
- A system for identifying where actual practices do not meet those that are documented and for implementing associated corrective action.
- Regular management reviews.
- Also, the ship must be maintained in conformity with the provisions of relevant rules and regulations and with any additional requirements which may be established by the company. Comments from the auditor and/or audit body and from the ship are incorporated into the SMS by headquarters.

Recognizing that no two shipping companies or shipowners are the same, and that ships operate under a wide range of different conditions, the Code is based on general principles and objectives, which include assessment of all identified risks to Company's ships, personnel and the environment and establishment of appropriate safeguards. The Code is expressed in broad terms so that it has a widespread application. Clearly, different levels of management, whether shore-based or at sea, require varying levels of knowledge and awareness of the items outlined. The cornerstone of good safety management is commitment from the top. In matters of safety and environment protection it is the commitment, competence, attitudes, and motivation of individuals at all levels that determines the end result.

Through an analysis of various safety management systems (Ship Management System – Shipping Company A (Europe), 2018; Ship Management System – Shipping Company B (Europe), 2020; Ship Management System – Shipping Company C (Europe), 2015; Ship Management System – Shipping Company D (Asia), 2017; Ship Management System – Shipping Company E (Asia), 2021) applied in shipping companies, the best management to perform specific critical job as hot work on board sea going vessels has been chosen and described in the paper. Authors had focused on management of hot work as recognized as high-risk task performed very often during seagoing vessels operation.

2. Safety Management System on board sea going vessels required by ISM Code

Safety Management System (SMS) should contain procedures and guidance for all persons aboard the Companies' vessels for the Safe Management of all operations, work and health control. SMS applies to all persons on board our vessels including any supernumeraries and shore management personnel. All Company personnel, both onboard and ashore shall be committed to achieving safety and environmental excellence. Senior Officers on-board and Managers ashore shall demonstrate their commitment by their behavior and through giving clear guidance and directions for achieving safety and environmental excellence. They shall lead by example, set precedents for others to follow and demonstrate leadership at every level. The Management Shipping Company is responsible for implementation and application SMS should by all means reinforce efforts towards Safety and Environmental excellence by individuals and ships crew on board managed vessels (Konwencja SOLAS..., 1998; ISM Code IMO, 1998; Standard OHSAS 18001:2007; British Standards No. 4778).

2.1. Shipboard Safety Committee

In order to have Safe Shipboard operations and activities, in compliance with all applicable Safe Working Practices and with due regard to Pollution Prevention requirements, Company establishes the Safety and Health Committee on board. The Committee is established to hear opinions of crew members regarding Safety and Health, maintain and improve working and sanitary environment, and for prevention of accidents. Safety Meetings are not to be used for the purpose of training or instructions. The Shipboard Safety and Health Committee Meeting is the pre-meeting for the Shipboard Maintenance & Review Committee (ISM Code IMO, 1998; British Standards No. 4778).

Members of the Committee are: Master as a Chairman and all officers, engineers and crew (except those on duty). Safety Committee meeting:

- The Safety and Health Committee meeting shall be held once a month.
- The Chairman should hold an extraordinary committee meeting whenever requested by the Safety or Medical officer or when deemed necessary.
- Occasional Meeting.

Occasional Safety and Health Committee meeting shall be held as soon as possible and within 24 hours after any serious accident or incident on board the vessel. Personnel and vessel safety, port call, expected visitors and Media control must be discussed in this meeting. If the vessel receives any Company information regarding a serious incident or accident within the group, a Safety meeting must be held at the first opportunity and not later than 72 hours of receiving the information. The following topics should be discussed among others:

- Risk assessment for the possibility of recurrence or similar situation on board.
- Preventive measures to avoid similar accident/incident.
- Lessons learnt from the incident.

Agenda of the Committee and following points should be among those discussed (Ship Management System – Shipping Company A (Europe), 2018; Ship Management System – Shipping Company B (Europe), 2020; Ship Management System – Shipping Company C (Europe), 2015; Ship Management System – Shipping Company D (Asia), 2017; Ship Management System – Shipping Company E (Asia), 2021):

- Minutes of the previous meeting must be read and progress on items stated. Outstanding items must be indicated with their expected completion dates.
- Broadcast Messages, Marine Notices, Information sharing or other information received from the Company. The reference numbers of messages discussed must be recorded.
- Any Non-conformity, Potential Hazards, unsafe acts or Accident found/occurred on board and their Preventive measures/Corrective measures.
- Requirements towards Ship's Security.
- Findings from Safety Officers Inspection and corrective actions.
- Findings from Health & Sanitary Inspection and corrective actions.
- Requirements for Critical Passages, port calls or operation
- Preparations towards upcoming Audits, Vetting or Inspections.
- Results of any Audits, Vetting or Inspections done.
- Safety procedures, correct work practices and precautions towards use of onboard equipment or non-routine jobs and hazards.
- Appointment of ratings as Crew Safety Representatives who will accompany the Designated Safety & Pollution prevention Officers on their rounds. One member from the Deck/Galley and one from the Engine department must be nominated for the month. The names of the nominated personnel must be recorded.

- Pollution Control – Bunkering/Transfer, Garbage, Ballast & Sediment Control, Smoke/Vapor emissions & Control.
- Proposals from Crew/Safety & Pollution prevention officers/Medical Officer towards improving health, safety, work & hygiene environment on board and any newly identified hazards.
- Hot work procedures.
- Hazardous work areas, working aloft, enclosed spaces etc.
- Review of Drills carried out.
- Review of Compliance with ISM and Company's requirements on board.
- Permit to work System, Work meetings, Training, Drills etc.
- Other subjects as may be required.

The Master shall report the contents of all discussion to the Company after the required signatures have been endorsed.

2.2. Tool Box Meeting

Tool Box Meeting is purposed to ensure the safety of work for the day and improve working efficiency (ISM Code IMO, 1998; Standard OHSAS 18001:2007; British Standards No. 4778).

Interval/place of the Meeting: Every Morning at 07:45 ship's time in principle at the place where specified by the Head of Department. Members of the meeting are: Head of respective departments and all crew concerned. During Tool Box Meeting topics to be discussed:

- Instruct the crew using Daily Work Plan to confirm assignment & procedure.
- Applicable Company Check Lists to be used.
- Working clothes and protective outfits to be checked.
- Discuss and confirm the Personal Protective Equipment to be used for all the jobs planned for the day.
- Check and preparation of equipment and tools to be used and appointment of persons to handle the equipment.
- Safety precautions for jobs to be highlighted as applicable.
- Confirmation of communication method between supervisors and workers and between workers themselves.
- Risk Assessment for the jobs by brainstorming and determine the necessary precautions, if required.
- Other matters necessary to conduct the work safely.
- Any doubts concerned planned job to be clarified and strictly explained.

2.3. Morning Meeting

Morning Meeting is purposed to ensure the safe working requirement, highlight any risks associated with the intended jobs and to confirm process of the works (Lloyds Register of Shipping..., 2006; Standard OHSAS 18001:2007).

Interval/Place of the Meeting: every Morning at 10:00 ship's time in principle at ship's office Member of the Meeting are all vessel's officers at management level.

Topics to be discussed:

- Review of the works carried out on the previous day.
- The work scheduled for the next day and requirements for same in reference to Monthly Work plan from Planed Maintenance System.
- Confirmation of the Special works that the Work Permit and/or Risk Assessment are required, identification of hazards, requirement for equipment. In case of any hazards identified which cannot be safely rectified on board, they must be reported immediately to the Company and any associated work processes totally discontinued. The situation must be fully assessed by the Company and the vessel and procedures agreed prior to continuing the operation.
- The Permit to Work shall be prepared for the special works and approved by the Master and the Safety Officer if acceptable.

3. Hot work procedures

Hot Work is any work which may generate high temperatures or produce an incentive spark, involving Welding or Burning, any other work including certain drilling, chipping and grinding, operations using any mechanical tools, equipment driven by an internal combustion engine or electrical work and the use of non-intrinsically safe electrical equipment – lamps or torches, which might produce and incendiary spark. Hot Work should only be considered if there are NO practical alternate means of repair. Hot Work should be carried out only after the following precautions have been observed and confirmed (Ship Management System – Shipping Company A (Europe), 2018; Ship Management System – Shipping Company B (Europe), 2020; Ship Management System – Shipping Company C (Europe), 2015; Ship Management System – Shipping Company D (Asia), 2017):

- The work area should not be subjected to vapor release, or a concentration of combustible vapors, and should be free of combustible material.
- The area should be gas free and tests with a combustible gas indicator should give reading of not more than 1% LFL.
- There must be no cargo operation, bunkering, tank cleaning, and gas freeing purging or inerting operations in progress. Vessel must not be at a terminal or port.

- Adequate fire-fighting equipment must be laid out and ready for immediate use.
- For grit blasting, the hopper and nozzle must be electrically bonded to the deck or fitting being worked upon.

Authors of this paper performed analysis of Hot Work procedures applied in many Shipping Management Companies and found that procedures are not the same. Management Companies have different procedures and approach to this high risk job. The best practices to perform safe Hot Work on board sea going vessels has been presented below as example. That procedures can be easy applied where is necessary to improve standards of safety.

3.1. Hot Work within designated spaces

Engine Room workshop is usually designated as Hot Work space. The person responsible for Hot work within the Engine room workshop is usually the First Engineer. The workshop should be assessed for Risks and the conditions under which the Hot Work can be undertaken must be specified. Instructions stating conditions and precautions for Hot Work should be posted in the designated space. These instructions may be issued by the Chief Engineer. Hot Work in the designated space must be authorized by the Chief Engineer or the First Engineer. The responsible officer must confirm that the conditions are as specified in above, prior to granting permission. No separate Hot Work permit or company permission is required for Hot work within the designated space subject to the above requirements being satisfied and the area confirmed safe for Hot Work (Ship Management System – Shipping Company C (Europe), 2015; Ship Management System – Shipping Company D (Asia) 2017).

NO Hot Work is permitted in any area of the vessel, including the designated area during cargo, ballast, tank cleaning, gas freeing, purging, bunkering or inerting operations.

3.2. Hot work outside designated space

If the Hot work outside the Engine Room Workshop is required, the Master and the Company shall take the following process/confirmation in advance.

The Master should decide weather the use of Hot Work is justified and whether it can be safely undertaken, and no viable means of repair exist other than Hot Work. The Master shall report the situations and the plan of the works to the Company in detail for approval.

The Master shall submit:

- Hot Work Permit.
- Details of the work in particular.
- Safety measure to be taken.
- Risk Assessment.
- Consideration should be given to only performing one hot work operation at a time, due to the resource limitations usually present onboard. A separate permit should be approved for each intended task and location.

- A written plan for undertaking the work should be completed, discussed and agreed by all who have responsibilities in connection with the work. This plan should define the preparations needed before work commences the procedures for actually carrying out the work and the related safety precautions. The plan should also indicate the person authorizing the work and the people responsible for carrying out the specific work, including contractors if appropriate.
- A Responsible Officer, who is not directly involved in the Hot Work, must be designated for Safety checks and to ensure that the plan is followed. Fire safety precautions and fire extinguishing measures should be reviewed. Adequate fire-fighting equipment must be prepared and laid out and be ready for immediate use. Safety Officer must check the work site personally.
- Fire watch procedures must be established for the area of hot work, and in adjacent, non Inerted spaces where the transfer of heat, or accidental damage, may create a hazard, e.g. damage to hydraulic lines, electrical cables, thermal oil lines, etc. the fire watch should monitor the work and take action in case of ignition of residues or paint coatings. Effective means of containing and extinguishing welding sparks and molten slag must be established.
- A separate risk assessment should be carried out regarding the needs for personal protective equipment and the means of evacuation of the fire watch personnel in an emergency. The risk assessment must also address the requirement, if any, for additional PPE required to ensure Risk levels are acceptable.
- A meeting to be held before hot work commencement and Master or his Responsible Officer shall notify following items to all concerned:
 1. General Precautions for handling of fire.
 2. Details of hot work.
 3. Appointment of a responsible person for the work and procedure for a safety check.
 4. Communication procedures.
 5. Measures against emergency.
 6. Crew who are not engaged in the Hot Work shall also be notified.
 7. Isolation of the work area and fire precautions should be continued until the risk of fire no longer exists.
 8. Personnel carrying out the work should be adequately trained and have the competency required to carry out the proposed job.
 9. The atmosphere of the area should be tested and found to be less than 1% LFL. The work area must be adequately and continuously ventilated and the frequency of atmosphere monitoring must be established.
 10. The hot work permit should be issued immediately before the work is to be performed. In the event of a delay to the start of the work, all safety measures should be re-checked and recorded before work actually commences.

11. If the conditions, under which the permit has been issued, should change, hot work must stop immediately. The permit should be withdrawn or cancelled until all conditions and safety precautions have been checked and re-instated to allow the permit to be re-issued or re-approved.
12. When alongside a terminal, hot work should only be permitted in accordance with prevailing national or international regulations, port and terminal requirements and after all necessary approvals has been obtained.
13. The Master and the Company shall verify whether intended hot work may be carried out in accordance with prevailing national or international regulations and/or port/terminal requirements.
14. The Company may consider permitting the hot work by verifying the planned hot work is justifiable, on the extent of the precautions necessary.
15. If the Company, after internal discussion with the requisite staff, permits the Hot Work, the confirmation of approval shall be notified to the Master by e-mail or by phone in case of after office hours.

The Flow Chart and Guidance Chart has been presented on Figure 1 and Table 1 should be consulted as a guide towards Hot Work requirements.

3.3. Hot work in dangerous or hazardous areas

For ships the dangerous or hazardous area effectively means the cargo tank deck or cargo deck areas, the cargo tanks or cargo holds and pump rooms and the atmospheric space around and above them. No Hot Work should be undertaken in a dangerous or hazardous area until it has been made safe, and has been proved to be safe, and all appropriate approvals have been obtained. Any Hot work in a dangerous or Hazardous area should be subject to a full Risk Assessment and the guidelines in section 3.2 of this part must also be followed. For Oil Tankers Hot Work in Dangerous or Hazardous areas is prohibited during laden passage and can only be allowed when the ship is in ballast. For LPG vessels Hot Work in dangerous or hazardous areas is prohibited during laden and ballast passages. No Hot Work is permitted in any area of the vessel, during cargo, ballast, tank cleaning, gas freeing, purging, bunkering or inerting operations.

3.4. Hot work in enclosed spaces

Where hot work involves entry into an enclosed space, the procedures outlined in SMS for enclosed space entry should be followed. Procedures given in Figure 1 (hot work flow) shall be followed. An enclosed space which hot work is to be undertaken shall be:

- Cleaned and all sludge or substances likely to give off flammable vapor shall be removed around the area of hot work. Particular attention should also be given to the condition of any adjacent spaces.

- Ventilated until the atmosphere reaches 21 % Oxygen content and less than 1 % LFL.
- Be continuously ventilated throughout the Hot Work.
- Adjacent Fuel Oil Bunker tanks may be considered safe if atmospheric tests give readings of less than 1% LFL in the vapor space of the bunker tank.

3.5. Hot work in Cargo Tanks

All sludge, cargo-impregnated scale, sediments or other material likely to give off flammable vapor, should be removed from the work area. The extent of the cleaned area should be established following a risk assessment of the particular work to be carried out. Special attention must be given to the reverse side frames and bulkheads. Other areas that may be affected by the hot work, such as the area immediately below the work location, should also be cleaned. The Table 1 provides guidance on the safe distance for areas to be cleaned and presents minimum requirements which may need to be extended, based on the output of the risk assessment. Cleaning distances are based on the type of work being carried out and the height above the tank bottom. Cleaning is taken to mean the removal of all sludge, cargo impregnated scale, sediments or other material likely to give off a flammable vapor.

4. Best practices to manage Hot Work procedures

In order to safely perform Hot Work on board the sea going vessels following procedures to be strictly followed:

- Details of hot work to be strictly described as presented on given example on Fig. 2 and Fig. 3.
- Hot Work Flow Chart – Fig. 1 and Hot Work Requirement Table – Tab. 1 to be followed.
- Risk Assessment and its Management to be performed as shown on example on Fig. 6.
- Safety measures to be applied during the work as presented on given example.
- Fire plan and escape routes to be marked as shown on example – Fig. 4.
- Hot Work Permit to be obtained as presented on example shown on Fig. 5.
- All planned procedures applied to accomplish successfully Hot Work to be followed very strictly.
- Proper manpower management to be applied all the time during performing Hot Work.

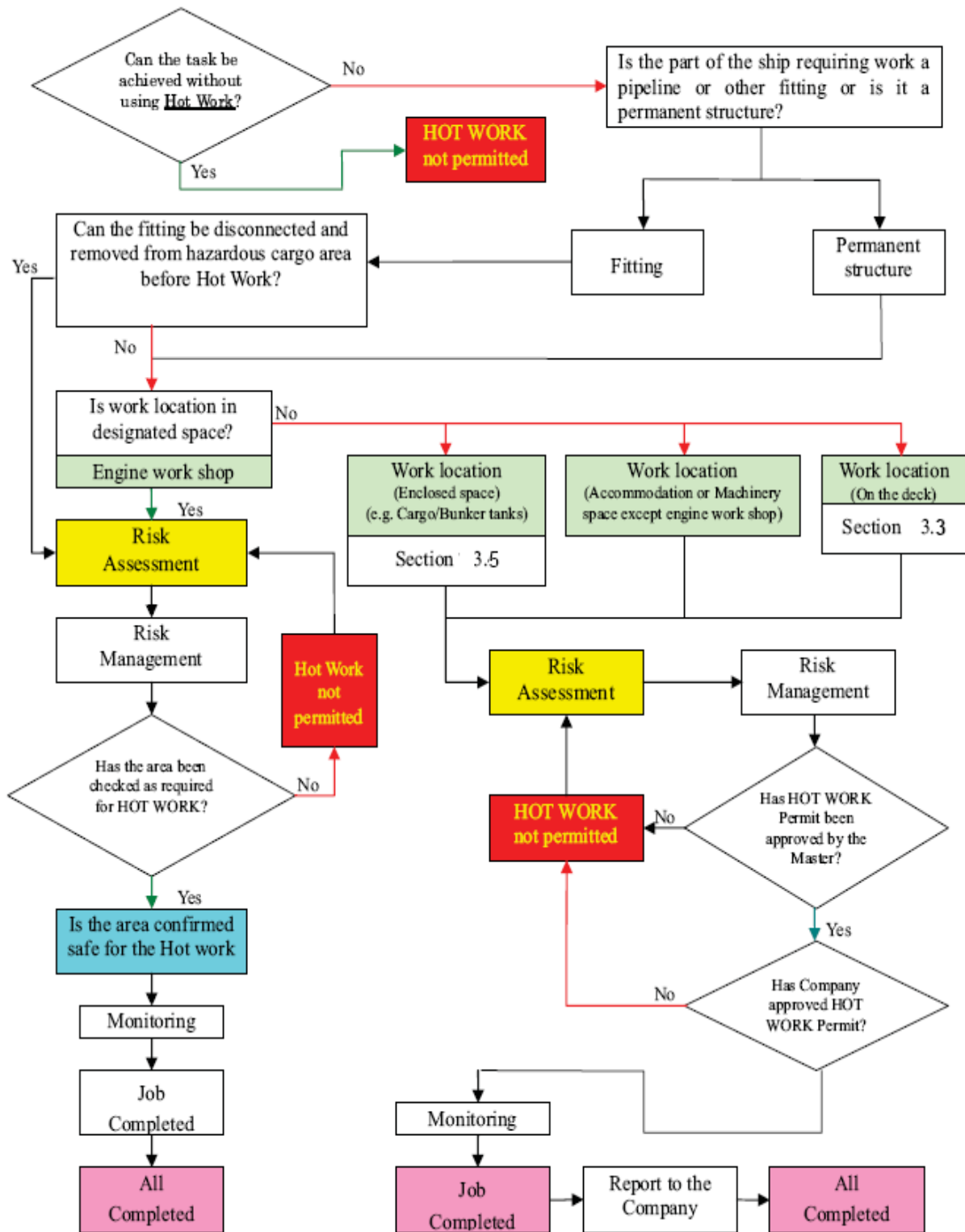


Figure 1. Hot Work Flow Chart. Source: Ship Management System – Shipping Company D (Asia) 2017; Ship Management System – Shipping Company E (Asia) 2021.

Table 1.
Hot Work requirements table

Work Location ----- Minimum Requirements	ER Workshop	Other parts of non-hazardous area	Open deck aft of accommodation	In Cargo Tanks	Plating or Structure in tank <500 mm from adjacent Cargo Tank bulkhead	On cargo tank deck plating Structures within 500 mm from deck.	Work on structures on the main deck area > 500 mm above the cargo tank deck.	Work on any cargo-related pipe lines inside a cargo tank incl. heating coils.	Cargo Pump room.	In Ballast tanks cofferdam or Voids.
Work in designated space with shield or curtain erected.	✓									
Adequate ventilation.	✓	✓		✓				✓	✓	✓
Confirmation from Master / CE or designate that work is OK to proceed.	✓									
Hot work permit issued in agreement with Company		✓	✓	✓		✓	✓	✓	✓	✓
Hot work permit approved by Master or Responsible Officer.		✓	✓	✓		✓	✓	✓	✓	✓
Atmosphere checks carried out.		✓	✓	✓		✓	✓	✓	✓	✓
Enclosed Space entry Permit issued				✓				✓	✓	✓
Tank to be washed and gas freed.				✓		✓		✓		
Adjacent Cargo Tank to be washed and Gas Freed.					✓					
Cargo tanks within 30 mtrs purged to below 2% HC by vol & Inerted to < 8% O ₂ .				✓		✓	✓	✓	✓	✓
Work to be carried out >500 mm from the Cargo tank deck or bulkheads.				✓			✓	✓	✓	✓
Work to be carried out >500 mm from a F.O. tank deck or bulkheads.			✓	✓		✓	✓	✓	✓	✓
Local cleaning to be carried out as per requirements.				✓				✓	✓	✓
All inter-connecting pipelines flushed and drained.				✓				✓	✓	
Tank valves isolated and Locked out.				✓				✓	✓	✓
Work planning meeting to be held and risk assessment completed.	✓	✓	✓	✓		✓	✓	✓	✓	✓

Source: Ship Management System – Shipping Company D (Asia) 2017; Ship Management System – Shipping Company E (Asia) 2021

Example of DETAILS OF THE WORK (with ships nomenclatures and names)

- Job scope: Hot work, Eng. Room bottom floor STB side aft, SO_xEGCS overboard sections of pipes Fwd and Aft to be cut out, renewed sections of pipes to be welded in place. Gas Cutting and Arc Welding piping is planned on 02/Oct/2021 from 08:00LT – 24:00LT.



Area of Hot Work

Figure 2. Forward SO_x EGCS overboard pipe.



Area of Hot Work

Figure 3. Aft SO_x EGCS overboard pipe.

- Job planned to be carried out: 02/Oct/2021.
- Tool Box Meeting Crew & Subcontractors to be performed prior the job commenced.
- The vessel will be in Ballast condition, **3 m** trim by ahead. Sea water overboard outlets will be over water line.
- All COT's are inerted, oxygen content less than 5.0%, pressure released to avoid accidental pressure release.
- Insulation from underneath to be removed (photo attached).

- Cutting points cleared from paint and dirtiness prior the work.
- All necessary permits submitted Company Management for approval. Permission to perform hot work to be obtained before commencement of job.
- Company Management will be informed prior job is commenced and after the job is completed.
- Hot Work Permit, Subsequent Gas check record, Cold Work Permit, Risk Assessment.
- Vessel will take all safety precaution for carrying out hot work in the areas as per ISGOTT and Company SMS guidelines.
- Work will be conducted according to procedure for HOT WORK OUTSIDE DESIGNATED SPACES.
- All appropriate Personal Protective Equipment to be used. 1A/E in charge to ensure compliance as per PPE matrix. The individuals performing hot work should wear clothing which should be free of grease and oil and other flammable substances. During welding he must wear welding shields or welding goggles with appropriate shade.
- Person assisting/supervising the work should also wear suitable eye protection to protect them from particles of hot metal and slag, and their eyes and skin from ultra-violet and heat radiation.
- Atmosphere to be checked for explosive gasses frequently. Personal gas detectors to be hold by persons involved in hot work.

Example of SAFETY MEASURES DURING THE WORK

- Adjoining spaces will be monitored by fire patrol by engine crew.
- Fire hoses will be rigged, Fire-fighting equipment shall be in state of readiness Fire Pump will be in operation, Charged Fire hose and Fire extinguisher (dry powder) will be standing by, ready use at the scene of Hot-work.
- Foam system for engine will be on stand-by.
- Fresh water hose will be rigged as additional measure. Fire blanket also kept in near vicinity.
- Warning notice will be posted at work area. Welding cables & cable connections to be checked for insulation. Connection of cables should be done in gas free space. During any break welding or hot work equipment to be turned off. Work area to be dry. If chance of rain work to be suspended.
- Main Fire pump will be kept running till it is ascertained that there is no chance of ignition.
- Monitor weather conditions during the Hot-work. If weather deteriorates hot work to be terminated. If required adjust the heading of the vessel.
- Monitoring for hot spots from underneath.

- Extra ventilation to be provided in Hot work area.
- After job completion area to be monitored for hot spots, tools withdraw, area cleaned, relevant forms signed, SI in charge advised.
- Resource Management will be applied, work and rest hours monitored.
- No Ballasting, Tank Cleaning, Gas Freeing, Purging, or IG operations will not be performed during Hot work.

PARTIAL DECK

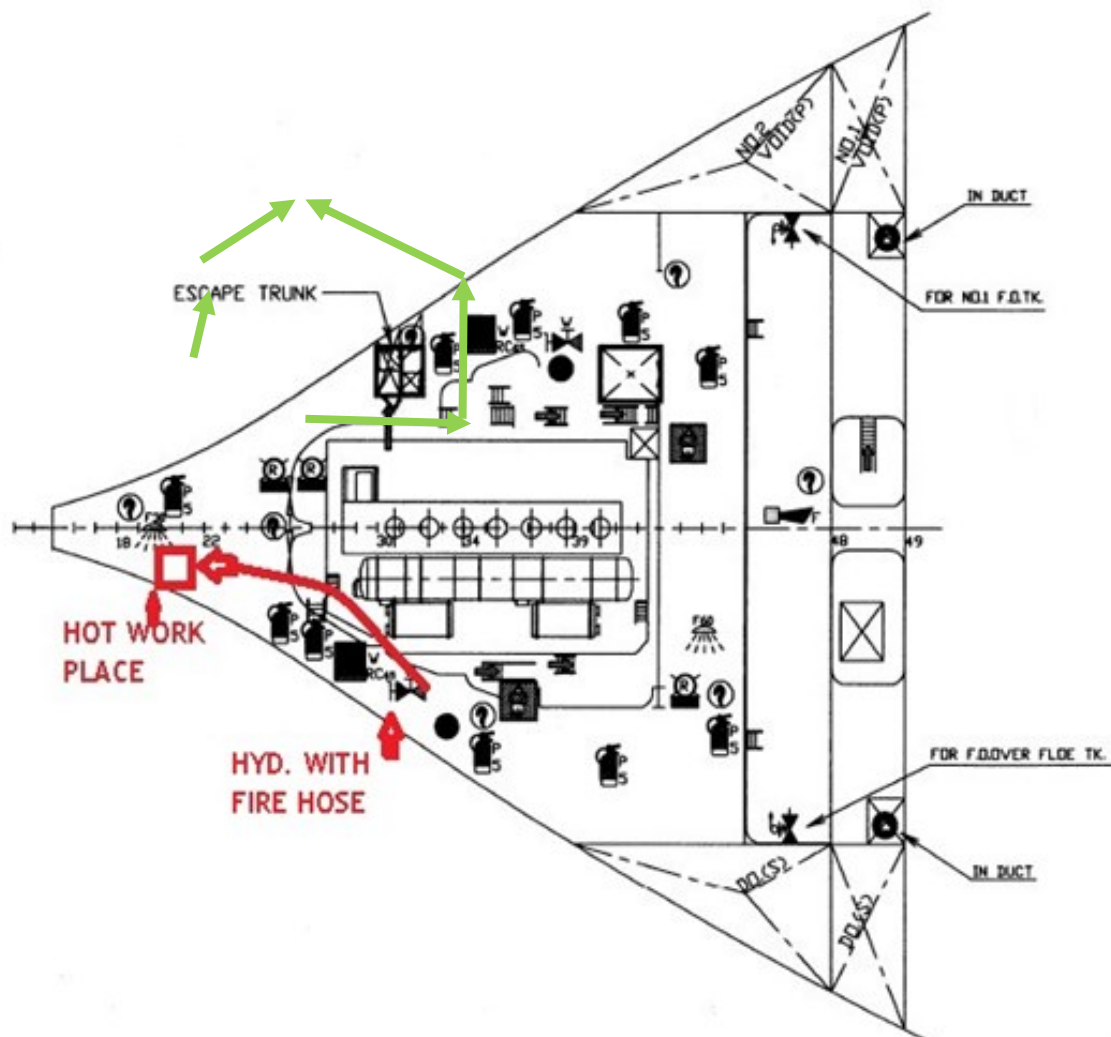


Figure 4. Example of Fire plan and Escape Roots.

HOT WORK PERMIT

Sections 1 & 2 of the Permit must be manually completed.

VESSEL M/T XXXX **Reference No:** 45654

This permit to work relates to any work involving temperature conditions which are likely to be of sufficient intensity to cause ignition of combustible gases, vapours or liquids in or adjacent to the area involved. Before completing this form, refer to the accompanying guidance notes, relevant section of the latest edition of International Safety Guide for Oil Tankers and Terminals, & Safety Management System - **On Board Procedures (OBP), for Hot Work requirements.** Company permission must be obtained and a Risk assessment done for Hot work outside the designated space.

IMPORTANT

(Hot Work Permit must be prepared in triplicate copies - Original must be displayed at the hot work site, duplicate in Bridge/Cargo Control Room, triplicate in Ship's file)

- | | | |
|---|---|--------------------------------------|
| 1. Validity of the Permit | From <u>12/05/22 @ 10:00 LT</u> | To <u>12/05/22 @ 15:00 LT</u> |
| 2. Location of hot work | <u>E/R bottom floor Aft/Stbd side</u> | |
| 3. Description of work | <u>overboard pipe to be welded, found pinhole</u> | |
| <hr/> | | |
| 4. Personnel carrying out the job | <u>Engine crew</u> | |
| 5. Person In-charge of Hot Work | <u>1 A/E X. XXXX</u> | |
| 6. Independent Responsible Officer for checks | <u>C/E Y.YYYY</u> | |

Section 1: These checks must be done prior seeking Office approval & prior Issuance of Permit.

- | | | | | |
|---|---|--------------|----------|--|
| 1.1 | Has the hot work area been checked with a combustible gas indicator for Hydrocarbon Vapours and it is less than 1% LEL. | | | |
| Checks for Office Approval: | DATE / TIME CONFIRMED <u>11/05/2022 16.30LT</u> | % LEL | <u>0</u> | |
| Checks for Permit Issuance: | DATE / TIME CONFIRMED <u>12/05/2022 09.40LT</u> | % LEL | <u>0</u> | |
| 1.2 | Has the surrounding area been made safe ? | | | |
| Date / Time: Prior Office permission: <u>11/5/2022</u> Prior Issuance <u>12/05/2022</u> | | | | |

Section 2

- Strike out what is not applicable.*
- | | | | | |
|----------------------|---|----------------------------------|-------------------------------------|---------------------------------------|
| 2.1 | Has company approval been obtained ? | <input checked="" type="radio"/> | NO | N.A. |
| 2.2 | Has a Risk Assessment been done and is acceptable? | <input checked="" type="radio"/> | NO | N.A. |
| 2.3 | Has the Equipment or Pipeline been gas freed ? | <input checked="" type="radio"/> | NO | <input checked="" type="radio"/> N.A. |
| | or completely filled with water ? | <input checked="" type="radio"/> | NO | N.A. |
| 2.4 | Has the Equipment or Pipeline been blanked ? | <input checked="" type="radio"/> | <input checked="" type="radio"/> NO | N.A. |
| 2.5 | Is the Equipment or Pipeline liquid free ? | <input checked="" type="radio"/> | NO | N.A. |
| 2.6 | Is the Equipment isolated electrically ? | <input checked="" type="radio"/> | NO | N.A. |
| 2.7 | Is the Surrounding area Safe ? | <input checked="" type="radio"/> | NO | N.A. |
| 2.8 | Is additional fire protection available ? | <input checked="" type="radio"/> | NO | N.A. |
| 2.9 | Has relevant section of the ISGOTT Guide & appropriate section in SMS manual read ? | <input checked="" type="radio"/> | NO | N.A. |
| 2.10 | Special conditions/ precautions | | | |
| | <u>Re-assessment of Risk to be done prior commencement of task</u> | | | |
| 2.11 | Has the hot work area been checked with combustible gas indicator for HC Vapours immediately prior to commencement of the hotwork ? | | | |
| (See Guideline No 8) | TIME CONFIRMED <u>12/05/2022 @ 09.40 LT</u> | % LEL | <u>0</u> | |
| 2.12 | Has the hot work area been checked immediately prior to the job | | YES | |
| (See Guideline No 8) | by the responsible officer to ensure that all the requirements of | TIME: | <u>09.45 LT</u> | |

In the circumstances noted it is considered safe to proceed with this hot work.

Signed <u>Aaaa</u>	Time : <u>09.55 LT</u>	Date <u>12/05/22</u> (Master)
Signed <u>Bbbbb</u>	Time : <u>09.50 LT</u>	Date <u>12/05/22</u> (Person In-charge of hot work team)
Signed <u>Ccccc</u>	Time : <u>09.45 LT</u>	Date <u>12/05/22</u> (Responsible Officer - safety checks)

Section 3

The work has been completed & all persons under my supervision, material & equipment have been withdrawn. (Do NOT Sign before completion.)

Authorized Person In-charge	Time _____	Date _____
Master	Time _____	Date _____

Figure 5. Example of Hot Work Permit.

Name of Vessel: M/T xxxx
 Date: 17-Mar-04
 Reference: aaaaaaa

Detail of Work Activity:

WELDING ON E/R partial deck
Opened space - welding SOxEGCS
effluent water Pipe

Refer to 'Criteria of Risk' Sheet for guidance towards evaluation criteria		Likelihood				
		1: Unlikely	2: Possible	3: Quite Possible	4: Likely	5: Very Likely
Consequence	1: Negligible	Low Risk	Low Risk	Low Risk	Medium Risk	Medium Risk
	2: Slight	Low Risk	Low Risk	Medium Risk	Medium Risk	Medium Risk
	3: Moderate	Low Risk	Medium Risk	Medium Risk	Medium Risk	High Risk
	4: High	Medium Risk	Medium Risk	Medium Risk	High Risk	High Risk
	5: Very High	Medium Risk	Medium Risk	High Risk	High Risk	High Risk

All Risks must be made As Low As Reasonably Practicable (ALARP) before commencing the job

STAGE 1		1. RISK ASSESSMENT		2. RISK MANAGEMENT STAGE 1				
Sr. No	Routine or Non-routine work (R/NR)	Hazards Identified (Use HAZD-001)	Consequence	Existing safeguards		Risk Ranking		
		What can go Wrong? Hazard is something with the potential to cause harm. Three Questions to ask:- 1. Is there a source of harm? 2. Who (or what) could be harmed? 3. How could Harm occur?	What will happen due to the hazard? Consequence is the loss associated if the hazard happens.	[For Example] 1. Work Permit System - Specify which is applicable 2. Safety Checklists - Specify Checklist & use. 3. PPE - specify which all PPE will be used 4. Lock Out & Tag out System- specify what will be locked & tagged out and at which locations. 5. SMS Procedures - specify which procedures.		Consequence	Likelihood	Risk
1	N/R	Fatigue	Personal injury	personel involved should be well rested with requirements of STCW & MLC		Moderate	unlikely	Low
2	N/R	Lack of training in welding operations	personal injury, damage of property	trained welder aware of hazard involving hot work is to perform task with supervising senior officer		Moderate	unlikely	Low
3	N/R	Poor communications between individuals and lack of understanding procedures	Personal injury	Communications must be agreed between personel, pre job briefing to be carry out. Concept Take 5 to be used. Senior officer responsible for operation should brief all involved abt. precautions to safely complete the operation		High	unlikely	Medium Risk
4	N/R	Inadequate PPE/ safety equipment	Personal injury	Proper PPE to be worn by all personel involved (ref Company PPE requirements Annex 1), welder and assistant must use proper welder 's gear.		Moderate	unlikely	Low
5	N/R	Inadequate preparation of work lokation and adjoining spaces	personal injury, damage of property	The work site to be free from oil and oil residues. Surface area and adjoining space must be prepared in accordance with ISGOTT requirements		High	Possible	Medium Risk
6	N/R	Flamable materials in vicinity of the hot work location	personal injury, damage of property	All flammable materials including oil residues, chemicals, rags must be removed from site of hot work location		High	Possible	Medium Risk
7	N/R	Faulty arc welding equipment, cable and electrode holder	personal injury, damage of property	Prior and on completion of arc welding equipment must be inspected by senior officer for any damage		Moderate	unlikely	Low
8	N/R	Explosive atmosphere	personal injury, damage property	Atmosphere in work location must be continuously monitored by proper instruments		High	unlikely	Medium Risk
9	N/R	Welding flush and fumes , hot debris	Personal injury	Area to be kept well ventilated and outlets of smoke escape to be maintained. Hot debris to be extinguished by small water hose. After surface to be wiped.		High	Possible	Medium Risk
10	N/R	Hot surfaces/ hot spots	personal injury, damage property	Temperature of surfaces in vicinity of hot work to be monitored by infrared temp.gage on top and down under surface.		High	Possible	Medium Risk
11	N/R	In appropriate weather conditions	Personal injury	Work must not be carried out if weather condition are not suitable for the operation		Moderate	unlikely	Low
12	N/R	High ambient temperature at hot work place	Personal injury	Personel involved must make frequently brakes to drink water and get rest, back up personel to be designated.		Moderate	unlikely	Low

Stage 2		2. RISK MANAGEMENT STAGE 2		3. EXECUTION			For Non Routine Jobs: Have involved personnel understood the Risks and implementation of safeguards and measures? Enter details below.		
Sr No	Additional Safeguards	Residual Risk			Name	Rank	Signature		
		Consequence	Likelihood	Risk					
	What can be done about the hazards? Consider the following: 1). Removal of the Hazard. 2). Substitution of the Hazard - reduce the Likelihood 3). Mitigation of the Hazard - reduce the Consequence 4) Use a combination of technical & procedural controls. 5). Ensure emergency arrangements are in place.								
1 to 10	Hot work permit PRMT -003 & 003A to be issued and strictly followed	High	Unlikey	Low Risk	xxx	2A/E			
1 to 10	Company approval of hot work to be obtained	High	Unlikey	Low Risk	xxx	3A/E			
3	Tool box meeting to be performed to. All aspects of work to be discussed and clarified . Full specific informations to be given to OOW on Bridge	High	Unlikey	Low Risk	xxx	No.1 Oiler			
4	Senior oficer have to make inspection of PPE	Moderate	Unlikey	Low Risk	xxx	Oiler A			
5,6	Proper preparation of area of hot work to be inspected and accepted by senior officer	High	Unlikey	Medium Risk	xxx	Oiler B			
8,9	Area to be kept well ventilated, atmosphere to be permanently monitored	High	Unlikey	Medium Risk	xxx	Wiper			
10	Person designated to monitor hot spots to be cleary quided by senior officer	High	Unlikey	Medium Risk					
1 to 12	Person in charge of hot work operation have to apply proper management of work	Moderate	Unlikey	Low Risk					
Add 1	Portable fire fighting equipment to be standing by close to work place. Fire lines to be pressurised . Nozzles to be ready to use.	Moderate	Unlikey	Low Risk					
Add 2	Portable fire fighting equipment to be standing by close to work place. Fire lines to be pressurised . Nozzles to be ready to use.	Moderate	Unlikey	Low Risk					
Add 3	Emergency action to be discussed during tool box meeting . evacuation roots to be marked and all personel involved in hot work to be acquainted with	Moderate	Unlikey	Low Risk					

Recovery and Mitigation procedures: (In case of undesired outcomes: List procedures and contingency plans that must be referred to for limiting the impact of any unplanned occurrences. E.g. in case of RA for enclosed space entry, contingency for Rescue from Enclosed Spaces and Emergency Medical Treatment will apply.)

List Applicable Contingencies & Procedures: OBP I - Part 1 (7.3.3) and OBP I Annex 2 (3)

In case of undesired outcomes: OBP VI- Contingency-Shopboard -Section 3 - 3.2 Fire in Engine Room

For Routine Jobs - This form is valid till: _____ (Maximum of 6 months)
 (unless reviewed due to an incident or when there is a change in the work conditions or additional hazards associated with the work have been identified.) For Routine jobs the form must be referred to and the Control measures understood and implemented. An entry to this effect must be made in the Daily work Plan form RECO-004.

1A/E xxxxx _____ Capt. Xxxx _____ C/E xxxxx _____
 Safety Officer (Name & Signature) Master: (Name & Signature) Other Officer incharge (Name, Rank & signature)

Figure 6. Example of Risk Assessment.

Conclusion

1. Procedures to manage hot work on board sea going vessels are quite complicated.
2. Due to this complication Tool Box Meeting to be performed professionally prior commencement of Hot Work. All doubts to be clarify.
3. Procedures for safety management during performing Hot Work to be simplified but in this process safety of crew, property and environment must be taken as priority.
4. Crew on board sea going vessels, through safety meeting and on board training, to be well acquainted with procedures to perform safe Hot Work. It is still a lot of space to improve.
5. Shipboard Safety Management system to be permanently improved by suggestions from crew to optimize complicated procedures as Hot Work but without jeopardize with safety on board.

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