

HOT WORK SAFETY INSTRUCTIONS
FOR SHIP PERSONNEL

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- 1.3 All sludge, scale and sediment should be removed from the area including transverse & longitudinal frames (reverse sides of frames also), bulkheads, etc. Adjacent tanks and spaces should be rendered safe by gas freeing or filling with water. Other tanks that are not gas free should be inerted to below 8% in oxygen content and then closed and monitored. An adjacent bunker tank containing fuel may be considered safe as long as the bunker ullage spaces are checked for LEL. If necessary, the bunker tanks should be ventilated or inerted when high LEL (above 5% LEL) levels are detected. Checks must be made to ensure that there is no ingress of flammable gases or liquid, toxic gases or inert gas from adjacent tanks or spaces by leakages into the working spaces.
- 1.4 Associated inert gas lines should be blanked off to prevent leakage into the working spaces. The inert gas system should be kept to minimum overpressure.
- 1.5 Cargo lines are to be thoroughly washed and kept flooded with water throughout the repairs.
- 1.6 Tanker pump rooms must be certified gas free and associated bilges free of oil.
- 1.7 All pump room and cargo oil tank valves are to be closed with valve controls locked/inhibited during the repairs with appropriate DO NOT OPERATE signs posted. The cargo valve hydraulic system is to be kept pressurized throughout the operation.
- 1.8 Hot work on deck and within tank spaces on tankers will require the COW line to be continuously pressured from the fire main throughout the course of the repairs.
- 1.9 All safety gear shall be rigged (including BA apparatus) at the entrance to the space with pressurized fire hose standing by. Additionally, two portable foam fire extinguishers and a pressurized hose shall be positioned at the work site.
- 1.10 A reasonable Officer shall be in attendance at all times to continually monitor the gas levels and ensure continuous ventilation of the spaces.



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- 1.11 Concurrent pumping cargo, ballast and tank washing and other operations utilizing the cargo system is not permitted during hot work in pump room, cargo tanks, ballast tanks, void spaces, duct keels and other associated spaces.
- 1.12 If the hot work could cause heat transfer through a common bulkhead, the adjoining space should either be filled with water or gas freed with all combustible residues on the bulkhead removed. Other tanks immediately below, above or adjacent to the place where the hot work is being undertaken shall also be cleaned and gas freed or filled with water. All other tanks, which are not gas freed, shall be inerted to below 8% in oxygen content.
- 1.13 The opening of any pipeline or valve, or operation of any valve connected to any pipeline, including cargo, fuel, hydraulic, ballast, steam and inert gas lines is not permitted without prior approval of shipmaster and agreement with safety inspector. All isolation valves must be closed, locked and keys should be in possession of the chief officer.
- 1.14 Proper access and emergency exist should be provided. The bottom walkway must be erected if not as built.
- 1.15 The points not included in this instruction shall be referred to Chapter 11 of ISGOTT (International Safety Guidelines for Tankers and Terminals) for entering into confined spaces and Appendix – F/G/H/I, Hot/ Cold/ Electrical/ Enclosed Space Entry/ Work Permit, general precautions on tankers – Chapter 2 and Emergency Procedures – Chapter 14.
- 1.16 Meters used for gas testing should be calibrated and a valid calibration card/sticker to be attached /pasted to the instrument.
- 1.17 All lifting tools, tackles and equipment should have valid test certificate from the reputed third party.
- 1.18 All vehicles engaged for the job should have valid registration.
- 1.19 Electrical lamps & equipment having supply voltage less than 50 volt only shall be used in the confined space.
- 1.20 Before working on any equipment it should be isolated and freed from electrical charge & motive power.



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2. Fire Precautions for ships

Check areas to ensure there are no substances near, below, above or adjacent that might ignite from heat or sparks. Always check other side of respective deck or bulkhead.

When welding near open hatches or vents ensure suitable screens are placed to prevent sparks from dropping down these openings.

Ensure all work spaces are gas free and continually monitored for gas throughout work period. Pipes and pumps previously used for volatile liquids should be thoroughly cleaned and gas freed prior to any required hot work.

The ship's fire main to be pressurized at all times.

Adequate numbers of continuous explosive gas monitors and oxygen monitors with audiovisual alarm should be placed in the confined spaces. In the event of alarm all personnel will evacuate the tank quickly and immediate actions shall be followed to suppress the situation.

3. Fire watch:

It is absolutely essential to mount a fire watch with portable extinguishers and charged fire hoses where appropriate whenever hot work is in progress and to continue to maintain a watch for two hours thereafter to control possible re-ignition from hidden smoldering debris. If hot work could cause heat transfer through a common bulkhead, deck-head, etc., the adjoining space should also be monitored.

3.1 At least one trained fire watchman to be present in working tank (and adjoining tank if heat transfer is possible) at all time and contact with bridge by portable VHF (walkie-talkie).

3.2 Before starting work and before resumption of work after a break, gas tests shall be made from the deck and at several levels within the tank including the work area. Thereafter, continuous gas and oxygen



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monitoring with audiovisual alarms to be kept in while hot work is in progress and the tank is occupied. All gas readings shall be clearly recorded in a special book.

- 3.3 In addition to the above and where applicable, continuous gas checks shall be made at the work area. If combustible gas readings or oxygen readings exceed the acceptable levels all work shall be immediately suspended and the space evacuated of all personnel. Re-entry shall not be permitted until ventilation brings the gas and oxygen readings to acceptable levels.
 - 3.4 Portable air fans should be in continuous operation in the working tank. Adjacent tanks should be ventilated if gas levels exceed 5 % LEL.
 - 3.5 Suitable warning notices shall be posted at the tank entrance.
 - 3.6 During break times, all electric welding equipment must be switched off. Similarly all cutting torches and cylinder valves to be firmly closed. The gas hoses should be withdrawn from the confined spaces.
 - 3.7 Even after proper tank cleaning, tank bottom to be flooded with water to cover any sludge or scale. Care must be taken with this precaution to:

Never stand in water when using electric welding equipment, flooding shall not take place if, as a result, the welder is exposed to additional danger from electrocution.

Ensure flooding does not allow release of flammable oil, which could ignite. Tank cleaning procedures must be ensure all remaining scale and sludge has negligible oil content or NIL oil content.
 - 3.8 "No smoking" rules to be strictly enforced even if hot work is allowed.
4. Work on Cargo Pumps, Valves, Coils and Pipelines

Work in cargo pumps, cargo pipelines, valves or heating coils should only be permitted after they have been first thoroughly flushed through with water.



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Even then there is a possibility that some cargo may remain which may be a source of ignition. Special care must therefore be taken when opening up such equipment and additional gas tests shall be made. For hot work, as above and also:

- 4.1 Ideally, after flushing, the affected section should firstly re- attached form the system by cold work (do not burn the bolts off) and the open ended section (s) of the remaining system sealed off. If possible the disconnected pipe should be then removed to a safe area (poop) for any hot work. If the work must be done within the tank the section of the pipe to be worked upon should be gas free to a “safe for hot work” standard.
- 4.2 If, after flushing, or if it is not possible to flush and repair the hole then the pipe in question should be firstly patched with epoxy or similar material and the filled with water. It is important to verify that the pipe is totally filled before commencing any hot work. Thereafter weld a double over the temporary epoxy patch.

OR

After flushing, cleaning the pipeline the system is then gas freed via forced air fans connected on deck (or elsewhere) to the pipelines.

5. Alongside a Terminal/Quay

When alongside a terminal no hot work should be allowed until the terminal representative and, where appropriate, the Ports Health & Safety Superintendent has been consulted and approval obtained.

6. Outside Contractors

The master should satisfy himself that whenever outside contractors or work gangs are employed arrangements are made to ensure their understanding of and compliance with all relevant safe working practices and that they are effectively supervised and controlled by a responsible officer. Only DPA approved ship repair contractors are allowed for the repair jobs. The list of approved contractors is available with port control.

7. Ventilators

Harmful gases can be produced during repair operations. Adequate ventilation must be provided and monitored when working in enclosed



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spaces. Usually the most appropriate ventilation during hot work is extraction to remove smoke with air replacement attained via other openings. Use fume extractor for welding jobs. Always ensure that all appropriate procedures are followed prior to entering an enclosed space.

Appropriate type of ventilators, Jet Blowers & suitable duct (if required) shall be used for venting the confined space.

8. Testing of Oxygen Deficiency

A steady reading of 20.8% oxygen by volume on an oxygen meter shall be obtained before entry is permitted and thereafter-regular tests performed in conjunction with continuous venting.

9. Testing of Flammable (Combustible) Gases or Vapour

The combustible gas indicator (sometimes called the explosimeter) detects the amount of flammable gas or vapour in the air. An instrument capable of providing an accurate reading at low concentrations should be used to judge whenever the atmosphere is safe. The meter is primarily intended to detect hydrocarbon gases concentrations in air UP TO A POINT WHERE THEY CAN SUSTAIN AN EXPLOSION. It will not measure flammable limits in an inerted atmosphere. For this secondary purpose, a special meter is used which measures combustible gases in inerted atmosphere.

In deciding whether the atmosphere is safe for entry, continuous NIL readings on an explosimeter are desirable. Atmosphere can be considered safe where readings 0% of LEL have been obtained, 0-PPM toxic gases and are confirmed to be steady in conjunction with oxygen readings of 20.8% by volume. Readings should continue to be taken throughout the period that spaces are occupied. Inerted atmosphere can contain toxic gases.

10. Testing for Toxic Gases or Vapour

Suspected toxic gases based on previous cargo and the last cargo content should be tested for the human worthiness prior to the entry to the confined spaces. In deciding whether the atmosphere is safe for entry, continuous NIL reading on meter or dry tubes is desirable without ventilation running.



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However, atmosphere can be considered safe where readings of less than the TLV (threshold limit value) of the chemical content.

11. Confined Space Venting

It is mandatory for continuously and thoroughly ventilate the space prior to entry and thereafter throughout the period it is occupied.

In the event of a problem with ventilation, all personnel should evacuate the tank/enclosed space.

Appropriate type of ventilators, Jet Blowers & suitable duct (if required) shall be used for venting the confined spaces.

12. Protective Clothing/Equipment

It should be considered that the Personal protective equipment does not eliminate the hazard but it is a protection against the residual hazards. Therefore, priority should be given to eliminate hazards by engineering methods, then reduce the exposure to hazards by administrative method and in addition to all these measures the PPE is used as third line of defense to protect persons from the hazards.

Personnel protective such as safety hard hat, safety shoes, cotton coverall and safety spectacles are mandatory PPEs for all works.

Protective clothing must be worn by the operator/welder to protect eyes and body from injury and electrocution. The operator/welder and his co-worker should normally wear:

- a. Welding helmets with coloured visor of appropriate shade.
Hand held eye shield or coloured goggles can also be used.
- b. Leather working gloves.
- c. Long sleeved boiler suit.
- d. Non-conductive safety footwear.
- e. Leather apron-when appropriate.
- f. Spats-shoe cover – when appropriate.



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13. Electric Welding Equipment and Precautions
 - 13.1 All welding equipment should be maintained according to the manufacturer's instructions. Only a competent person should service or repair the equipment.
 - 13.2 To avoid voltage drop the lead cable should be as short as possible.
 - 13.3 Ensure that the earth (return) connection is as close to the weld site as possible to avoid sparks at remote locations.
 - 13.4 Cables should be inspected before use, if insulation is impaired or conductivity reduced they should not be used until repaired by a competent person.
 - 13.5 Cable connectors should be fully insulated when connected and so designed and stalled that current carrying parts are adequately recessed when disconnected.
 - 13.6 Electrode holders should be fully insulated so that no live part of the holder is exposed to touch.
 - 13.7 In addition to wearing the protective clothing as specified previously, it is particularly important to ensure gloves are kept DRY as wet leather is a good conductor of electricity.
 - 13.8 Never weld alone, an assistant (suitably protected) or fellow welder should always be in attendance during welding operations. He should be alerted to the risks of electric shock and know how to instantly cut off the power, raise the alarm and apply artificial respiration.
 - 13.9 Great care must be taken when working in a confined space in conditions of high temperatures and high humidity with consequential body sweat and clothing. It may be necessary to place insulation mats to protect the sweating operator from shock.
 - 13.10 Under no circumstances should a welder work while standing in water or with any part of his body immersed in water.
 - 13.11 The electrode holder should be isolated from the supply before changing electrodes. This precaution is necessary as some electrodes have extremely low resistances. Even the flux coating can accidentally become damp and is thus potentially dangerous. For this reason every effort should be made to keep spare electrodes dry by keeping them in a separate container and when not in use



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should be kept in a warm dry location (e.g. close to boiler). As an added precaution, always wear dry gloves.

- 13.12 Hot electrodes should be ejected into a suitable container. They should not be handled with bare hands.
- 13.13 Always remove the electrode when welding operations are completed or temporarily suspended.
- 13.14 Cables should be so laid as to avoid kinks or becoming tangled, cut or otherwise damaged. Never lay them through access ways.

14. Gas Welding and Cutting

- 14.1 Flame cutting equipment must be well maintained with particular reference to regulators, back fire and back flow valves, hoses, joints and fittings, pressure gauges and torches. Defective equipment shall not be used. Only a competent person should repair and service the equipment.
- 14.2 The pressure of oxygen used for welding should always be high enough to prevent acetylene from flowing back into the oxygen line.
- 14.3 Acetylene should not be used for welding / cutting at a pressure exceeding 1 atmosphere gauge as it is liable to explode under excessive pressure.
- 14.4 Ideally, back pressure valves should be fitted adjacent to the torch in the oxygen and acetylene supply hoses. Only if the design dictates otherwise should the valves be positioned at the cylinder.
- 14.5 Only hoses specifically designed for gas operations should be used.
- 14.6 Flame arrestors (back fire valves) in the supply lines and elsewhere shall be maintained and kept in good order.
- 14.7 Should a backfire occur the valves on the oxygen and acetylene cylinder should be immediately closed. A watch should be maintained on the acetylene cylinder and should it become hot it should be immediately cooled by either immersion in water or by copious amounts of water with the cylinder stop valve in the open position. If this cannot be done safely the cylinder suspected of



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overheating should be treated with extreme cautions because any impact could set off internal ignition which might cause an explosion.

- 14.8 Any gas manifolds should be clearly marked with the gas contained therein.
- 14.9 Manifold connections should be different for each type of gas to preclude interchange between different gases.
- 14.10 Any length of hose in which a backfire has occurred should be discarded.
- 14.11 The connections between hose and blow pipe and hose joints should be fixed with cramping/ metal hose bands.
- 14.12 Hoses should be laid as to avoid kinks or becoming tangled, cut or otherwise damaged. Never lay it through access ways.
- 14.13 Only soapy water should be used to test for hose leaks.
- 14.14 Blowpipes should only be lit with special friction igniter, stationary flame or other safe means.
- 14.15 Should a blow pipe tip become blocked it should be cleaned only with dedicated tools.
- 14.16 When changing a blow pipe ensure gases are shut off at the regulators. Never do it in the confined spaces.
- 14.17 During a temporary (less than 15 minutes) stoppage, supply valves on gas cylinders and gas mains should be shut. For longer (more than 15 minutes) stoppage supply valve on gas cylinders/gas mains should be closed, the hoses/blow pipes should be withdrawn from the confined spaces and it should be gas freed.
- 14.18 Whenever storing or transporting cylinders ensure caps are in place and cylinders are secured in upright position.
- 14.19 Never lift a cylinder by its valve or cap. Always try to use an approved cradle in preference to a net. If there is no alternative to using a net, ensure the net is in good condition with mesh size sufficiently small to prevent the cylinder slipping through.



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- 14.20 Never drop a cylinder.
- 14.21 Do not allow grease, oil or other combustible material to touch any part of a cylinder. This is particularly critical with oxygen cylinders. Oxygen under pressure reacts violently in contact with oil, grease, and other combustible material. Pure acetylene forms a dangerous explosive compound with copper. Do not use fittings, in contact with acetylene, which have a copper content greater than 65%. Only use approved fittings. NEVER use copper washers on acetylene bottles.
- 14.22 Always return cylinders with some positive pressures. Be sure valves are closed after use.
- 14.23 As a fireproof barrier, keep oxygen cylinders separated from acetylene cylinders during storage, (by a physical compartment barrier in newer vessels and in older vessels without a physical compartment barrier then if possible by atleast 6M). Always provide adequate ventilation. Never store cylinders in accommodation areas or machinery spaces. Storage areas should be provided with intrinsically safe lighting, with NO SMOKING signs posted. Cylinders must be stored and used at less than 130F (54C)
- 14.24 Never strike or hammer cylinders or use spanners to open the valve. Remember acetylene has left-hand thread and oxygen cylinders, a right hand thread.
- 14.25 Gas cylinders should be colour coded to prevent confusion.

15. Safe Work Permit for Ship Repair Jobs-Format:

Please see the attachment form.



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