HINDUSTAN ZINC
Zinc & Silver of India

Sustainability Framework

SAFETY STANDARD

HZL Standard - Hot Work

Hindustan Zinc Limited

Document Control Details

	Issued by	Approved by
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Sign		
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1.0 Purpose

The purpose of this standard is to provide principles & methodology for safe work that has the potential to generate a source of ignition and having potential for injuries & property damage. It provides basic frameworks to ensure safety in all kinds of hot jobs.

2.0 Scope

The standard is applicable across the HZL sites including Operations & Projects, Marketing, Stores, Colonies, Gas godowns etc.

3.0 References

- HSE Policy
- HSE Principles
    - Related Corporate Safety Standards & Vedanta guidance notes: Lock Out and Tag Out; Working at Height; Permit to Work; Hot Work; PPEs; GESM, Confined Space, Chemical Handling, Vedanta guidance note on risk assessment and others as applicable.
- IS: 5572:1994 for Classification of Hazardous area having flammable gases and vapors for Electrical Installation.
- IS Codes on Gas cutting, welding.

4.0 Management Responsibilities

Line management across HZL has the responsibility to implement this standard whenever applicable.

5.0 Definitions

Electrical arc welding:

The arc is generated between an electrode and the work piece. The temperature attained by welding arc is approximately 4000 degrees centigrade. At this temperature the work pieces are melted and fused together .

Flammable area/ Critical flammable area:

Any area that is restricted or flammable and where a potential source of combustible materials is always present.
Some examples of Critical Flammable areas: Diesel Storage & Handling area, MIBC Storage area, Gas storage area, Hydrogen evolution area
Some examples of Flammable areas:- coal hopper, coal storage area etc.

Flammable liquids (Flash point < 90deg C) :

Means any liquid hydrocarbon or mixture of hydrocarbons and any inflammable mixture (liquid, viscous or solid) containing any liquid hydrocarbons and defined in material safety data sheet in reference to use of such materials in plant.

a. Extremely Flammable : FP </=23deg C and BP <35deg C;
b. Very Highly Flammable : FP </=23deg C and BP >35deg C;
c. Highly Flammable : FP >23 to < 60 deg C
d. Flammable: >60 deg C to < 90 deg C.

Flammable solids:

Any Solid substances that are easily ignited, readily combustible, ignite spontaneously and Solid substances that emit a flammable gas when wet or react violently with water.
Note:- Unit must refer material safety data sheet (MSDS) of all chemicals or substances being used in plant for more clarity about the property of chemical or substances

Fire Watcher

Dedicated person or persons whose sole responsibility is to look for sparks/ fires within an identified critical area.

Gas Cutting:

When acetylene gas is burned with oxygen a high temperature flame, of about 3500^0C can be produced and this heat is used for cutting metal by melting along the cutting line.

General area:

An area that is not a Restricted or Flammable Area but where a potential source of combustible materials can be present. Stores and other non-process buildings can be considered General Areas

Hot work

Is any process that can be a source of ignition when flammable material is present or can be a fire hazard regardless of the presence of flammable material in the work place. Example: Welding, Burning, Brazing, Soldering, Drilling (To be checked), Chipping, Sawing, Cutting, Grinding etc.

Hot Work Permit:

The written/printed document that is signed by the supervisor to allow Hot Work

Ignition/Spark:

An incandescent particle, especially or thrown off from a burning substance or remaining in an otherwise extinguished fire.

Lower Explosive Limit (LEL)

This is the minimum concentration of a flammable gas or vapor that will propagate flame when exposed to a source of ignition. Commonly abbreviated LEL or LFL, a Mixture below this concentration level is considered too "lean" to burn. E.g. The LEL for natural gas is 5% gas to 95% air. The LEL for LPG is 2.5% gas to 97.5% air.

MSDS: Material Safety Data Sheet indicating characteristics of chemical, emergency handling & antidote.

Upper Explosive Limit (UEL)

This is the maximum concentration of flammable gas or vapor in air that will combust. Any higher percentage of combustible gas or lower amount of oxygen in the mixture of the two, and the mixture will be too "rich" to sustain combustion. E.g. The UEL of natural gas is 14% gas to 86% air. The UEL for LPG is 9.5% gas to 90.5% air.

Welding

Welding is defined as the fusion of two pieces of metal by heat or by fusion or by both.

Zone 0

A place in which an explosive atmosphere, consisting of a mixture with air of flammable substance in any form of gas, vapor or mist, is present continuously for long period or frequently.
Examples are vapor space above closed process vessels, storage tanks or closed containers, areas containing open tanks of volatile, flammable liquid etc.

Zone 1

A place in which an explosive atmosphere, consisting of a mixture with air of flammable substance in any form of gas, vapor or mist, can get formed occasionally in normal operation.

Here, Flammable gas or vapor concentration is likely to exist in the air under normal operating conditions.

Zone 2

A place in which an explosive atmosphere consisting of a mixture with air of flammable substance in any form of gas, vapor or mist is not likely to occur in normal operation, but get formed due to any abnormal circumstance like leakage, breakdown, failure to contain during maintenance

6.0 Requirements

6.1 General Requirements:

- Site will carry out a survey to identify critical flammable area and general area based on storage handling, loading, unloading of flammable material (solid, liquid, gas) in the format

enclosed as an Appendix B . A typical example of such critical flammable areas are Diesel storage, tank/ loading-unloading area, gas cylinder storage area, godown containing flammable material, a place containing alternate fuel (waste) material, coal handling circuit etc.

- Irrespective of the area, whenever the hot job is planned, a process for Hazard Identification and Risks Assessment (HIRA) must be carried out in line with HZL safety standard and necessary elimination / reduction / control measures should be identified, documented and necessary responsibility and accountability should be assigned to individuals and mentioned in the SWP /JSA/PTW form.
- Hot work will be permitted with issue of General Work Permit Form, Refer Permit to work procedure and satisfying the criteria as indicated in hot work checklist.
- Hot work in the critical flammable area shall be carried out only after getting special authorization from Unit Head for any job related to Operations & Project Head for any jobs related to Project.(In case of his location absence , he should nominate second in line to authorize the same) in form no: APPENDIX A and complying with conditions mentioned besides obtaining General work permit system.
- Safety precautions - Gas cutting and welding, Gas cylinder handling and use of required personal protective equipment (PPEs) are described in Appendix C.
- List of critical area should be displayed at plant entrance.
- In addition to HIRA, implement dynamic risk assessments during hot work to account for changing conditions
- Include escape route mapping in PTW documentation in critical flammable area.
- Specific requirement for other critical job involving hot material handling and related equipment.

6.2

- The requirements for Hot Work may vary depending upon the type of Hot Work being performed and the location where the work is to be done. Detail requirement of hot work will be governed in line with following matrix:

Sr. No	Requirements	Critical / Flammable Area	General Area
1	Required training, knowledge and skills	Y	Y
2	Permit to Work	Y	Y
3	Special authorization (APPENDIX A)	Y	N
4	Atmospheric Monitoring	Y	N

5	Barricade the Area	Y	Y
6	Fire Watcher	Y	N
7	Guard against Ignition	Y	N
8	Fire Extinguisher	Y	Y
9	Tool Inspection	Y	Y

6.3 Required training, knowledge/ skill for personnel involved in hot job:

- Site shall maintain a record of people (employee or Contractor employee) authorized to carry out Hot Job, based on his competency, basic qualification or years of experience or both.
- Site will carry out a specific training program for these authorized people. They can also conduct skill development program on welding and gas cutting for contractor supervisors who in turn after training can be enrolled as authorized person.
- BP Contractor ensure every 2-year Refresher Training should be provided by Third Party certification and submit the records to HZL.

6.4 Tools and inspection

All tools and/or equipment used as part of the Hot Work job shall be inspected prior to use to ensure that they are in good working order. All these tools, equipment & accessories should be ISI / equivalent certified / meeting minimum standard requirements of HZL. This includes, but is not limited to:

a) hoses and clamp
b) Cutting set- torches fitted with flash back arrestors at both end
c) Regulators, cylinders, extension cords
d) Grinder – fully insulated & grinding wheels-in line with manufacturer's criteria (with respect to valid period, suitable for job, within specific diameter of grinding material
e) Handles and heads of hammers and hammer-struck tools, etc.
f) Welding machine, pug cutting machine, plasma arc cutting machine, TIG welding, MIG welding, Gas manifolds/gas bank, welding leads, holders etc.

- When flammable materials are introduced as part of the hot work job, pay particular attention to checking connections and hoses for leaks. (For example, acetylene cylinders for welding and cutting.)

6.5 Inspection System

As a guide to establish a formal inspection system, following information needs to be considered to achieve compliance to this requirement

Identify each type of hot work equipment which needs to be inspected e.g.

i. Welding machine (electric)
ii. Mobile diesel welding generating sets
iii. Oxy & acetylene sets
iv. Portable hand tools (As per Electrical safety standard& Procedures) Gas testing equipment
v. Determine who is capable of conducting the inspection
vi. Establish a specific inspection checklist for each type of equipment which will be inspected in line with guideline given in Appendix C.
vii. Detail the method for recording inspection findings
viii. Determine the frequency for performing inspections both formal and informal, it is recommended to do it quarterly.
ix. Pre use/ operation inspection, Formal periodic Inspection (monthly, 3 monthly, after service or repair)

6.6 Prohibited activities

In case of hot work is to be carried out in a prohibited area (areas with a smoke detection system, self-actuated sprinkler / protection system etc. prior notification to be obtained from affected person in case of disablement of detection, protection equipment.

All affected employees need to be formally notified about disabling of critical safety equipment, in line with requirement under Permit to Work Procedure for Critical Safety Equipment Disablement Notification). Signed copy by owner of affected area should be attached with Safe Work Procedure (SWP) document.

6.7 A specific requirement for hot job in critical flammable area

i. Hot work shall not be done in Flammable Area if there are other practical means to do the job or the equipment can be moved to shop or general Area.

ii. In case of not meeting above requirement, besides HIRA & JSA, a special authorization (as outlined in Appendix A to carry out hot job should be obtaining from Unit Head/Project Head.

iii. While requesting for the authorization, permit requester should assign a fire watcher to overview the adequacy of safety system and also to ensure compliance to work permit conditions. Skill requirements, roles and responsibilities are outlined in Appendix F

iv. Before carrying out the hot job, atmospheric monitoring should be carried out to assess presence of oxygen and other flammable gases, as applicable. In case of presence of these gases at concentration equal to or > 10% of LEL is recorded, no hot job should

be started or continue till adequate ventilation is carried out to bring LEL < 10%. Detail requirement is outlined in Appendix E

v. Supervisor of HZL or Contractor personnel doing hot work must

vi. Ensure that personnel are aware about proper techniques and methods for preparing and conducting the Hot Works.

vii. Approved and authorized risk assessment and JSA are developed and implemented.

viii. Provide updated training whenever tools, equipment, methods, techniques, hazards or safeguards are changed.

6.8 Preparing the hot work

- In order to ensure safety from released spatters sparks, hot material etc. following preparatory work must be carried out before starting the hot job.
- Relocate any flammable or combustible materials wherever practical, outside the
- Flammable Area or away from the Hot Work (safe distance 5 meter minimum) Clear the Affected Area of all persons not directly involved in the work.
- Barricades are required if persons not involved in the Hot Work could potentially enter the hot work Area.
- Reduce the travel of sparks and hot parts by the use of physical barriers like fire blanket/ fabric / ceramic clothing / GI Sheet.
- Protect trenches and sewers located within the Hot Work Area in conjunction with the isolation of energy sources. Also consider the areas below the area where Hot Work is being done
- All adjacent floor openings should be tightly covered with a non-combustible material (GI/ MS sheets/ ceramic clothing) in order to arrest spatters. Ensure availability of fire extinguishing equipment

6.9 Preparing the Equipment for Hot Work

If...	Then one must ...
The equipment	Clear all flammable or combustible materials from the equipment. Be sure to clear flammable materials that may be trapped behind liners or in dead legs.
has residual	Isolate the energy sources in line with LOTO standard requirements and Process Flow Diagram (PFD) and Piping & Instrument Diagrams (P&IDs)

materials, For eg : any pipeline containing flammable products, LPG,	1.	Disconnect piping to provide an air gap such that no material can enter the area or equipment where the Hot Work is being performed.
	2.	Install blinds. When used, they shall be identifiable and distinguishable and shall be appropriate for the chemical, temperature and pressure of the service
	3.	Use a double block, bleed & Purge. Confirm that the isolating devices are isolating the energy sources and are secure from inadvertent operation. (For example, verify that the block valves are isolating the energy sources by opening and unplugging the bleed.)
	4.	When the above 3 methods are not possible, then the use of other isolation methods with a documented hazard analysis and approval from Unit Head / Project Head shall be taken.
Clearing of residual contents is not feasible	U se plugs/stopples and purge gases to ensure that:	
	1.	The Lower Explosion Limit (LEL) at the point of hot work is at 0% and
	2.	The LEL at the point of exit of the purge gas is less than 10%.
Inert purging is used to clear contents	Document the following in the Safe Work Permit or the Hot Work Operating Pr ocedure.	
	1.	The purge gas to be used.
	2.	A description of how the purging will be done.
	3.	Considerations for ventilation and personnel protection in a potentially oxygen deficient atmosphere.

6.10 Emergency response

If the equipment cannot be moved, take the following precautions:
Site will ensure availability of response plan for fire emergencies as per following requirement.

- Providing firefighting training to fire watcher and personnel with high-risk exposure to fire
- Availability of evacuation/ rescue plan and medical help to manage multiple injuries
- Conducting mock drills of fire emergencies
- Identifying various fire extinguishing measures and providing training on its requirements for emergency responders

- Having emergency equipment, including fire tender/fire hydrant, communications equipment, available and accessible
- Establishing procedures for securing the scene of a fire incident

6.11 Audit and self-assessment

First party audit shall be carried out by a site audit team, as per schedules defined by SRP & audit subcommittee. The audit shall be focused on the following aspects Knowledge about the Unit & Plant/Section level procedure

- Compliance to the Standard & Unit level procedure
- Implementation of the procedure, especially procedure under exclusion.
- Compliance of Authority
- Documentation & record

Record of Deficiencies shall be submitted to the respective Unit Head/Project Head after reporting to SBU Head /HOD for taking steps to correct them. Records of such corrective actions (including revision of procedure, training etc.) shall also be maintained by the plant/section.

7.0 RACI

	Line Management	SBU Head / HOD	Unit Site Apex	Unit Safety /Corporate Safety
Identifying Hot Work	R	A	C/I	C
Preparing Safe Work Procedure	R	A	C/I	C
Preparation of Hot job	R	A	I	C
Atmospheric Monitoring in confined Space	R	A	I	C
Inspect tools and Tackles	R	A	I	C
Obtaining a permit for Hot job	R	A	I	I
Audit for compliance	I	C	A	R

- Overall accountability for safe execution of hot work in critical flammable areas lies with Unit Head / Project Head

- Responsible People who are expected to actively participate in the activity and contribute to the best of their abilities.
- Accountable the person who is ultimately responsible for the results.
- Consulted People who have a particular expertise and can contribute to specific decisions.
- Informed People who are affected by the activity/decision and therefore need to be kept informed, but do not participate in the effort.

8.0 Key Performance Indicator

1. Number of identified areas as per area classification (Appendix B)
2. Number of Special authorization issued for hot job in critical areas (Appendix A)
3. Number of trained personnel on Hot work standard (Employee / Contractor)
4. Number of Fire watchers
5. Compliance to Self-assessment audit check list
6. Compliance to Tools and inspection checklist

9.0 Management system

1. Management Records: - Site can prepare a procedure in line with this standard and maintain the document in line with site document control system. Following records will be generated as part of implementing requirement of this standard and should be
   retained as per the site document control system.
   - List of identified and numbered designated places
   - Training records of authorized person to carry out Hot Job, skill development program for contractor supervisors and fire watchers
   - Records of annual verification of compliance
   -

10. Standard renewal process

This standard shall be reviewed and revised as necessary, at a minimum not later than two years from the date of the last revision.

2. **Audit Requirements:** - Each site shall audit compliance with this standard as part of its First Party Safety audit program.
3. **Standard Renewal Process: -** This standard shall be reviewed and revised as necessary and, at a minimum, not later than two years from the date of the last revision
4. **Deviation Process:-**Deviations from this standard must be authorized by the Corporate Safety Head after consultation with the CSC. Deviations must be documented, and documentation must indicate causes of deviation with safety plan. Deviation authorization must be renewed periodically and no less frequently than every one year

Appendix - A

SPECIAL AUTHORIZATION FOR HOT JOB IN CRITICAL AREAS

Job to be done			**Authorization No…….**
General Permit to Work No. :			
Section of plant or site:	_____	Equip. name/number:	_____
Description of job to be done _____ **Equipment to be used**: *(tick where required)*			
o Electric Arc Welder	o MIG/TIG welder	o Butane/ Propane	o Other
o Oxy Acetylene Torch	o Cutting/soldering	o Grinder, Drop saw	_____
Flammable Gas testing			
Is the presence of flammable gases or vapors possible?		Yes_____	No_____
If yes, mention flammable gas test result :			--- %LEL
Signature of person performing test:_____		Date:_____	Time:_____
Flammable gas test is required PERIODICALLY/CONTINUOUSLY while the work is in progress. (Every two hours)			
Fire			
Is Fire Watcher deputed?		Yes:_____	No:_____
Name of the Fire Watcher : _____			

The following fire protection equipment will be set up ready for use at a safe distance from the work:			
Fire hose ready to use:	_____	Fire extinguisher:	_____
Other fire protection system:			
Safety Precautions (tick where required)			
Assessment	Protective Equipment	Additional/ Attachments if any	
Risk Assessment o Complete	o Eye protection	o Confined space permit	
O Communication done	o Leathers (apron spats, gloves)	o Work at Height permit	
o Area cleaning / purging done	o Barricading & signage	o Isolation & lockout	
Ventilation (supplied O ventilation)	Other ----------o -----	o Excavation Permit /	
Rescue Plan		Others……..	

Authorization : I certify that ,

1.		The building, area or plant item is positively isolated from every dangerous source of gas, liquid, dust and motive power.
2.		The Fire watcher has been briefed on his or her duties.
3.		The building, area or plant item described above has been inspected by me and is, in my opinion, in a clean and safe condition for the above job to be performed, provided the conditions and precautions listed above are observed.

Signature of Custodian: _____ Signature of issuer:		
	Date:_____	Time:_____

Signature of authorized person:_____		

Recipient

I have read this authorization and have understood the hazards and precautions to be taken in carrying out hot job in the area. I undertake to comply with the conditions of authorization and to explain these conditions to the people working with me on the job.

Signature of Initiator / recipient:_____	Date:_____	Time:_____

Unit Head …… Date..…….. Time..……..

If the Hot work in the critical flammable area continuous beyond 06:00 pm than informed approval again to be taken from Unit Head / Project Head.

Note: 1. Before 2 hours prior to the job , permit to be issue.
2 Renewable of permit to be taken in continuous process of work

Closure :Appendix B

Survey for Area Classification

Form No:

Effective Date:

SECTION:

DATE:

DEPARTMENT:

NAME OF SBU/HOD :

S.NO	DESCRIPTION OF AREA	DETAILS OF FLAMABLE MATERIAL / STORED / HANDLED	FIRE DETECTION/ PROTECTION SYSTEM PROVIDED	SPECIFIC REQUIREMENTS (PROCEDURES POLICIES IN RELATION TO HOT WORK AT FACILITY)	AREA CLASSIFICATION (CRITICAL FLAMMABLE AREA/ GENERAL AREA)

Note: No work to be carried out in critical flammable area after 6pm.

Appendix - C

Safety precautions - Gas Cylinder handling, Welding and Cutting

A. Gas Cylinder Handling,

1. Placing cylinders

a. Compressed gas cylinders shall be secured in an upright position at all times except, if necessary, for short periods of time while cylinders are actually being hoisted.
b. When cylinders are hoisted, they shall be secured on a cradle, sling board, or pallet. They shall not be hoisted or transported by means of magnets or choker slings.
c. Cylinders should not be transported by rolling down. They shall not be intentionally dropped, struck, or permitted to strike each other violently.
d. When cylinders are transported by vehicles, they shall be secured in a vertical position.
e. Valve protection caps shall be in place and secured. The same should not be used for lifting cylinders from one vertical position to another
f. A suitable cylinder truck, chain, trolley or other steadying device shall be used to keep cylinders from being knocked over while in use. Such cylinders are not considered to be "in storage."
g. Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 6.0 m or by a noncombustible barrier at least 1.5 m high having a fire-resistance rating of at least one-half hour.
h. Cylinders shall be kept far enough away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them. When this is impractical, fire resistant shields (GI sheet, Metal Cap, Ceramic Clothing etc shall be provided.
i. Cylinders shall not be placed in a location where they would be subject to open flame, hot metal, or other sources of artificial heat.
j. Cylinders shall be placed where they cannot become part of an electrical circuit. Electrodes shall not be struck against a cylinder to strike an arc.
k. Cylinders containing oxygen or acetylene or other fuel gas shall not be taken into confined spaces.

2. `Treatment of cylinders

a. No person other than the gas supplier shall attempt to mix gases in a cylinder. No one except the
owner of the cylinder or person authorized by the owner shall refill a cylinder. No one shall use a cylinder's contents for purposes other than those intended by the supplier.

b. No damaged or defective cylinder shall be used- See valid date of cylinder on arm (of LPG) or on collar of compressed cylinder , generally there are two round about one indicates the month while other indicates the year.

3. Use of fuel gas.
   The employer shall thoroughly instruct employees in the safe use of fuel gas, as follows:
   a) Before a regulator to a cylinder valve is connected, the valve shall be opened slightly and closed immediately. (This action is generally termed "cracking" and is intended to clear the valve of dust or dirt that might otherwise enter the regulator.) The person cracking the valve shall stand to one side of the outlet, not in front of it. The valve of a fuel gas cylinder shall not be cracked where the gas would reach welding work, sparks, flame, or other possible sources of ignition.
   b) The cylinder valve shall always be opened slowly to prevent damage to the regulator. For quick closing, valves on fuel gas cylinders shall not be opened more than 11/2 turns. When a special wrench is required, it shall be left in position on the stem of the valve while the cylinder is in use so that the fuel gas flow can be shut off quickly in case of an emergency. In the case of manifold or coupled cylinders, at least one such wrench shall always be available for immediate use. Nothing shall be placed on top of a fuel gas cylinder, when in use, which may damage the safety device or interfere with the quick closing of the valve.
   c) Fuel gas shall not be used from cylinders through torches or other devices which are equipped with shutoff valves without reducing the pressure through a suitable regulator attached to the cylinder valve or manifold.
   d) Before a regulator is removed from a cylinder valve, the cylinder valve shall always be closed and the gas released from the regulator.
   e) If on opening a fuel gas cylinder, leak is detected around the valve stem, the valve shall be closed and gland nut to be tightened. If this action does not stop the leak, the use of the cylinder shall be discontinued, and it shall be properly tagged and removed from the work area. In the event that fuel gas should leak from the cylinder valve, rather than from the valve stem, and the gas cannot be shut off, the cylinder shall be properly tagged and removed from the work area. If a regulator attached to a cylinder valve effectively stops a leak through the valve seat, the cylinder need not be removed from the work area.
   f) If a leak should develop at a fuse plug or other safety device, the cylinder shall be removed from the work area.
   g) Cylinders not having fixed hand wheels shall have keys, handles, or nonadjustable wrenches on valve stems while in service. In multiple cylinder installations one and only one key or handle is required for each manifold.

4. Fuel gas and oxygen manifolds.

a) Fuel gas and oxygen manifolds shall bear the name of the substance they contain in letters at least 1-inch high which shall be either painted on the manifold or on a sign permanently attached to it.
b) Fuel gas and oxygen manifolds shall be placed in safe, well ventilated, and accessible locations. They shall not be located within enclosed spaces.
c) Manifold hose connections, including both ends of the supply hose that lead to the manifold, shall be such that the hose cannot be interchanged between fuel gas and oxygen manifolds and supply header connections. Adapters shall not be used to permit the interchange of hose. Hose connections shall be kept free of grease and oil.
d) When not in use, manifold and header hose connections shall be capped.
e) Nothing shall be placed on top of a manifold, when in use, which will damage the manifold or interfere with the quick closing of the valves.

5. Hose.

a) Fuel gas hose and oxygen hose shall be easily distinguishable from each other. The contrast should be made by different colors (LPG- Orange, A-Red, Oxygen – Blue). Oxygen and fuel gas hoses shall not be interchangeable. A single hose having more than one gas passage shall not be used.
b) When parallel sections of oxygen and fuel gas hose are taped together, not more than 4 inches out of 12 inches shall be covered by tape.
c) All hose in use, carrying acetylene, oxygen, natural or manufactured fuel gas, or any gas or substance which may ignite or enter into combustion, or be in any way harmful to employees, shall be inspected at the beginning of each working shift. Defective hose shall be removed from service.
d) Hose which has been subject to flashback, will not be used.
e) Hose couplings shall be of the type that cannot be unlocked or disconnected (Use Jubilee clamp) by means of a straight pull without rotary motion.
f) Boxes used for the storage of gas hose shall be ventilated.
g) Hoses, cables, and other equipment shall be kept clear of passageways, ladders and stairs.

6. Torches.

a) Clogged torch tip openings shall be cleaned with suitable cleaning wires, drills, or other devices designed for such purpose.
b) Torches in use shall be inspected at the beginning of each working shift for leaking

shutoff valves, hose couplings, and tip connections. Defective torches shall not be used.

c) Torches shall be lighted by friction lighters, and not by matches or from hot work.

d) Flash back arrester should be fitted in the torch.

Regulators and gauges. Oxygen and fuel gas pressure regulators, including their related gauges, shall be in proper working order while in use.

7. Oil and grease hazards.

Oxygen cylinders and fittings shall be kept away from oil or grease. Cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus shall be kept free from oil or greasy substances and shall not be handled with oily hands or gloves. Oxygen shall not be directed at oily surfaces, greasy clothes, or within a fuel oil or other storage tank or vessel to avoid flammability and explosion.

8. Operational Requirement:

People authorized for gas cutting jobs shall be trained for correct use of fuel and support gases covering important steps as follows;

I. Setting up the equipment : Adhere to following steps when setting up oxy-fuel equipment:		
Steps	Description of activity	Reason
1	When not in use, compressed fuel-gas cylinders must be secured in the upright position with cylinder valve protector caps in place.	Cylinder valves can easily be knocked off, rapidly releasing the fuel gas and discharging the cylinder
2	Before installing a regulator on an oxygen or fuel cylinder, inspect the regulator valves and the cylinder valves for oil or contaminants. Do not use dirty components. Check the cylinder valves for leaks around the valve packing glands. Also check the cylinder valve threads for damage.	Oil and grease in the presence of oxygen can cause an explosion. Dirt and foreign matter can prevent the regulator and the cutting equipment from working properly loose cylinder valves or fittings allow leaks.
3	Standing to one side of the valve nozzle, crack the cylinder valves.	This technique will blow any dirt out of the nozzle without injuring the operator.

4	Release the tension on the regulator by adjusting the screw counterclockwise. Attach the regulator to the cylinder. Do not over-tighten the regulator compression nuts at the cylinder valves.	This technique prevents damage to the regulator diaphragm and to the regulator valve seat. Also, this will not give the operator a "full system" of gases before he or she can check the hose and torch. Over-tightening pull the threads on both the regulator valves and cylinder valves, eventually causing leaks.
5	Open the oxygen cylinder valve slowly, standing on one side of the regulator and the gauge.	This technique limits the risk of explosions and injuries to the operator. These accidents typically occur in the front or the back of the regulator and the gauge.
6	Fully open the oxygen cylinder valve.	The oxygen valve tightly seals when it is fully open or fully closed, but may leak when it is in an intermediate position.
7	Open the fuel-gas cylinder valve. (Acetylene cylinder valves should not be opened more than 3/4 turn. Other cylinder valves may be opened fully.)	The fuel-gas cylinder valve (other than acetylene) tightly seals when it is fully open or fully closed, but it may leak when it is in an intermediate position.

8	Attach the hose to the regulator. If the hose is new or has been out of service, purge it for five seconds for every 50 feet (15 meters) of hose.	Purging removes contaminants from the hose, ensuring that it does not contain an explosive mixture of residual fuel gas and air.	
9	Check the seating surfaces and the O-rings of the torch. Assemble the torch.	This technique reduces the risk of leaks that could cause a fire.	
10	Check the orifice of the nozzle. If it is blocked, clean it only with a nozzle cleaning tool. Do not rub the cutting or heating tip on any soft material (such as wood) to clean the tip.	Cleaning the nozzle removes any obstructions, a prime cause of backfires.	

II Li ghting the Torch: Adhere to the following ste ps when lighting the torch:

Steps	Description of activity	Reason	
1	Open the fuel-gas valve on the torch. Then set the fuel-gas cylinder regulator to the Recommended pressure: not more than 30 mks (205 kPa) for fuel gas, and less than 15 mks (105 kPa) for acetylene. Close the torch fuel-gas supply valve, then the fuelgas cylinder valve. Watch the regulator pressure gauges. If the pressure drops, check for leaks in the assembly. If the pressure remains constant, reopen the fuel-gas cylinder valve slowly.	These techniques set the correct pressure, check for leakages and purge the line of any explosive gas mixture	
2	Open the oxygen valve on the torch. Then set the oxygen cylinder regulator to the recommended pressure per the tip manufacturer's tip chart, but not to exceed 80 mks (550 kPa). Close the torch oxygen supply valve, then the oxygen cylinder valve. Watch the regulator pressure gauges. If the pressure drops, check for leaks in the assembly. If the pressure remains constant, reopen the oxygen cylinder valve slowly.	These techniques set the correct pressure, check for leaks, and purge the lines of explosive gas mixtures	

3	Open only the torch fuel-gas valve to a high flow rate. Light the torch with an approved spark lighter.	A high flow of fuel gas cuts down on smoke. Lighting only fuel gas reduces the risk of flashback.
4	Reduce the gas flow until the flame starts to smoke. Open the oxygen valve on the torch slowly to get the desired flame.	This technique sets the correct flow of fuel gas and oxygen for the torch tip. If less heat is required for heating, welding, or brazing, change the tip. Do not reduce the pressure or the flow of either fuel gas or oxygen

II Re-lighting the Torch : Adhere to the following steps when lighting the torch:

Steps	Description of activity	Reason
1	Always re-purge the system by opening and re-closing the fuel gas torch valve.	This technique mixtures that may have accumulated in the system.
2	Re-purge the oxygen line by opening and re-closing the oxygen torch valve.	This technique removes any explosive mixtures that may have accumulated in the system.
3	Open only the torch fuel-gas valve to a high flow rate. Light the torch with an approved spark lighter.	A high flow of fuel gas cuts down on smoke. Lighting only fuel gas reduces the risk of flashback.
4	Reduce the gas flow until the flame starts to smoke. Open the oxygen valve on the torch slowly to get the desired flame. reduce the pressure or the flow of either fuel gas or oxygen	This technique sets the correct flow of fuel gas and oxygen for the torch tip. If less heat is required for heating, welding, or brazing, ch ange the tip. Do not reduce the pressure or the flow of either fuel gas or oxygen
IV. Clo sing the System : Adhere to the following ste ps when closing the system:		
1	Close the oxygen valve on the torch first. Then close the fuel-gas valve on the torch.	If the oxygen valve leaks, the system may backfire. If the fuel-gas valve leaks, the flame will not go out. Either situation indicates that the equipment is defective and requires immediate repairs before continuing use.
2	Close both cylinder valves. Release the hose pressure by opening the torch valves and allowing gas to escape from the system.	This technique prevents leaks and fires. It also prepares the equipment for the next start-up.

3	Close both regulator valves by releasing the tension on the regulator screw.	This technique prepares the equipment for the next start-up.
	Note: When the regulator screw is turned counterclockwise, the valve is closed, and when turned clockwise, the valve is opened.	

10. Guideline for conducting quarterly tests on specific parts of oxy-fuel equipment

- Regulators and Gauges

a. Visually inspect for damage all components of fuel-gas and oxygen regulators, including the following:
   i. Compression nipples and nuts
   ii. filter screens in the inlet nozzles
   iii. Gauges
   iv. Regulator adjusting screws
b. Attach the fuel-gas and the oxygen regulators to inert gas or oil-free air systems for
c. testing. Use transition test nipples for testing.
d. Release regulator-adjusting screws counterclockwise. Then open the cylinder valve and verify that the high- pressure gauge is operating properly. If no inert gas or air flows through the regulator when the cylinder valve is opened, the regulator
e. adjustment valve is in good condition and the regulator diaphragm is not damaged. d) Block with a valve the outlet nozzle of the regulator using a plug or hose.
f. Adjust the regulator-adjusting screw clockwise until the low-pressure gauge indicates a normal operating pressure. Use soapy water to inspect the regulator and gauge connections for leaks.
g. Close the cylinder valve, and watch the gauges for a drop in pressure. A drop in pressure indicates a leak. Reopen the cylinder valve, and check the low-pressure gauge for any slight drop in pressure (needle creep). Gauge needle creep greater than 2 to 3 psi (14 to 20 kPa) indicates that the diaphragm is damaged.

- Hoses

a) Visually inspect each length of hose for burns, worn areas, decay, and other defects. If

defects are found those could cause leaks, remove the hose from the system.

b) Pressurize each length of hose, and run it through a water vat to check for leaks. Use inert gas or oil-free air for this test at a pressure sufficient to indicate leaks, typically between 15 and 80 mks (103 and 550 kPa). Any length of hose that cannot be tested in the water vat must be tested with soapy water. replace any length of hose that has leaks.

- Combination Reverse-Flow Check Valves and Flame Arresters:

a. Visually inspect each check valve/arrester to verify that the inlet nozzle is free of
b. oxidation, burns, and other defects.
c. Visually inspect each check valve/arrester by using reverse-flow pressure in the outlet nozzle to verify that the check valve is sealing. For this test, either blow through the unit or use inert gas or oil-free air at a pressure between 1 and 10 mks(7 and 70 kPa), sufficient to close the check valve.
d. Replace, but do not repair, defective check valves/arresters.
e. Between inspections and tests, if the units have significant backfires or flashbacks, remove the check valve/arrester for additional inspections and tests.

4. Cutting Torches and Mixing Chambers

(a) Visually inspect for damage to all components of each torch and mixing chamber, including the following:
- O-rings on the torch
- Seating surface in the mixing chamber
- cutting tip seating surface in the torch head

(b) Test the complete system, including cutting torches and mixing chambers, by following the instructions for setting up the system, lighting the torch, and re-lighting the torch as stated in earlier attachments. B.

Arc welding and cutting

1. Manual electrode holders
   a) Only manual electrode holders which are specifically designed for arc welding and cutting, and are capable of safely handling the maximum rated current required by the electrodes, shall be used.
   b) Any current-carrying parts passing through the portion of the holder which the arc welder or cutter grips in the hand, and the outer surfaces of the jaws of the holder,

   shall be fully insulated against the maximum voltage encountered to ground.
2. Welding cables and connectors.
   a) All arc welding and cutting cables shall be of the completely insulated, flexible type, capable of handling the maximum current requirements of the work in progress, taking into account the duty cycle under which the arc welder or cutter is working. It is recommended to use copper cables.
   b) Only cable free from repair or splices for a minimum distance of 3.0 m from the cable end to which the electrode holder is connected shall be used, except that cables with standard insulated connectors or with splices whose insulating quality is equal to that of the cable are permitted.
   c) When it becomes necessary to connect or splice lengths of cable one to another, substantial insulated connectors of a capacity at least equivalent to that of the cable shall be used. If connections are effected by means of cable lugs, they shall be securely fastened together to give good electrical contact and the exposed metal parts of the lugs shall be completely insulated.
   d) Cables in need of repair shall not be used. When a cable, other than the cable lead referred to in subdivision (b) of this subsection, becomes worn to the extent of exposing bare conductors, the portion thus exposed shall be protected by means of

rubber and friction tape or other equivalent insulation.

3. Ground returns and machine grounding.

a) A ground return cable shall have a safe current carrying capacity equal to or exceeding the specified maximum output capacity of the arc welding or cutting unit which it services. When a single ground return cable services more than one unit, it's safe current-carrying capacity shall equal or exceed the total specified maximum output capacities of all the units it serves.

b) Pipelines containing gases or flammable liquids, or conduits containing E&I circuits, shall not be used as a ground return.

c) When a structure or pipeline is employed as a ground return circuit, it shall be determined that the required electrical contact exist at all joints. The generation of an arc, sparks, or heat at any point shall cause rejection of the structures as a ground circuit.

d) When a structure or pipeline is continuously employed as a ground return circuit, all joints shall be bonded, and periodic inspections shall be conducted to ensure that no condition of electrolysis or fire hazard exists by virtue of such use.

e) The frames of all arc welding and cutting machines shall be grounded either through a third wire in the cable containing the circuit conductor or through a separate wire which is grounded at the source of the current. Grounding circuits, other than by means of the structure, shall be checked to ensure that the circuit between the ground and the grounded power conductor has resistance low enough to permit sufficient current to flow to cause the fuse or circuit breaker to interrupt the current.

f) All ground connections shall be inspected to ensure that they are mechanically strong and electrically adequate for the required current.

g) In case of welding in equipment having battery, it should be isolated first before commencing the welding works.

4. Operating instructions. Employers shall instruct employees about the safe means of arc welding and cutting as follows:

a. When electrode holders are to be left unattended, the electrodes shall be removed and the holders shall be so placed or protected that they cannot make electrical contact with employees or conducting objects. It is recommended to use specially made wooden rectangular pot for keeping these electrode holder / torch, instead of
b. hanging it somewhere. All waste electrode should be kept in designated box.
c. Hot electrode holders shall not be dipped in water; to do so may expose the arc
d. welder or cutter to electric shock.

e. When the arc welder or cutter has occasion to leave work or to stop work for any appreciable length of time, or when the arc welding or cutting machine is to be moved, the power supply switch to the equipment shall be opened.

f. Any faulty or defective equipment shall be reported to the supervisor.

g. All transformer type welding machine is prohibited for use at HZL sites in order to improve quality of welding and eliminating risk of an accidental instantaneous peak of current that may damage the other vulnerable electronic parts, cable etc and in turn cause life risk to welders.

h. A green sticker will be pasted on welding machine once it is okayed for use at HZL site by Electrical Engineer. Such checking of welding must be done quarterly or after any repair of the welding machine whichever is earlier.

i. Before use of welding machine, it must be checked for specific electric switch from distribution box (so that it can be powered off as per need), availability of ELCB at incoming-set at 30 mA, adequate equipment body earth, return earth from job and quality of cable used. It should also be checked for all AC arc-welding machines connected to the same phase of the supply circuit and with the same instantaneous polarity.

5. Shielding.

Whenever practical, all arc welding and cutting operations shall be shielded by noncombustible or flameproof screens which will protect employees and other persons working in the vicinity from the direct rays of the arc.

6. Employee protection.

Where welding or cutting operations are being performed in areas where it is possible for molten slag to come in contact with other employees, those employees shall be protected from being burned by providing overhead protection, by barricading the impact area, or other effective means.

7. <u>Protective clothing:</u>

1. General requirements. Employees exposed to the hazards created by welding, cutting, or brazing operations shall be protected by personal protective equipment in accordance with the requirements. Appropriate protective clothing required for any welding operation will vary with the size, nature and location of the work to be performed.
2. Specified protective clothing. Protective means which may be employed are as follows:
    - Except when engaged in light work, all welders should wear flameproof gauntlet / full sleeves leather gloves.

- Flameproof aprons made of leather, or other suitable material may also be desirable as protection against radiated heat and sparks. It is recommended to use leg guard while welding.
- Sparks may lodge in rolled-up sleeves or pockets of clothing, or cuffs of overalls or trousers. It is therefore recommended that sleeves and collars be kept buttoned and pockets be eliminated from the front of overalls and aprons. Trousers or overalls should not be turned up on the outside.
- Underground mining welding

Note: For heavy work, fire-resistant leggings, high boots, or other equivalent means should be used.

- It is a general practice to provide a sheet metal screen in front of the worker's legs which provides further protection against sparks and molten metal in cutting operations.
- Under no case, falling spatters from hot jobs is allowed. It must be protected from falling by using Ceramic Clothing, GI sheet or other suitable means.
- Welders are never allowed to see the arc directly – they will use welder's helmet/shield, shade no: 10-14 (Refer Appendix G for details) while helpers will wear plain goggles with shatter proof lens > 3mm thick.

8. Fire prevention:
   a) When welding, cutting, or heating is performed on walls, floors, and ceilings, since direct penetration of sparks or heat transfer may introduce a fire hazard to an adjacent area, the same precautions shall be taken on the opposite side as are taken on the side on which the welding is being performed.
   b) For the elimination of possible fire in enclosed spaces as a result of gas escaping through leaking or improperly closed torch valves, the gas supply to the torch shall be positively shut off at some point outside the enclosed space whenever the torch is not to be used or whenever the torch is left unattended for a substantial period of time, such as during the lunch period. Overnight and at the change of shifts, the torch and hose shall be removed from the confined space. Open end fuel gas and oxygen hoses shall be immediately removed from enclosed spaces when they are disconnected from the torch or other gas-consuming device.
   c) Except when the contents are being removed or transferred, drums, paints, and other containers, which contain or have contained flammable liquids, shall be kept closed. Empty containers shall be removed to a safe area apart from hot work operations or open flames
   d) Drums, containers, or hollow structures which have contained toxic or flammable substances shall, before welding, cutting, or heating is undertaken on them, either be filled with water or thoroughly cleaned of such substances and ventilated and tested.

e) Before heat is applied to a drum, container, or hollow structure, a vent or opening shall be provided for the release of any built-up pressure during the application of heat.

9. Ventilation and protection in welding, cutting, and heating: Mechanical Ventilation.

For purposes of this section, mechanical ventilation shall meet the following requirements:

a) Mechanical ventilation shall consist of either general mechanical ventilation systems or local exhaust systems.

i. General mechanical ventilation shall be of sufficient capacity and so arranged as to produce the number of air changes necessary to maintain welding fumes and smoke within safe limits.

II. Local exhaust ventilation shall consist of freely movable hoods intended to be placed by the welder as close as practicable to the work. This system shall be of sufficient capacity and so arranged as to remove fumes and smoke at the source and keep the concentration of them in the breathing zone within safe limits. Contaminated air exhausted from a working space shall be discharged into the open air or otherwise clear of the source of intake air.

b) All air replacing that withdrawn shall be clean and repairable.

c) Oxygen shall not be used for ventilation purposes, comfort cooling, blowing dust from clothing, or for cleaning the work area.

10. Welding, cutting, and heating in confined spaces

When sufficient ventilation cannot be obtained without blocking the means of access, employees in the confined space shall be protected by airline respirators, and an employee on the outside of such a confined space shall be assigned to maintain communication with those working within it and to aid them in an emergency in line with requirement outlined in Safety Standard on Confined Space Entry.

11. Inert-gas metal-arc welding

Since the inert-gas metal-arc welding process involves the production of ultra-violet radiation of intensities of 5 to 30 times that produced during shielded metal-arc welding, the decomposition of chlorinated solvents by ultraviolet rays, and the liberation of toxic fuels and gases, employees shall not be permitted to engage in, or be exposed to the process until the following special precautions have been taken:

a) The use of chlorinated solvents shall be kept at least 200 feet, unless shielded, from the exposed arc, and surfaces prepared with chlorinated solvents shall be thoroughly dry before welding is permitted on such surfaces.

b) Employees in the area not protected from the arc by screening shall be protected by filter lenses. When two or more welders are exposed to each other's arc, filter lens goggles of a suitable type shall be worn under welding helmets. Hand shields to protect the welder against flashes and radiant energy shall be used when either the helmet is lifted or the shield is removed.

c) Welders and other employees who are exposed to radiation shall be suitably protected so that the skin is covered completely to prevent burns and other damage by ultraviolet rays. Welding helmets and hand shields shall be free of leaks and openings, and free of highly reflective surfaces

12. General welding, cutting, and heating

a) Welding, cutting, and heating, not involving conditions or materials described in subsections 10 or 11 of this section, may normally be done without mechanical ventilation or respiratory protective equipment, but where, because of unusual physical or atmospheric conditions, an unsafe accumulation of contaminants exists, suitable mechanical ventilation or respiratory protective equipment shall be provided.

b) Employees performing any type of welding, cutting, or heating shall be protected by suitable eye protective equipment as indicated above in sub-section 7-2g of this section.

13. Welding, cutting, and heating in way of preservative coatings.

a) Precautions shall be taken to prevent ignition of highly flammable hardened preservative coatings. When coatings are determined to be highly flammable, they shall be stripped from the area to be heated to prevent ignition.

14. Protection against toxic preservative coatings:

a) In enclosed spaces, all surfaces covered with toxic preservatives shall be stripped of all toxic coatings for a distance of at least 4 inches from the area of heat application, or the employees shall be protected by airline respirators or self-contained breathing apparatus.

b) In the open air, employees shall be protected by a respirator or self-contained breathing apparatus.

Appendix E

Atmospheric monitoring

Atmospheric Monitoring is required for:

- All Hot Work done in Flammable Areas, confined spaces.
- The person doing the Atmospheric Monitoring has the required training, knowledge and skills.

a. Monitoring

- Immediately prior to the start of the job at the time of PTW
- When the working conditions upon which the PTW was based are not being maintained and/or have changed.
- Periodically or continuously as specified by the PTW
- Before Hot Work is allowed to resume after a work stoppage or plant emergency.
  o Continuously for % LEL for all High Energy Hot Work in Flammable Areas

b. Document

- The date and time monitoring was done,
- The name of the person performing the monitoring, and the level of flammables detected (LEL).
- Stop the Hot Work if your Atmospheric Monitoring has detected the presence of flammable materials. (For example, the explosive meter has detected a reading above zero LEL.)

All Atmospheric monitoring instruments shall be calibrated and performance-tested in accordance with the manufacturer's instructions prior to use. The manufacturer's instructions will provide calibration instructions, performance testing guidelines and instrument response time. Acceptable Air Quality in such atmosphere shall be

- Oxygen levels - not less than 19.5% nor more than 23.5% oxygen in ambient air.
- Flammability/Combustibility - Less than 10% of the Lower Flammability Limit (LFL) or Lower
- Explosive Limit (LEL). These terms are used interchangeably on MSDSs and in product literature.

Note: Flammable concentrations of dusts cannot be measured by a LFL meter. You should consider dust that obscures vision 5 ft away to be potentially flammable

Appendix F

FIRE WATCHER - Skill requirements, roles and responsibilities

Fire watcher must be identified at the job site when hot work to be carried out in Critical areas like Flammable areas or General areas where presence of flammable atmosphere may be present or identified or Confined spaces where welding fumes may reduce oxygen concentration or similar potential oxygen deficient areas. Risk associated in this aspect must be assessed and appropriate control measures must take to mitigate associated hazards.

NOTE: Personnel performing a fire watch must be trained in these responsibilities

Fire Watcher responsibilities:

- The fire watcher must remain on site for 60 min to 120 min after the completion of the hot Work to prevent undetected sparks from smouldering and then later catching fire.
- Must carry communication devices and wear distinctive PPE
- In case of fire all concern should be informed immediately
- Utilize non-combustible materials to contain hot slag or sparks, or relocate combustible materials if possible.
- If the Hot Work takes place in elevated areas, it may be necessary to provide more than one fire watcher.
- Fire extinguishers use.
- Have a proper type of fire extinguisher for the work taking place and the location. Consideration must be given to the capacity, extinguishing agent and its effect on Class A, B, C, or D fires. The fire extinguisher must be charged and ready for use.
- The operator of the fire extinguisher must be knowledgeable in the proper uses of the extinguisher.
- A fire extinguisher must be dedicated to the Hot Work. Do not use mounted fire
- extinguishers in the building as the primary means of protection

Appendix G

FILTER LENS SHADE NUMBERS

RECOMMENDED FOR PROTECTION AGAINST RADIANT ENERGY WELDING OPERATIONS

Serial No.	Description of Welding Job	Shade Nos. (Ref. ANSI Z87.1)
1	Shielded Metal-Arc Welding 1/16-,3/32-,1/8-,5/32- inch diameter electrodes	10
2	Gas shield welding (Non-ferrous) 1/16-,3/32-,1/8-,5/32- inch diameter electrodes	11
3	Gas shield welding (Ferrous) 1/16-,3/32-,1/8-,5/32- inch diameter electrodes	12
4	Shielded Metal-Arc Welding 3/16-,7/32-,1/4-,5/32- inch diameter electrodes	12
5	Shielded Metal-Arc Welding 5/16-,3/8- inch diameter electrodes	14
6	Atomic Hydrogen Welding	10-14
7	Carbon-arc welding	14
8	Soldering	2
9	Torch Brazing	3 or 4
10	Light Cutting – up to 1 inch	3 or 4
11	Medium Cutting –1 inch to 6 inches	4 or 5
12	Heavy Cutting – over 6 inches	5 or 6
13	Gas Welding (Light) – up to 1/8 inch	4 or 5

14	Gas Welding (Medium) – >1/8 inch to < ½ inch	5 or 6
15	Gas Welding (Heavy) – over 1 /2inch	6 or 8

Appendix H

SAMPLE CHECKLIST FOR INSPECTION OF WELDING MACHINE

The inspection of machine needs to consider as minimum the following points:

Dept:		Section:		
Date:		Performed by:		
	Machine No.	Machine No.	Machine No.	Machine No.
Check Points	Status	Status	Status	Status
Electrode Holder Fully insulated				
Electrode Cable & Lugs				
Power Source				
Work Cable, Work Clamp and Lugs				
Primary Cable, Plug/Receptacles				
Covers, casing and terminals				
Welding case / transformer case grounded				
Shrouds on hand pieces (MIG/TIG /Plasma)				
General insulation to all leads				
Voltage Reduction Device				

Please write status as OK/ Not OK

SAMPLE CHECKLIST FOR INSPECTION OF OXYGEN AND ACETYLENE SETS

The inspection of Oxygen and Acetylene Sets needs to consider as a minimum the following points:

Dept:		Section:		
Date:		Performed by:		
	Set No.	Set No.	Set No.	Set No.
Check Points	Status	Status	Status	Status
Regulators & seals				
Cylinder condition (test date)				
Gauges & covers				
Cylinders Labelled				
Hoses and connections				
Covers, casing and terminals				
Flash back arrestors fitted				
Hand piece				
General insulation to all leads				
Valve condition				

Please write status as OK/ Not OK