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मानक

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Mazdoor Kisan Shakti Sangathan

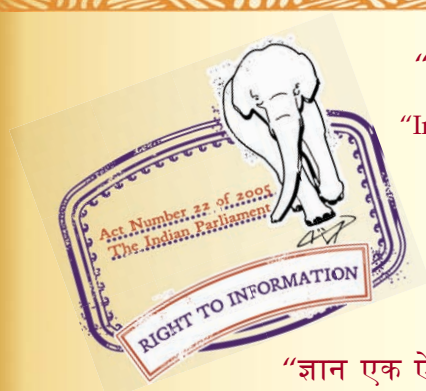
“The Right to Information, The Right to Live”

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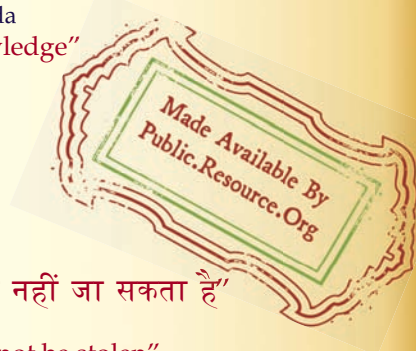
IS 3016 (1982): Code of practice for fire precautions in welding and cutting operations [MTD 11: Welding General]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS : 3016 - 1982

(Reaffirmed 1990)

Indian Standard

CODE OF PRACTICE FOR FIRE PRECAUTIONS IN WELDING AND CUTTING OPERATIONS

(*First Revision*)

First Reprint AUGUST 1993

UDC 621.791.555.624.014.2 : 006.76

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**BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002**

*Indian Standard*CODE OF PRACTICE FOR
FIRE PRECAUTIONS IN WELDING AND
CUTTING OPERATIONS*(First Revision)*

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(Continued from page 1)

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(Continued on page 19)

Indian Standard

CODE OF PRACTICE FOR FIRE PRECAUTIONS IN WELDING AND CUTTING OPERATIONS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 1 June 1982, after the draft finalized by the Welding General Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1965. In this revision the concept of 'hot work' permit system has been introduced with a view to establishing some control over welding and cutting operations using naked flame or producing sparks. The provisions relating to general precautions have been amplified.

1. SCOPE

1.1 This standard covers the recommendations for the practices for prevention of loss of life and/or property by fire or explosions arising out of the use of gas and electrical-equipments for the purposes of welding, cutting and similar operations.

1.2 General precautions recommended cover the normal work area designated for the fabrication and maintenance activities using welding, cutting and allied processes and also special situations having potential fire hazards.

1.3 Special precautions recommended cover the situations or locations which are susceptible to fire or explosion hazards arising out of the presence of naked flame or sparks, capable of igniting the combustible materials present in the area.

2. GENERAL PRECAUTIONS

2.1 Hot Work Policy — It is recommended that the management of industrial establishments should consider the necessity of preparation of a

policy statement for introducing 'hot work' permit system. The purpose of introducing the 'hot work' permit system is to establish some control over welding and cutting operations using naked flame or producing sparks, capable of igniting combustible materials in areas outside the normal specified ones for carrying out such activities regularly.

2.1.1 The type and extent of such a system should be prepared keeping in view the following:

- a) The size and facility of the plant,
- b) The complexity of the operations, and
- c) The degree of hazards present at the work site and in surrounding areas.

2.2 Hot Work Permit System

2.2.1 Identification of Hazardous Areas — In introducing the hot work policy and the permit system, it should be ensured that the specific areas throughout the plant considered as hazardous by the Competent Authority, for any type of hot work, should be identified and prominently marked as 'hazardous area' in consultation with the various departmental heads.

2.2.2 Application for Hot Work Permit — For conducting hot work of any type, inside the designated hazardous areas, or in close proximity to the hazardous areas, or near that area for prolonged period or in any new locations, the departmental head or this authorised person should put up application for 'Hot Work Permit' filling in a suitable Hot Work Permit form.

2.2.2.1 Hot work permit form — A suitable form should be developed specifically for the purpose of considering the plants operations, and degree of hazards present. It should incorporate specifically the type and nature of precautions that should be taken in performing the hot work at the particular location and time. It should also mention the Competent Authorities through whom, the application should be corroborated before seeking permission from the person incharge of the plant, by designation, such as Plant Manager, Works Manager, Site Incharge, etc. In Appendix A, an example of Hot Work Permit form has been included for reference.

2.2.3 Accordance of Permission — The person incharge of the plant shall make a thorough inspection of the place, if possible, accompanied by a fire officer, before cutting or welding operations are commenced, particularly in (a) any new place where hot work is proposed for the first time, and (b) where the work is to be extensive in proximity to the marked hazardous area. He shall then either accord his sanction with or without conditions or insist upon the adoption of alternative methods of carrying out the work, should he find the conditions unsafe for hot work operations.

2.2.4 Supervision of the System — The Competent Authority should supervise the working of the system by issuing clear instructions regarding the precautions required to be taken at different hazardous areas marked, periodically checking the hazardous areas, notice boards, equipments for fire fighting and extinguishing and training of personnel for handling small fires and alarm systems.

2.3 General Precautions Before Welding and Cutting

2.3.1 Cutting and Welding Equipment — All cutting and welding apparatus shall conform to relevant Indian Standards where available and also fulfil the requirements laid down in IS : 818-1968*.

2.3.1.1 Installation of cutting and welding apparatus — The installation of all cutting and welding apparatus shall fulfil the requirements laid down in IS : 818-1968* and in respective Indian Standards.

2.3.2 Operators of Cutting and Welding Equipment — Only responsible operators, fully trained in the care and use of cutting and welding equipment, shall be permitted to carry out cutting and welding operations in or near hazardous locations.

2.3.2.1 Cutting or welding operators shall not work alone in or near any hazardous location, but shall be provided with an assistant trained in safety precautions. Implements necessary for ensuring safety and for carrying out rescue operations should be provided wherever necessary.

2.3.3 Protective Clothings and Seat for Operators

2.3.3.1 Protective clothings — Wherever necessary, the operators of welding and cutting equipments should wear protective clothings, such as gloves, aprons, foot guards, goggles, helmets, etc. The clothings of operators should be free from oil or grease and from open pockets, trouser flaps, cuffs, etc.

2.3.3.2 Seat — The usage of empty thinner or oil drums as a seat for operator or as a support for job shall be avoided to avoid fire and explosion risk.

2.3.4 Protection of Flooring

2.3.4.1 Wooden flooring — Where any cutting or welding is to be done over a wooden flooring it shall be swept clean and protected by such means as (a) thoroughly wetting with water, (b) covering with damp sand, and (c) sheet metal, asbestos or similar heat resistant materials at points where sparks or hot metal shall fall. Provision shall be made to

*Code of practice for safety and health requirements in electric and gas welding and cutting operations (*first revision*).

protect the welders and operators from the hazards of electric shock when the floors are wet or covered with metallic sheets.

2.3.4.2 Protection of floors covered with oil, grease dirt, etc — Some installations of machineries, for example rolling mills, oil reservoir and burner installations in melting shops, floors are very often covered with grease, oil, dirt, etc. During cutting or welding operations for maintenance purposes, adequate precautions shall be taken to ensure that the oil, grease, dirt may not catch fire from sparks, flame or hot metal droplets or hot metal pieces. The floor shall be swept clean before starting any welding or cutting.

2.3.5 Protection of Rope and Cordage — During cutting or welding operations, rope and cordage shall be protected from the heat of cutting or welding blowpipes and from sparks, slags, and hot metal particles. Particular care shall be exercised in the case of ropes supporting loads, guy ropes and ropes securing scaffolding.

2.3.6 Protective Guards — In all protective guards for covering the floor or other combustible materials, only non-flammable, fire-resistant materials should be employed for shielding sparks, hot metals, etc.

2.3.6.1 All protective guards shall be sufficiently large and fit tightly enough not to permit any sparks, slags or hot metal droplets to roll underneath or bounce through any openings. Curtains shall be weighted down against the floor or ground with such things as angle iron, pipe, bricks or sand so that sparks cannot possibly get underneath.

2.3.6.2 Wherever there are floor openings or holes in walls opening doorways, or open or broken window which cannot be closed or covered readily, precautions shall be taken to ensure that no sparks or hot metal droplets pass through such openings to the adjacent locations or the floor below which may cause fire or explosions.

2.3.6.3 When welding or cutting very close to a wooden construction, it shall be protected from direct heat. Wooden beams, partitions, floorings or scaffoldings shall be protected always from the direct heat or the welding flame by sheet metal or asbestos curtain guards.

2.3.7 Disposal of Off-Cuts and Electrode Ends — Before any cutting operation is commenced, arrangements shall be made to prevent the cut-off pieces from dropping into a place where there is any possibility of starting a fire. This shall be done by:

- a) welding a rod or bar to the piece to be cut off,
- b) securing the piece to be cut off with wire or chain, or
- c) having a helper to hold the piece or catch it in a suitable receptacle.

2.3.8 Fire extinguishing equipments suitable to fight the type of hazards shall be kept ready within easy reach of the welding and cutting operators and their assistants. Such equipments may consist of pails of water, sand filled buckets, portable extinguishers, etc, depending upon the nature and quantity of the combustible materials exposed to fire hazards.

2.3.8.1 Special provisions shall be made to deal with any outbreak of fire as follows:

- a) Cutting and welding operators, and every other person concerned, shall be instructed to watch for and be ready immediately to extinguish any fire that may occur and know how to transmit a call to the nearest fire station;
- b) Ample supply of dry sand in suitable containers shall be provided;
- c) Suitable extinguishers conforming to IS : 1648-1961* shall be available for immediate use;
- d) Hoses connected to an effective water supply, or where such supply is not available an ample supply of water in suitable containers shall be available; and
- e) All persons concerned should be instructed and trained where necessary in using efficiently all the equipment and devices listed in **2.3.8.1(a)** to **2.3.8.1(d)**.

NOTE — Appropriate fire authorities should be consulted to ensure that the type of extinguisher provided is suitable for the kind of fire which may be anticipated in any particular location.

2.4 General Precautions During Welding and Cutting

2.4.1 Detection of Fire — With the exception of explosions most fires start as small ones. At the beginning extinction of small fires seldom presents much of a problem, but once a fire begins to gain headway it may develop into a conflagration of disastrous proportions. Therefore, prompt detection of fire during welding and cutting is of prime importance.

2.4.2 Signalling of Fire Alarm — The first impulse of many individuals on discovering a fire is only to try to extinguish it. This has frequently led to long delays in sending the alarm.

2.4.3 The welding and cutting operators and their helpers shall be instructed and practically trained to sound the alarm as soon as the fire is discovered, and to handle fire extinguishers of different types.

2.4.4 Somebody, other than the welding or cutting operator, shall always be put on the watch for sparks or hot metals which may cause small fires beyond the protective guards and give immediate alarm if small fires break up.

*Code of practice for fire safety of buildings (general) : Fire fighting equipment and its maintenance.

2.4.5 Oxygen gas from gas cylinder should not be used as cooling agent or vented out near any naked flame.

2.4.6 In operating oxyfuel gas cutting apparatus, the oxygen pressure shall be set appropriately. An oxygen pressure greater than necessary increases the amount of sparks and slag flow over and above the cost.

2.4.7 The detection of fire, signalling promptly an alarm and acting immediately to try to extinguish the fire require training to the workers and their assistants to act effectively under such circumstances. Where the welders and their assistants are not trained in handling small fires, they should have means to call the attention of other people trained in fire fighting.

2.4.8 *Backfire and Flashback*

2.4.8.1 Backfire is caused by the return of the flame into the blow-pipe, the flame being either extinguished or reignited at the nozzle.

2.4.8.2 Flashback is much more severe and potentially more hazardous. In this, flame returns through the blowpipe into the hose and even regulators. It may also reach the fuel gas cylinder, causing heating and decomposition of the contents.

2.4.8.3 The main reason is the feeding of high pressure gas into the low pressure line forming a highly combustible gas mixture through which the flame can propagate at a very high speed. This can happen due to a number of reasons, for example nozzle becoming partially blocked, the control valves not being fully closed or leaking, incorrect pressure settings and overheating of the blowpipe.

2.4.8.4 The welding or cutting operator should check before commencement of work that there is adequate supply of gas, pressure settings are correct and there is no leakage in the equipment that is regulators and blowpipes and all the gas connections. Damaged or defective nozzles should not be used. When working on heavily scaled material, the surface should be cleaned prior to welding and/or cutting to prevent scales flying off and blocking the tip nozzle. The use of properly designed hose check valves can minimise the risk of flame travelling into the hoses.

2.4.8.5 Where gases are drawn from pipelines, flashback arrestors must be used at the outlets of acetylene pipelines.

2.4.8.6 In spite of precautions mentioned at 2.4.8.4 and 2.4.8.5 sometimes backfire or flashback occurs. The operator shall be alert and take the following actions promptly as necessary in the sequence given below:

- a) The oxygen control valve on the blowpipe shall be closed quickly followed by closing of the other control valve;

- b) In case of flashback travelling towards regulators, the pressure adjusting screw of the oxygen regulators shall be loosened quickly followed by loosening the pressure adjusting screw of the other regulator;
- c) The oxygen cylinder valve shall be closed quickly followed by closing the other cylinder valve;
- d) If there is a suspicion that the fire has reached the regulators, both the regulators shall be taken out;
- e) After backfire or flashback is over and if it is not severe enough to damage the equipment, the blowpipe should be cooled by immersing in a bucket of water with a trickle of oxygen flow through the nozzle; and
- f) It shall be ensured that flashback or backfire has been quenched properly before relighting the blowpipe.

2.5 General Precautions After Welding and Cutting

2.5.1 Watch Against Smouldering Fires — When cutting and welding operations are carried out in such locations where sparks, molten slag or hot metal pieces may start smouldering fires in slow burning inflammable material such as cotton waste soaked with lubricating oil or grease, wood chips, paper bags or rags, etc, it is necessary that a watchman be deputed at the scene of the work at least one hour after the job is through. The watchman shall look carefully for smoke or fire before leaving the site.

2.5.1.1 When a watchman is deputed, a 60 minute per hour watch on the spot where the job was done is needed and not just a casual tour of the plant. This is considered to be the most dependable method of precaution against smouldering fires, particularly in smaller workshops or other premises.

2.5.1.2 The more dangerous the surroundings is, the greater shall be the frequency and longer the period during which the surrounding should be checked for suspicious heat, smoke or glowing spots. According to the rules in force in some countries, the possibility of a smouldering fire shall be guarded against for at least eight hours at the scene of the work.

2.5.2 Fire Detection Device — When it is desirable to instal in big plants, storehouses, etc, a fire detection device which automatically actuates the alarm, one of the following two most familiar types may be selected:

- a) The fixed temperature type, designed to operate when the temperature in the vicinity of the alarm reach a predetermined level. Such an alarm can be set to operate when the temperature reach 135°C, 150°C or 200°C; and

- b) The rate of rise type, designed to operate when there is a rapid rise of temperature.

2.5.2.1 The decision as to which type to use for a certain location should be taken only by competent authorities after careful analysis of needs. Each of these systems has its own advantages for particular installations.

2.5.2.2 When an automatic alarm system is installed, certain general requirements must be met:

- a) A reliable signal must be transmitted;
- b) The signal must reach all personnel, including those trained for fire protection, no matter where they are located;
- c) The signal must be of such a nature that it will be instantly recognised; and
- d) The signal must be used for no other purpose than to sound the alarm for fire.

3. SPECIAL PRECAUTIONS

3.1 Special precautions shall be taken in conducting any cutting and welding operations:

- a) In hazardous locations;
- b) In close proximity to hazardous locations; and
- c) Near hazardous locations for prolonged period, and any new locations.

3.1.1 As specified in 2.1 and 2.2.2 hot work permit should be obtained before conducting any hot work in hazardous locations.

3.1.2 In the hot work permit, the special precautions required to be taken before, during and after the cutting and welding work shall be indicated clearly.

3.1.3 The persons entrusted in doing the hot work at the particular location shall ensure implementation of the special precautionary measures indicated in the permit with meticulous care and sincerity.

3.2 Welding and cutting operations using naked flames of any kind or red hot glowing objects of any kind, such as sparks, hot molten metal globules, etc, should not be carried out for purpose of repair, additions or alterations of any kind, in the hazardous locations, if the proposed work can be carried out by suitable alternative methods.

3.2.1 If the work pieces have to be welded or cut in the hazardous locations, endeavour should be made, either, to:

- a) remove the movable work pieces to a designated safe location where there will be no possibility of any fire hazards, or
- b) remove all the movable hazardous materials in the vicinity of the work pieces to safe location for a temporary period where there will be no possibility of fire hazards.

3.2.2 The safe distance between flammable material and the working place should be as decided by the Competent Authority having regard to the flammability of such materials, approach of the source of ignition and the confinement of the space. It is recommended that the safe distance should, generally, be not less than 15 metres.

3.2.3 If the work piece to be welded or cut cannot be moved and if all the fire hazards cannot be removed, then guards must be used to confine the flame, heat, sparks and slag, and to protect the immovable material adequately ensuring safety from explosion and fire hazards (*see* also 2.3).

3.2.4 In conducting welding and cutting operations in close proximity to hazardous locations, it should be considered unsafe, unless there is absolutely no chance of the source of ignition getting into the hazardous location, or flammable vapour or gas, liquid or dust coming in contact with the source of ignition from the adjacent hazardous location. Adequate protective measures should be taken using effective guards to ensure safety, under such situations.

3.2.5 Before starting welding or cutting in any new locations, it is always necessary to collect information from the nearest Shop Superintendents or Foremen, on the flammable, combustible or explosive materials that might be existing and might lead to a fire or explosion in the presence of a source of ignition.

3.2.5.1 Only after satisfactory investigation carried out by a Competent Authority, hot work permit should be endorsed with or without conditions for the special precautions that should be observed to ensure safety from fire hazards.

3.2.6 Special situations having potential fire hazards should be considered in detail and special precautions that should be taken to ensure safety, should be worked out. Prescribed special precautions for special situations should be informed to all concerned and if deemed fit, exhibited on notice boards. The persons concerned should strictly follow the prescribed special precautions and periodic checks should be carried out by the Competent Authority.

3.3 Recommended Precautions for Special Situations

3.3.1 Location Having Combustible Material or Dust — Welding and cutting operations shall not be carried out in or near hazardous location having combustible material or dust, for example any ventilation or other duct system. Welding and cutting operations may be carried out only after any accumulated combustible material or dust has been completely removed from the place. Where practicable, a section of the duct in which such work is to be done should be isolated from the remainder of the system, the fans should be shut down so that they cannot be started again till the work is complete and declared safe to start the fan.

3.3.1.1 Where it is impracticable to clear up the combustible dust from the location as in case of a dusty room or tunnel, any inert dust, such as limestone, gypsum, etc, may be used for general dusting around the operational area before commencement of the operation. It is necessary to ensure that more than 80 percent of the inert dust is in suspension depending on the nature of the combustible dust, to assure reasonable safety from the explosion hazards.

3.3.2 Drums, Barrels, etc — Cutting or welding shall not be done on any drum, barrel, tank, or other container until it has been cleaned so thoroughly as to make absolutely certain that no flammable materials or substances such as acids which, under the action of heat, may produce flammable gases or vapours are present in them.

3.3.2.1 Where steam is available this may be used to remove materials which are easily volatile. Washing with strong soda solution will remove heavier oils. After thorough cleaning, the container should, wherever possible, be filled with water before any cutting or welding operation is performed.

3.3.2.2 In practically every case it will be found possible to place the container in such a position that it may be filled with water to within a few centimetres of the point where cutting or welding is to be done. In doing this, however, care shall be taken to make sure that there is a vent or opening to provide for the release of heated air from inside the container.

3.3.2.3 Where it is not practicable to fill the container with water, a protective gas such as carbon dioxide or nitrogen can be used, feeding in a continuous stream at low pressure, at the commencement of the work. Care should be taken in using carbon dioxide. If carbon dioxide flows with great speed from the container into the space to be washed, there is a possibility of it being loaded with static electricity and sparks may easily be given off. The carbon dioxide should, therefore, be gradually introduced so that no dimness or frost is observed at the outlet of the gas container. Further, the protective gas (carbon dioxide or nitrogen) should

not be introduced into the tanks or the vessel at the commencement of the work but there should be a constant stream of the gas introduced during the work so as to prevent inlet of unsuspected dangerous gases from outside and to rinse out any possible dangerous mixture that might be formed on the inside of the tank. The use of carbon tetrachloride for this purpose is not recommended, as it gives off poisonous vapour when heated. If possible, periodic examination of the air contents of the vessel should be made wherever possible by means of a detector of combustible gases, where such an instrument is available.

3.3.2.4 While purging a container with carbon dioxide or steam, care should be taken to purge for sufficient length of time to ensure complete removal of volatile liquid or vapour. Purging gas should not be used at high velocity which may generate static electricity and cause concern for fire hazards.

3.3.3 Any plant, drum, barrel, tank or other container on which welding or cutting has been carried out should be allowed to cool down sufficiently to obviate the risk of ignition or explosion when the flammable material is let inside the container.

3.3.4 Cutting During Rescue Operations — Before resorting to cutting during rescue operations, a check shall be made to determine whether explosive or flammable liquids, gases, or vapours are present, and no cutting shall be done until these are absorbed or expelled.

3.3.5 Cutting or Welding in Confined Spaces — When cutting or welding is being carried out in any confined space, suitable precautions shall be taken to prevent the ignition of any timber or other flammable material that may be present. Furthermore, sufficient ventilation shall be provided. No oxygen shall be blown in. The escape path shall be kept at safe location with means of easy reach, such as, ladder.

3.3.6 Gas Mains and Apparatus — No cutting shall be carried out on any gas main pipe or apparatus unless such main, pipe, or apparatus is totally isolated from live gas plant and completely purged of gas and relieved of pressure.

3.3.7 Coal Bunkers — Where practicable, no cutting or welding shall be carried out in or near coal bunkers or other fuel storages, without the removal of the fuel; however, where this is not practicable, special precautions shall be taken to prevent ignition of the fuel itself or any gases given off by the fuel.

3.3.8 Sprinkler Installations — Sprinkler installations if provided shall be checked before commencing any welding or cutting operations to ensure that it is in working order and shall be maintained in good working condition even during extensive repairs or alterations of the building while

cutting and welding operations are in progress and at least half an hour after such operation ceases. If the sprinkler system must be shut down for certain period of time, this shall be done when welding and cutting operations are not in progress.

3.3.8.1 Where cutting or welding operations are to be carried out on a sprinkler installation itself, such work shall be done by an approved sprinkler contractor. All fire-prevention precautions required by these clauses shall be taken, and in addition, in hazardous locations, an officer of the fire station shall, where possible, be in attendance. Where possible the water shall be cut off only from that portion of the installation which is actually under repair. Further, alternate water supply arrangement shall be provided for the period of the water supply system is out of commission.

3.3.9 *Stores and Depots of Inflammable Liquids and Gases*

3.3.9.1 When no other suitable means of carrying out the required repair, addition or alteration is available, cutting and welding may be carried out in the installations for storage of inflammable liquids and gases.

3.3.9.2 After all necessary investigations and tests, the Site-Incharge or Superintendent of the installation or Officer Incharge of fire precautions shall issue the permit for carrying out the required work at scheduled time. The permit shall be renewed daily when required.

3.3.9.3 Officer Incharge of fire precautions shall ensure that the portion in the circuit of the liquid or gas circulation, for example, the storage tank, pipelines, valves, pumps, etc, where welding and cutting work shall be carried out, is blanked or isolated and purged with steam or inert gas or washed thoroughly so as to make absolutely certain that no inflammable liquid gas is present in an amount which can catch fire under the action of heat, spark, flame, welding spatter or red hot objects. A combustible gas indicator shall be used to determine the concentration of combustible gas in the air, and if this concentration is greater than 0.2 percent, the hot work permit shall not be signed by the Officer Incharge of fire precautions until the concentration is obtained below that limit.

3.3.9.4 Before cutting and welding on any part of the supporting structure for inflammable liquid or gas storage vessels precautionary measures similar to 3.3.9.3 shall be observed. Where necessary, the storage vessels, pipeline, etc, shall be propped up adequately to support the load while the supporting structure is cut or welded for required modification or repair.

3.3.10 *On Wharfs and Ships*

3.3.10.1 *Master responsible for precautions* — Wherever a ship may be, the Master shall be responsible for taking adequate precautions against

explosion or fire during and after all cutting and welding operations, and no such operation shall be carried out except with the permission of the Master or Officer-Incharge.

3.3.10.2 Provision of fire-fighting facilities — During cutting and welding operations ships at wharfs or in docks shall have their hydrant and hose system in good working order and connected to a water supply which shall be adequate and frequently tested. If the ship's pumps cannot be used, arrangements shall be made to obtain supply from shore, preferably by connecting the ship's hydrant and hose system to an effective shore supply. Pumps shall not be put out of action until the shore supply is assured. Supply from shore shall be tested frequently to make certain that the supply is immediate and of sufficient pressure to enable distribution all over the ship. In addition, fire extinguishers and buckets of water or sand shall be laid out ready in the vicinity.

NOTE — Spaces under, over, or adjacent to the cutting and welding operations shall be treated as being 'in the vicinity'.

3.3.10.3 Provision of guards — When cutting or welding where sparks might lodge in wooden parts or drop through pipes or openings to the space below, sheet metal guards, asbestos or fireproof millboard curtains or similar non-combustible devices shall be used to keep sparks close to the work being done. The guards shall be large enough and sufficiently tight not to permit sparks to roll underneath flammable material or slide through openings. Curtains shall be weighted to the deck floor, or ground, so that sparks do not possibly get underneath.

3.3.10.4 Cutting or welding shall be performed only after consultation between the Master of the vessel and the responsible Official Incharge of the arrangements for securing the goods. The greatest consideration shall be given to the commodity immediately beneath the deck, and the work proceeded with when it has been ascertained that there is no risk involved. Welding cleats and ring bolts to secure heavy goods on weather decks shall be carried out before the ship is loaded. Cutting cleats and ring bolts on weather decks shall be carried out after the 'tween deck cargo has been discharged.

3.3.10.5 Cutting or welding in tanks, etc — When cutting and welding operations are being done in a ship's tank or similar locations, an assistant should be stationed at the manhole entrance to the tank to cut off the gas supply to cutting and welding equipment quickly on hearing the slightest backfire explosion. Provision should be made for adequate ventilations of such confined locations. Lifting tackles should be kept ready at hand in case the operator needs to be rescued from inside the confined space against dangerous accumulations of harmful gases or fumes formed during hot work operations.

In case of an oil tank on board, containing flammable oil, welding and cutting operations shall not be carried out unless the oil tank, and any compartment or space adjacent to the oil tank have been made free of flammable gases by draining out or removing the contents and by thoroughly washing with hot water or by steaming to remove all traces of flammable liquid. Proper tests should be carried out to check the absence of flammable vapours in explosive concentrations, before commencement of any hot work.

3.3.10.6 Cutting or welding on decks or bulkheads — When cutting through or at edges, suitable receptacles containing a layer of sand should be provided in such a manner as to collect all the molten slag, sparks and hot metal particles generated during the hot work operations. In the vicinity of wooden decks, damp sand may be employed as a fire arrester and to protect the deck.

3.3.10.7 Cutting or welding in engine rooms — When cutting or welding in an engine room, particular care shall be taken to see that the space where the work is carried out is clear of oily waste, and the Officer-In-charge shall make an inspection after the workmen leave, and satisfy himself that there is no fire hazard.

3.3.10.8 Cutting or welding near magazines — Cutting or welding shall not be carried out in close proximity to a magazine, or any other compartment containing explosives. There shall be at least the space of a compartment, or two bulkheads, between the operations and the explosives. This shall refer also to decks above and below a magazine. If necessary, the explosives shall be removed to another compartment in a safe place and carefully guarded.

3.3.10.9 Watch to be kept — Where cutting or welding operations are being done on or about a ship a watch shall be maintained in the vicinity, irrespective of any precaution undertaken by those responsible for such operations. After cutting or welding in the work vicinity of flammable cargo or ship's fittings, when finishing work or knocking off for the day, the ship's watchman shall be instructed to keep a strict watch during the night in the vicinity where the work was carried out. The watchman should report immediately in case any smoulding fire is detected in the vicinity of the area where hot work operations were carried out earlier.

3.3.10.10 Mineral oil on water surfaces — Special care shall be taken to prevent sparks, slag, or hot metal particles coming into contact with mineral oil on water surfaces, particularly in the vicinity of wharfs and ships.

NOTE — Cases are on record where thin layers of oil discharged from ships or accidentally from tankers or waterside oil tanks have been ignited during cutting operations, even under severe winter conditions with ice on the surface of the water.

APPENDIX A (Clause 2.2.2.1)

WORK PERMIT

HOT WORK AND SAFETY PERMIT

Special Instructions	Permit valid from	AM	
Inside refinery		PM	Date
1. No smoking			
2. Safety hat must be worn	To	AM	
3. In case of liquid/gas release. Stop work and immediately advise process supervisor concerned		PM	Date
4. In case of fire alarm. All welding machines/mobile equipment must be stopped. Gas cylinders closed, everybody leaves the work site. Contractor personnel to go to designated safe areas.			

PERMISSION IS HEREBY GRANTED TO.....

NATURE OF WORK.....

EXACT LOCATION OF JOB.....

THE FOLLOWING ITEMS MUST BE CHECKED BEFORE ISSUING PERMIT

<i>Item</i>	<i>Done</i>	<i>Not Required</i>
1. Personally inspected equipment/work area		
2. Surrounding area, hot lines checked and covered		
3. Equipment properly drained and wedged open		
4. Equipment properly steamed and gas freed		
5. Equipment water flushed		
6. Proper ventilation and lighting provided		
7. Gas test made and found gas free/gassy		

Item	Done	Not Required
8. Following precautions taken against release of oil or gas in the area		
<i>Equipment Blinded/Disconnected/Isolated</i>		
9. Sewer openings covered		
10. Control for welding sparks provided		
a) Outside the equipment		
b) Inside the equipment		
11. Following standby fire equipment provided:		
Fire/Water Hose/Extinguisher		
12. Following personal protective equipment provided:		
Safety Hat/Gloves/Goggles/Safety Shoes/		
Boiler Suit/Dust Respirator/Face Shield/		
Air Mask/Apron		
13. Proper means of exit available		
14. Equipment properly tagged		
15. Portable equipment/Hose Nozzles properly grounded		
16. Checked for trapped oil/gas behind lining in equipment		
17. Life line provided		
18. Process/Mechanical/Contractor standby provided		
19. Area cleaned up; oil, rags removed		
20. Iron sulfide removed or kept wet		

GAS TEST RESULTS

HYDROCARBON GASES	Percent of Lower Explosive Limit	
CARBON MONOXIDE	Percent	
GAS TEST MADE BY	OXYGEN DEFICIENCY	Yes/No
	HYDROGEN SULPHIDE	%

(Continued from page 2)

Subcommittee for Safety Health and Hygiene Aspects of Welding, SMDC 14 : 5

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