CUTTING AND WELDING
SAFE OPERATING PROCEDURE

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3.2 PROJECT CONSTRUCTION MANAGER

3.3 DISCIPLINE MANAGER

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1. PURPOSE & SCOPE
This standard establishes the project safety requirements for cutting and welding. This standard applies to all construction activities where hot cutting and welding operations are required.

2. DEFINITIONS
Not applicable.

3. ROLES & RESPONSIBILITIES

3.1 Project Manager (PM) / Construction Manager
- Ensure effective implementation of this standard.

3.2 Project SHE Manager
- Audit and monitor compliance with this standard;
- Identify remedial corrective actions required to meet the Cutting and Welding Standard.

3.3 Supervisor
- Ensure the application of this standard;
- Where appropriate ensure that a RA is developed for tasks associated with this standard;
- Ensure that employees review and sign the RA prior to task commencement.

3.4 Employees
- Ensure that they are aware of the risks associated with the job;
- Ensure compliance with this standard;
- Ensure compliance with RA;
- Shall not operate equipment unless competent and tools/equipment have been inspected prior to commencement of task.

4. PROCEDURES
General
- Flash back arrestors shall be fitted on both ends of oxygen and acetylene hoses
- Hose clamps will comply with this standard and specification using the SCHMITTER crimping tool.
- Risk of fire from welding and cutting activities shall be observed and controlled by using approved shields or blankets.

4.1 Personal Protective Equipment

4.1.1 Recommended Equipment for Various Processes – (See Annexure 1)
Protective equipment and clothing which shall be used for various processes is listed in Table 1.

4.1.2 Protection of Eyes and Head

4.1.2.1 Helmets and Face shields

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The construction of a typical helmet, together with the protective filters incorporated within them, shall conform to Site Specific Requirements. Where possible, welders shall always use full helmet equipment to provide the maximum possible protection. Such helmets or Face shields shall be constructed of non-flammable, non-conducting materials with non-reflecting surfaces, e.g. fibre, glass fibre reinforced plastic or similar materials. Helmets shall have sufficient clearance from the face to permit ventilation and shall be light yet durable.

4.1.2.2 Protective Goggles
- Protective goggles shall conform to Site specific requirements;
- Welders shall wear safety spectacles with side shields underneath helmets to provide increased protection at all times.

4.1.2.3 Contact Lenses
Persons who wear contact lenses shall take precautions to avoid dust, metallic particles and the like being lodged in their eyes.

Suitable protective filters shall be worn during welding operations Refer to Table 2.

There is no additional risk arising from any welding process or operation such as exposure to arc flash when using contact lenses.

4.1.2.4 Protective Filters
Protective filters are provided to reduce the intensity of radiation entering the eye and thus effectively filter out part of the visible, infrared and ultraviolet radiation. Such filters are incorporated within welding helmets and can be fitted to certain goggles. To prevent damage to the filters from molten or hard particles an additional hard clear glass or CR39 plastic external cover is provided. This cover shall always be kept in place and replaced before the damage becomes sufficient to impair vision.

Lift-front welding helmets shall incorporate a high impact resistant chipping lens made of polycarbonate material.

4.1.3 Welders’ Caps
Welders’ caps will provide additional protection for the top of the head from radiation reflected from adjacent surfaces. They shall be used in welding overhead. Welders’ caps shall be made of heat resistant material which is not readily flammable. Welders with long hair shall use hoods or nets which cover and hold the hair underneath appropriate caps or head shields.

4.1.4 Type of Work Clothing
The normal working clothing of a welder is generally his own responsibility. Clothing shall:
- Protect all parts of the body from hot particles or objects;
• Be preferably of cotton/wool or flame-resistant canvas which is much safer in fire than most synthetic materials such as nylon which melt or readily stick to skin when overheated. Woollen materials have much greater resistance to ultraviolet radiation, e.g. from Gas Metal Arc or Gas Tungsten Arc Welding of aluminum and stainless steel;
• Be free of cuffs or open pockets which could trap molten metal causing local burns or setting fire to clothing;
• No Jewellery
• APRON
• SPATS
• GLOVES

4.1.5 Gloves
These shall:
• Be worn during all arc, gas or thermal cutting operations;
• Be of pliable flame-resistant leather or of aluminized type for very hot operations such as confined heavy arc or oxy-gouging;
• Comply with Site specific requirements. 4.1.5 Footwear

4.1.6 Footwear
• Safety footwear in accordance with site specific requirements must be used;

As minimum requirements the following types of footwear are required:
• Normal Work – Type 2 (medium duty)
• Heavy Platework – Type 1 (heavy duty)

Table 1:  Minimum Protective Equipment For Various Welding and Allied Processes

<table>
<thead>
<tr>
<th>Process</th>
<th>Hazard</th>
<th>Protective Equipment</th>
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<tbody>
<tr>
<td>Flame cutting</td>
<td>Radiation Burns (heat)</td>
<td>Goggles with appropriate filters Adequate clothing gloves and footwear Suitable head Protection for overhead welding Woollen or Cotton Socks Respirator where appropriate</td>
</tr>
<tr>
<td>Gas Welding</td>
<td>Radiation Burns (heat)</td>
<td>Goggles with appropriate filters, gloves and respirator</td>
</tr>
<tr>
<td>Plasma Cutting (Machine)</td>
<td>Radiation Burns (heat)</td>
<td>Full face protection shield with filters Adequate clothing Ear protection Respirator when appropriate</td>
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<tr>
<td></td>
<td>Noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fumes</td>
<td></td>
</tr>
<tr>
<td>Arc Gouging / Cutting</td>
<td>Radiation Burns</td>
<td>Goggles with appropriate filters. Adequate clothing, gloves and footwear. Rubber soled safety shoes Dry gloves and footwear Ear protection</td>
</tr>
<tr>
<td></td>
<td>Electric Shock</td>
<td></td>
</tr>
<tr>
<td>Arc Welding (Manual)</td>
<td>Radiation Burns</td>
<td>Full face protection shields with filters, gloves and footwear Dry Clothing etc Respirator when appropriate</td>
</tr>
<tr>
<td></td>
<td>Electric Shock</td>
<td></td>
</tr>
<tr>
<td>Arc Welding (Merchandised)</td>
<td>Radiation Burns</td>
<td>Goggles with suitable protective filters Dry clothing etc</td>
</tr>
<tr>
<td></td>
<td>Electric Shock</td>
<td></td>
</tr>
<tr>
<td>Grinding</td>
<td>Hard Particles</td>
<td>Eye protection (goggles with lens) and face shield Ear protection</td>
</tr>
<tr>
<td></td>
<td>Noise</td>
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<tr>
<td>Operation</td>
<td>Condition</td>
<td>Protection Measures</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Chipping</td>
<td>Hard Particles (possibly hot)</td>
<td>Eye protection (goggles with lens) Adequate clothing Ear protection</td>
</tr>
<tr>
<td>Overhead Welding</td>
<td>Working at Heights Refer to Project Standard</td>
<td>Shoulder, head and neck protection. Ankle spats Eye protection Hand and arm protection</td>
</tr>
<tr>
<td>Welding inside tanks / vessels</td>
<td>Toxic gas / vapour Confined space fire</td>
<td>Use a voltage reduction device when changing electrodes Rubber soled shoes RCD protection Adequate ventilation</td>
</tr>
<tr>
<td>Welding, Cutting or grinding inside containers/tanks</td>
<td>Toxic gas / vapour Confined space fire</td>
<td>Adequate ventilation, mechanical extraction, or adequate forced ventilation Hearing protection Eye protection Hand protection Clothing</td>
</tr>
<tr>
<td>Cutting overhead</td>
<td>Working at Heights Refer to Project Standard</td>
<td>Adequate barricading to prevent people below being hit by sparks and off cuts</td>
</tr>
<tr>
<td>Grinding overhead</td>
<td>Working at Heights Refer to Project Standard</td>
<td>Adequate barricading to prevent people below being hit by sparks and off cuts</td>
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</table>

Notes:
1. Wherever practicable, mechanical fume extraction must be used during welding activities. Where this is not possible, effective alternative controls must be implemented to prevent the inhalation of fumes by welders and nearby workers.
2. Welding or face shield, as applicable, shall have flame resistant hoods securely / permanently attached.

When selecting an appropriate filter, the following factors shall be kept in mind:
- The intensity of radiation, and thus degree of protection required, depends mainly on the process and welding current. Table 2 gives recommendations for suitable filters and shall provide the basis for selection;
- The objective is to achieve protection for the eyes whilst maintaining adequate visibility of the work piece. Poor visibility causes eye-strain and spoiled work;
- If, after selecting a filter suited to the welding process and conditions (Table 2), vision is poor, attempts shall be made to improve illumination of the work piece rather than using an inadequate filter;
- Observers who are required to closely view the arc shall also wear full face protection and also select filters as recommended in Table 2.
Table 2: Guidance on Selection and Use of Filters for Protection Against Optical Radiation Generated During Welding and Allied Processes

<table>
<thead>
<tr>
<th>Process</th>
<th>Approx. Range of Welding Current (AMPS)</th>
<th>Filter Recommended</th>
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<tbody>
<tr>
<td>Manual Metal Arc Welding – covered electrodes (MMAW)</td>
<td>Up to 100, 100 – 200, 200 – 300, 300 – 400, Over 400</td>
<td>8, 10, 11, 12, 13</td>
</tr>
<tr>
<td>Gas Tungsten Arc Welding (GTAW) – (TIG)</td>
<td>Up to 100, 100 – 200, 200 – 250, 250 – 350, Over 350</td>
<td>10, 11, 12, 13, 14</td>
</tr>
<tr>
<td>Gas Metal Arc Welding (GMAW) (MIG)</td>
<td>Up to 250, 250 – 350, 300 – 400, Over 400</td>
<td>12, 11, 10, 14</td>
</tr>
<tr>
<td>Aluminum and Stainless Steel</td>
<td>Up to 150, 150 – 250, 250 – 300, 300 – 400, Over 400</td>
<td>11, 12, 13, 14</td>
</tr>
<tr>
<td>Other than Aluminum and Stainless Steel</td>
<td>Up to 300, 300 – 400, 400 – 500, Over 500</td>
<td>11, 12, 13, 14</td>
</tr>
<tr>
<td>Flux-Cored Arc Welding (FCAW)</td>
<td>Up to 300, 300 – 400, 400 – 500, Over 500</td>
<td>11, 12, 13, 14</td>
</tr>
<tr>
<td>- With or without shielding gas</td>
<td>Up to 300, 300 – 400, 400 – 500, Over 500</td>
<td>11, 12, 13, 14</td>
</tr>
<tr>
<td>Plasma Arc Welding, Cutting &amp; Spraying (PAW) and Wire-Arc Spraying</td>
<td>Up to 50, 50 – 100, 100 – 200, 200 – 300, 300 – 400, 400 and over</td>
<td>10, 11, 12, 13, 14</td>
</tr>
<tr>
<td>Air-Arc Gouging</td>
<td>Up to 400</td>
<td>12</td>
</tr>
<tr>
<td>Gas Welding</td>
<td>Up to 400</td>
<td>3, 4, 5</td>
</tr>
<tr>
<td>- Low heat input</td>
<td></td>
<td></td>
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<tr>
<td>- Light fusion welds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Heavy fusion welds</td>
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</tbody>
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Notes:
1. The shade numbers are minimum. If any discomfort is felt, higher shade numbers, i.e. darker filters shall be used.
2. If the surface temperature of the filter rises above 100 Deg C, e.g. when welding preheated sections in a confined space, filters of solid glass or glass laminates with dyed inserts shall be used.
3. These processes give off a higher proportion of infra-red radiation than others which gives rise to an uncomfortable increase in filter temperature. An auxiliary heat absorbing filter shall be placed between the cover glass and filter glass.
4. Where these processes are fully automatic, shade 3 filter may be used. The appropriate filter shall be used for close examination.
5. When these processes are provided with their own shield, lighter eye protection filters may be used.
6. A darker filter may be required to closely watch the molten pool in electroslag welding.

4.1.7 Additional Protection
Aprons, sleeves, shoulder covers, leggings or spats of pliable flame-resistant leather or other suitable materials may also be required in positions where these areas of the body will encounter hot metal, e.g. overhead welding or if leaning on hot metal, or sitting at a bench where molten metal may land in the lap.
4.1.8 Clothing Condition
- All clothing including, gloves and boots shall be kept reasonably free from oil or grease to avoid problems with fire, slipping or dirty work. They shall also be dry to reduce electrical risk;
- Safety footwear shall be Type 4 (Waterproof) for all wet work activities.
- Risk assessment shall be performed and approved by Line manager prior to working in wet areas.

4.1.9 Screens
- All electric welding operations shall be screened to prevent the rays of the arc from affecting other persons working in the vicinity. Where the work is carried out at fixed benches or in welding shops, permanent screens shall be erected. Where the nature of the work is such that these are not practicable, temporary screens shall be used to limit the radiation;
- All screens shall be opaque or of appropriate translucent materials, of sturdy construction to withstand rough usage, and of material which will not readily be set alight by sparks or hot metal. They shall not, however, be so heavy or cumbersome as to discourage their use. They shall permit ventilation under and over; 300 mm bottom clearance is usually adequate.

4.1.10 Respiratory Protection Devices Introduction

Introduction
In special situations where general or local ventilation systems are not effective in reducing fume levels, personal respiratory protection is required. The following general requirements shall be considered when selecting respiratory protective devices:
- They are carefully selected for each application (expert occupational hygiene advice may be required). A common problem is fitting respiratory protection devices under welding face pieces and helmets, and specifically designed variants may have to be used.
- Face pieces of filtering devices or negative pressure supplied air devices have to closely fit the face. Full or half face piece respirators shall not be worn by individuals with beards, long moustaches or sideburns or with heavy stubble growth. Air supplied hood type respirators shall be used;
- All respirators must be clean and in good condition before use. They must only be transferred between persons if they have been adequately washed and disinfected;
- Training in correct use of respiratory protection devices is essential;
- When working in close habitat including confined spaces, appropriate respiratory protection devices and/or mechanical ventilation shall be used.

4.2 Welding or Cutting in or on Containers
The contractor shall develop standard operating procedure for welding or cutting in or on containers. The procedure shall be approved by the PM prior to welding or cutting. The procedure shall apply the following:

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4.2.1 Supervision and Approval

4.2.1.2 Permits
- **Permits**: In all situations where such work is to be carried out, the supervisor shall supervise all preparations for the work and process the necessary hot work permits;
- **Confined Space Procedures** shall be observed in the following circumstances:
  - To enter the confined space of a vessel;
  - To carry out hot or cold work inside a vessel.

4.2.1.2 Gas Freeing Area
Unless a building has been designed and approved for such work, all "gas freeing" must be performed outdoors, remote from all sources of ignition (in the case of combustibles) or sufficiently isolated to protect personnel in the immediate vicinity. The following points shall be noted:
- Gas freeing areas shall be clearly identified;
- The tank or vessel shall be positioned where vapours will not drift indoors, towards sources of ignition (in the case of combustibles) or endanger personnel in the case of toxic or asphyxiating gases;
- Many vapours are heavier than air and will accumulate in low areas;
- Safe distances need to be established from sources of ignition in the case of combustibles and air contamination requirements in the case of toxic gases, etc;
- Where water or steam is used, the work area must have a sealed area complying, with statutory and environmental requirements.
- Gas free status atmospheres for safe entry must be checked by instruments which are used by experienced and qualified personnel. Unless skilled personnel are used, there is a likelihood of dangerous consequences due to malfunctioning of the instrument.

4.2.1.3 Other Considerations
- Identification of contained materials or previously contained materials and assurance that safe conditions apply shall be required prior to issuing of work permits;
- Fire precautions shall be adhered to;
- Interruptions to work which involve a reasonable elapsed time require an assessment of the conditions to ensure that it is safe to recommence work.

4.3 Welding or Cutting Containers which have held Combustibles
The contractor shall develop standard operating procedures for welding or cutting containers, which have held combustibles. The procedures shall be approved by the
Project SHE Manager prior to welding or cutting commencement. The procedure shall address the following:

### 4.3.1 Identification of Hazard
- If the previous contents of a vessel to be worked on are unknown, it shall be treated as having contained a combustible substance however long it may have remained empty;
- Petroleum products and other volatile liquids release vapours at atmospheric pressure which may remain after a container is emptied;
- Containers which have contained plastic products, heavy oils or tars or have been coated inside or outside with plastic or paint may fill with explosive vapours when the metal is heated by welding, cutting etc. The welding or cutting, may then provide the spark which sets off an explosion
- Hydrogen may be present in metal containers which have held an acid, due to reaction between the metal and acid;
- Deposits of sludge, scale, traces of gum, resin, varnish, bitumen or similar non-volatile oils or solids may release flammable or explosive gases when heated in welding or cutting operations;
- Explosive conditions may exist if a container has held a flammable or explosive solid and finely divided particles of this matter are present in the form of dust.

### 4.3.2 Basic Precautions
The following lists the basic precautions to be met when welding or cutting on containers which hold or have previously held combustibles:
- Appropriate chemical methods carried out by qualified personnel shall be used to identify any doubtful situations. Even small amounts of residual gas-forming substances can cause a serious explosion;
- Sight or smell cannot be used to determine if safe working conditions apply;
- Cutting, welding or heating shall only be carried out by experienced welders directly supervised by a person who fully understands the hazards involved;
- Cleaning by methods appropriate to the size of the container and nature of its contents is required prior to cutting or welding except where the hazard can be avoided by other methods;
- Ventilation during cleaning shall be such that any flammable gases are quickly and safety dispersed. Open air cleaning is preferred. Note: Some gases, e.g. vapour from petroleum products are heavier than air and will tend to collect at floor level;
- Ignition sources listed below can be dangerous:
  - Flame or arc from welding and cutting, hot metal, smoking, matches or a lighter;
  - Electrical discharge from equipment not approved for hazardous areas;
  - Defective electrical equipment;
  - Portable equipment (electrical);
  - Hot engine exhaust;
  - Friction or impact sparks;
  - Spontaneous combustion (oily rags);
- Auto ignition from vehicle;
- Static electricity including, discharge for synthetic clothing or footwear;
- Lighting – electrical;
- Chisels, hammers etc made of steel shall not be used for cleaning or scrapping of residues as sparks can be generated and ignite gases. Wooden or bronze mallets and scrapers of non-sparking material are preferred;
- Internal piping, baffles, trays etc shall, where possible, be removed and drained to facilitate cleaning;
- Residue removed from containers shall immediately be stored in a safe place;
- Compartment within a container shall all be treated in the same manner, even if only a localised portion of the container is to be worked on;
- Rendering of materials to a non-explosive or non-flammable condition may, under certain circumstances, provide an alternative to cleaning;
- Solvents may in themselves constitute a hazard in a welding environment and advice shall be sought before their use;
- Flushing with either hot or cold water is not generally an acceptable method of cleaning, as many materials are not soluble in water. Exceptions are noted.

4.3.3 Cleaning Procedures for Small Vessels

Note: Cleaning of a vessel is necessary in all cases. It shall be supplemented by filling the container with water or an inert gas prior to and during the hot repair work.

4.3.4 Water Washing and Rinsing

- Application: Only suitable for substances known to be readily soluble in water, e.g. acids, caustic, acetone, alcohol;
- Method: Complete filling and draining of vessels a number of times with appropriate testing of the drained liquid;
- Caution: Dilute acids frequently react with metals to produce hydrogen when concentrated acids will not. All traces of acid must therefore be removed by repeated flushing.

4.3.5 Hot Chemical Solutions

- Application: Suitable for vessels which are not entered by workmen and which have contained petrol, domestic heating oils and other light petroleum by products;
- Method: A two-stage cleaning process is generally used which involves thorough flushing of the container with water to remove any remaining sludge, scum or liquid followed by cleaning with a hot solution of detergent. The cleaning procedure involves:
  - Dissolve chemicals in small quantities of boiling water and pour into container.
  - Typical chemicals used are sodium silicate or trisodium phosphate, the amount required being determined by the size of the vessel;
  - Fill vessel with fresh water;
- Make a steam connection either to a separate drain connection at the bottom of the container or by a pipe through the filling connection or vent and leading to the bottom of the container;
- Maintain solution at 75 to 900C;
- During steaming, add sufficient water at intervals to allow discharge and continue steaming until the overflow is clear;
- Drain container and carry out an appropriate gas test before issuing work permits;

Caution: Personnel shall guard against injury from either steam or caustic cleaning compounds by wearing suitable protective clothing. The chemicals used in cleaning, shall be such that corrosion of the vessel cannot occur.

4.3.6 Steaming

- **Application**: As for hot chemical method.
- **Method**:
  - Where practicable, the inside surfaces shall be flushed with a 25% caustic solution and the vessel thoroughly drained prior to steaming;
  - For containers with two openings, live steam shall be blown through the drainage hole. When the container has only one opening it shall be positioned so that condensed steam can drain away whilst steaming continues;
  - Low Pressure shall not be used as this will not provide sufficient cleaning action.
  - Steam pressure shall be controlled by a valve positioned at the head of the hose;
  - Continue steaming until the container is free of odours and sufficiently hot to allow steam to freely flow out of the container vent and all parts of the container are hot;
  - Flush container with boiling water and drain;
  - Inspect the inside of the vessel to ensure it is clean. This may require the use of mirrors to reflect light into the vessel;
  - Carry out appropriate gas tests before issuing work permits;
  - Caution: Metal nozzles on the steamline shall be non-sparking types to prevent accidental ignition of flammable gases. Metal nozzles shall be grounded to the container and the container also grounded to prevent a build up of static electricity. Protective clothing including that necessary to protect the operator's head is required in steam cleaning. Any light sources used for inspection purposes shall be of a type approved for use where flammable vapours are present.

4.3.7 Water Filling Treatment

- **Application**: It is advisable to use either this method or the inert gas to supplement the cleaning methods described. Dependent upon the contents of the vessel and if the vessel is in a non-hazardous location, it may be approved as the sole method required before commencing hot work;
- **Method**: The container is filled with water to within a few centimetres where welding or cutting is to be carried out. Vents or openings are required to allow the release of heated air or vapour from the container.
- **Caution:** Approval of this method as a single means of protection requires written approval of a responsible officer.

### 4.3.8 Non-Flammable Gas Purging

- **Application:** As for water filling treatment;
- **Basis:** Use of this method requires that flammable gases and vapours are rendered safe by diluting them sufficiently with a non-flammable gas;
- **Suitable Gases:** Carbon dioxide added as dry ice or in gas form and nitrogen are the most commonly used gases;
- **Method:**
  - The only openings in the vessel shall be a drain and vent;
  - The vessel shall initially be filled to overflow and flushed with water. Where possible, the portion of the vessel to be worked on shall be uppermost;
  - Drain off water but allow as much to remain as the cutting or welding work permits in order to reduce the amount of inert gas required;
  - Introduce inert gas in the amount required. The determination of this amount and monitoring of it during the work must be controlled by a person who has thorough knowledge of this work;
  - Tests of the contained gas must be carried out prior to and during work where extended work periods are required;

- **Caution:** Where solid carbon dioxide (dry ice) is used, protection is required to avoid bodily contact as "burns" will result. Where solid carbon dioxide is used, openings shall be fitted with non-return valves to prevent undue loss of gas or excessive pressure building up. Analysis of contained gas before and during hot work is essential.

### 4.4 ARC Welding

#### 4.4.1 Requirements

- The contractor shall develop standard operating procedures for Arc Welding. Procedures shall be approved by the CM. Procedures shall address the following:
  - Installing the Arc Welder;
  - Ventilation;
  - Fire Prevention;
  - Personal Protection;
  - Safe operating of the welder;
  - Safety precautions for engine powered welders;
  - First Aid
  - Hoses and cables shall be routed in a safe manner to prevent obstruction
  - Employees shall be competent in the use of welding, grinding and cutting equipment
  - Sparks and slag shall be contained where any hot work activity is performed to eliminate potential hazard to other employees and damage to installed equipment.

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- Sufficient fire blankets and Fire Fighting equipment shall be used and supplied by the contractor to ensure zero fire risks.
- Sufficient and adequate PPE/C shall be provided for Hot work activities specific to type required.
- Others as deemed necessary.

- The following essential safety aspects shall be followed:
  - Be sure the welder is properly installed and grounded;
  - Never weld without adequate ventilation;
  - Take proper precautions to prevent fires;
  - Protect your entire body with fire retardant clothing, shoes and gloves;
  - Wear eye protection at all times;
  - Weld only in a fire safe area;
  - Never do any welding, cutting, or hot work on used drums, barrels, tanks, or other containers;
  - Mark metal ‘HOT’ with a soapstone;
  - Keep a well-stocked first aid kit handy.
- Power supply for 240 volt equipment shall be provided with ELCB fitted and shall always be properly protected for over current.
- Welding equipment shall be within SANS requirement standards
- Welding machines shall be fitted with an approved Voltage Reducing device.

5. OXYGEN, ACETYLENE AND LPG CYLINDERS

- Storage areas should whenever possible be well clear of buildings.
- A protective covering shall be provided.
- Adequate ventilation shall be provided.
- Storage areas shall be kept free from all combustible materials, no other materials shall be stored in cylinder enclosure.
- Full cylinders shall be kept apart from empty cylinders so that it shall not be necessary to open valves to check whether cylinders are empty or full. Mark empty cylinders clearly and store in space provided.
- Cylinders shall always stand upright, special stands shall be used for cylinders and the cylinders shall be chained separately in an upright position.
- Cylinders shall be stored in rows with aisles in-between for easy removal in event of fire. For security and ventilation purposes a wire mesh fence should surround the storage area. Keep the enclosure locked.
- All danger signs shall be prominently displayed at storage area; e.g.:
  - No Smoking
  - No naked flames
  - Adequate fire fighting equipment shall be available.
  - Oxygen and acetylene should be stored separately.
  - The storage should be clearly marked:
    - 12.1 Oxygen - Full Oxygen - Empty
    - 12.2 Acetylene - Full Acetylene - Empty
  - Flammable and oxidising gasses shall not be stored together, greases and oils shall never be allowed to come in contact with Oxygen.
If electrical lighting is required, it should be of an approved type and comply with SABS Code 0108 – 1974.

- Gas cutting equipment and connections shall be within compliance to SANS requirements, standards and specifications.
- Gas cutting hose connection fittings shall be within the Namaqua Engineering requirements and crimping lugs shall be used and crimped with the approved Schitter crimping device tool.
- Regular inspections on hoses, fittings and equipment shall be conducted and defective equipment such as perished hoses, damaged regulators, gauges and such shall be removed from operation or destroyed.
- Approved flash back arrestors shall be fitted on both sides of the hoses
- Gas torches shall not be light with matches or gas type lighters, the correct type flint lighter shall be used.
- Hoses shall not exceed the maximum length of 30m
- Gas cylinders used on site shall be stored in approved trolleys and in a upright position
- Cylinders shall not be transported in a horizontal position. Cylinders shall be transported in an approved cage that is properly secured to prevent possible fall over or damage to cylinder heads.
- All cylinders shall be fitted with a valve cover to protect the valve from possible damage.
- Cylinders not fitted with a valve shall have a spindle key available at the location of the cylinder.
  - Cylinder Trolleys shall be fitted with a fire extinguisher.
  - A pre-inspection (leak test) on all gas connections shall be conducted with approved gas leakage testing fluid and findings recorded and displayed at trolley for audit and inspection purposes.
  - Transportation of gas cylinders shall be in a upright secured position
  - Lifting of gas cylinders shall only be with a approved gas cylinder cage
- No gas cylinders shall be permitted to be stored or positioned on an elevated working platform unless it is secured in a approved lifting cage.
- Sufficient gas cutting goggles shall be supplied and utilised when working with gas cutting equipment.
- LPG cylinders shall be fitted with approved regulator systems when in use.

All hot work operations shall be required to have a valid hot work permit at the place of work.
6. GENERAL WELDING, CUTTING, GRINDING AND HEATING

Comply with OH&S Act – General Health and Safety Regulation 9

Contractors shall instruct employees in the safe use of welding equipment. Cutting and welding work shall be carried out in accordance with General Safety Regulation 9. Non-combustible or flameproof shields to protect employees from direct rays and air-borne particles shall shield arc welding, cutting and grinding operations.

Electrode holders or welding guns shall be maintained in good order, and when they are to be left unattended, the electrodes shall be removed and the holders shall be placed or protected so that they cannot make electrical contact with employees or conducting objects.

All arc-welding cables shall be properly maintained and completely insulated. There shall be no repairs or splices within 3 metres of the electrode holders, except where splices are insulated equal to the cable. Defective cable shall be repaired or replaced. The earth cable shall be connected to the work place.

Fuel gas hose and oxygen hose shall be of an approved type, be easily distinguishable and shall not be interchangeable. Hoses shall be inspected at the beginning of each day and shall be repaired or replaced if defective.
6.1 Hot Work
1) Hot work permit to be obtained before job starts
2) Falling sparks and/or Hot cuttings to be contained
3) Fire Blankets and Fire Extinguishers shall be at hand
4) Ensure not to carry out any Hot work, Cutting and/or Grinding in the vicinity of Flammable Liquids
5) Protect Rubber lined Vessels / Tanks etc.
6) Combustible Floors shall be wetted down, covered with Damp sand or Fire proof sheets
7) All wall and floor openings covered
8) Containers / Pipes purged of Flammable vapours
9) Fire watch shall be provided
10) Area to be inspected after Hot work has been completed
11) Fire watch to stay in place for at least 30 minutes after operation
12) Warn all Employees working under hot work process.
13) Ensure adequate Mobile Water supply with Water Spray / Pressure available, at all times during Hot work Operation.
14) Harmful gases are given off when doing certain types of welding work and the Contractor shall provide a breathing apparatus when welding, cutting or heating:
   - zinc, lead, cadmium, mercury, or beryllium bearing based or coated materials in enclosed spaces;
   - stainless steel with inert-gas equipment;
   - in confined spaces;
   - galvanised steel;
   - Where an unusual condition can cause an unsafe accumulation of contaminants.
15) Proper protective equipment to prevent exposure of personnel shall be provided.
16) No welding or cutting shall be undertaken where hot metal or sparks can fall onto walkways, work areas, cable ladders, electrical equipment, etc. Before welding or cutting is started, fire retardant blankets shall be placed to arrest such hot metal or sparks. Particular attention shall be taken when working above cables that are not adequately covered.
17) Use an approved type flint gun for lighting of torches. Do not use matches, rope wicks or other smoldering materials.
18) Hoses shall be deflated before cutting torches are cleaned and nozzles not robbed against gloves
19) During welding operations, the earth lead is to be attached to the work area and never such that the earth is established through equipment bearings or through clearance gaps of any sort.
20) Welders and other people executing hot work shall not wear any jewellery and or carry cigarette lighters on their person.
21) All welding machines shall be earthed, receive power through an approved earth leakage and fitted with an approved voltage reducer. A certificate to be kept on register.

6.2 Grinders – Operating Procedures
- All machine guarding shall be in place
• Portable electrical equipment shall be numbered, on register, monthly inspected by competent appointed person with findings noted. Electrical equipment shall be colour coated (See portable electrical equipment procedure).
• Grinders (fixed grinders and angle grinders) may only be used on items emitting sparks when grinding.
• Fire extinguishers shall be present at all hot work activities.
• Only correct type disc shall be used for application. Do not grind with a cutting disc and do not cut with a grinding disc. Store discs properly and keep dry at all time. Do not use damaged, defective or expired discs.
• Sparks shall be contained and directed away from other employees.
• The use of angle grinders as cutting devices must be limited as far as practicable.
• The use of angle grinders is limited to artisans and operators who have received specific training in the use thereof. Competency certification shall be required.
• The use of angle grinders over 230mm is prohibited.
• Double eye protection and hearing protection is mandatory when using an angle grinder.
• Pferd, Performance Line SG, Grade S (steel) cutting and grinding discs must be used and kept in stock. Disc for special applications can be purchased as and when required.
### ANNEXURE 1: PPE/C SURVEY

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