

## Welding Safety

Document Number – OHS-PROC-137

This document applies to the following site(s):

Brisbane Office	<input type="checkbox"/>	CQ Hydrogen	<input type="checkbox"/>	FEITH	<input type="checkbox"/>
Iron Flow Battery SPS	<input type="checkbox"/>	Meandu Mine	<input type="checkbox"/>	Non-Operational Land	<input type="checkbox"/>
SAMCo	<input type="checkbox"/>	Stanwell Battery	<input type="checkbox"/>	Stanwell PS	<input checked="" type="checkbox"/>
Tarong Battery	<input type="checkbox"/>	Tarong Site	<input checked="" type="checkbox"/>	Wambo Wind Farm	<input type="checkbox"/>
Wivenhoe Pipeline	<input type="checkbox"/>				

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## 1.0 Purpose/ Scope

This Business Procedure describes Stanwell's methods for managing welding related hazards and controls; it does not address the specifics of the welding, brazing, cutting and gouging techniques that are included within the scope of welding.

This Business Procedure applies throughout Stanwell, all its operational sites that are under Stanwell's control. It applies to all Stanwell employees and contractors, including visitors to Stanwell workplaces.

This Business Procedure does **not** cover the electrical testing requirements for welding equipment. These requirements are covered in ASM-PROC-ENG-MAN-12: Electrical Compliance for Welding Machines, Generating Sets and Temporary Supplies.

## 2.0 Actions

When welding is undertaken, risks to health and safety arising from hazards must be controlled.

Examples of hazards include:

- contact with electrically live components;
- fire and explosion due to having a thermal source or spark in combination with combustible dusts, flammable materials, gases or liquids;
- radiation burns caused by exposure to welding arc;
- thermal burns caused by exposure to weld spatter or hot / molten materials;
- eye injury caused by exposure to radiation and foreign matter;
- excessive noise levels created as part of equipment use;
- illness caused by exposure to inhalation of fumes during welding, brazing, cutting, gouging or heating and welding of surfaces coated with plastics and / or other materials;
- asphyxiation caused by the displacement of oxygen by other gases in the work area, and
- carbon monoxide poisoning.

## 3.0 Safe Work Practices

A risk assessment is to be undertaken prior to a welding activity being carried out on site so as to identify the specific category of the welding area / environment, and to determine the necessary control measures to be implemented.

Note: Specialist welding and engineering workers may need to be sourced to assist in the determination of required welding and expected welding outcomes, (i.e. specific welds, welding techniques, inspections, etc.) as part of welding planning processes.

Requirements from the business procedure OHS-PROC-128: Hot Work must be considered and followed as part of the risk assessment undertaken for welding activities. This includes the use of the T-3840: Hot Work Area Assessment and T-3841 Hot Work Area Re-Assessment.

### 3.1 General Controls

During work tasks or when stored, welding leads, hoses, blowpipes, tips and nozzles are not to be left laying across workshop floors where they may be subject to damage and/or where they may create a trip hazard.

- Specific manufacturer requirements for each welding apparatus or item of equipment are to be followed at all times. Where specific requirements or safety precautions are not known, workers are to seek advice from a competent person prior to undertaking the work.
- Welding equipment and machines are to be manufactured in accordance with AS 60974.1:2006 Arc welding equipment Part 1: Welding Power Sources.
- Welding machines are required to have a clearly visible and permanent name plate that provides legible information relevant to the operating conditions of the machine.

- Welding machines must be within the current testing period. Attached to the machine will be a coloured electrical test tag indicating the category it has been tested for and current and next test date.
- All bottles, hoses and connections are to be checked to ensure that they are connected properly and ready for safe use prior to undertaking welding tasks.
- Gas cylinders are to be restrained and secured against movement at all times during storage, transport and use, and are not to be positioned in an access way or traffic area.
- Gas cylinders are to be transported in accordance with the Australian Dangerous Goods Code 2022, and are not to be transported within closed vehicles.
- Areas in which welding is undertaken are to be isolated through the use of translucent screens to reduce the impact of welding flash on persons working adjacent to the welding operations.
- Prior to undertaking welding tasks in designated hot work areas and non-designated hot work areas on site, specific planning and controls as per OHS-PROC-128 Hot Work and the Stanwell Safe Work System (ePAS) are to be implemented.
- If during any welding task, a faulty or unsafe item of welding plant is identified, the piece being worked on becomes unsafe, or the environment becomes unsafe, the task is to cease until the equipment or situation is corrected and it is safe to re-start work.

### 3.2 Fire and Explosion Controls

During welding tasks, controls are to be implemented to prevent fire and explosion as a result from:

- sparks and hot metallic particles and slag being generated that can cause combustion and smouldering of adjacent materials;
- electrode stubs that remain at high temperatures;
- gas leakages, improper use of oxygen and unsafe equipment;
- pierced or cut pressure hosing by sharp objects;
- burning of hosing by sparks, flame or hot slag;
- heating of gas cylinders;
- welding and cutting containers and piping that contain unknown gases / substances capable of causing ignition or explosion;
- burning or cutting through walls and partitions;
- poor electrical connections; and
- igniting metallic and non-metallic dusts capable of causing fire or explosions.

Note: The draining or opening of lines containing flammable substances and materials may also need to be supplemented by specific cleaning, rinsing and purging actions prior to work.

Flash back arrestors, suitable for the types of equipment used are to be fitted into both oxygen and fuel gas lines:

- between the blowpipe and hose; and
- at the regulator outlet.

Welding tasks that are required to be undertaken in, or adjacent to, a hazardous area on site must have the appropriate controls in place and align with requirements in OHS-PROC-128.

### 3.3 Fume Inhalation Controls

The type of welding and the work pieces being used dictate the various types of fumes that may be produced. During welding a range of metal oxide fumes and gases such as carbon dioxide, carbon monoxide, nitrogen oxide, ozone, argon and helium, are the principle constituents that may be produced. Controls must be implemented when generating airborne contaminants, including the use of suitable **Respiratory Protective Equipment (RPE)**. Controls include, as a minimum:

- Adequate ventilation and fume controls (natural ventilation, local exhaust ventilation or mechanical dilution ventilation) are to be ensured whenever welding tasks are being undertaken.

- Where a welding product is also a hazardous chemical, the Safety Data Sheet (SDS) for the product is to be provided. Refer to Hazardous Chemicals OHS-PROC-108, for further information regarding hazardous chemical use.
- Extraction systems and fans, both fixed within workshops and mobile units, are to be used wherever practicable to reduce the likelihood of workers breathing in fumes and other particulates.
- Powered Air Purifying Respirators (PAPR's) or half face respirators are also to be used by the welder.
- PAPR's or half face respirators are also to be used by other workers to supplement or in addition to the above-mentioned ventilation and extraction methods where fumes cannot be adequately drawn away from the breathing zones of workers.
- Where the following types of welding tasks are performed, additional information and verification is to be sought, as deemed necessary, from competent persons, the Health and Safety team, suppliers and / or welding documentation to ensure appropriate controls are implemented:
  - during the grinding of tungsten rods where dust may be inhaled;
  - during the welding of stainless where chrome VI (hexavalent chromium) may be inhaled;
  - during welding tasks involving 'exotic metals' where quantities of such constituents improve the performance of high-pressure systems or those that require a high level of chemical resistance;
  - during the welding of items covered or surrounded in coatings, paints, teflon, etc. where toxic compounds in a gas form may be inhaled that are not able to be blocked by particulate respirators.

## 3.4 Electrical Safety

### 3.4.1 General Controls

- Electrodes and work pieces are to be considered electrically 'live' at all times.
- During manual metal arc welding and arc-air gouging, the welder often frequently changes electrodes while the electrode holder is live. Fuses or earth leakage contact breakers do not protect the welder from such a hazard. Therefore, workers are to take every precaution to ensure they do not simultaneously touch the electrode and the work piece or steel work in the welder return path.
 

*Note: Hazard reduction devices (HRD) must be fitted on Category B and Category C welders which can be either a voltage reduction device (VRD) or a hand piece trigger switch. Remote isolation devices (RID) should also be fitted to the arc welding units and used wherever practicable by SCL workers and contractors to minimise the electrical hazards during arc welding tasks.*
- Faulty lead insulation and faulty insulation on the electrode holder or torch is also a common way in which electrocution may occur, therefore workers are to inspect their equipment to ensure that it is safe to work with prior to commencing welding tasks.
- Where practicable, measures are to be taken to ensure that live welding leads are not dragged on the ground during work and / or that they are protected against damage.
- The work area and piece(s) being welded are to be made dry and electrically safe as best as possible by using dry, fire-resisting insulation. Wooden duckboards, leather covered cushions, leather aprons and / or heat resistant blankets etc. may be used to achieve this.
- Areas where welding tasks are to be undertaken are to be made and / or kept as dry and cool as possible.
- In hot conditions or where high levels of perspiration may occur, suitable ventilation, regular rest breaks and glove / clothing changes are to be implemented as required and as practicable during the work.
- Other electrical requirements include, but are not limited to:
  - equipment is to be connected through a Residual Current Device (RCD).

- equipment, welding devices, leads and connections are to be checked and inspected prior to work to ensure that they are safe;
- when not in use, electrode holders and torches are to be placed in a location where they cannot make electrical contact with persons or the work piece / conductive objects;
- all equipment is to be turned off or disconnected, and manual metal arc welding (MMAW) electrodes and stubs removed from electrode holders, when not in use;
- manufacturer's instructions regarding electrical precautions for all equipment is to be implemented at all times;
- electrical and welding equipment is not to be used in a wet environment;
- unauthorised repairs or modifications (other than those by the manufacturer or SCL authorised electrician for electrical work tasks) on electrical and welding equipment is not to be undertaken; and
- extension cords and return leads are to be elevated and secured on a non-conductive surface and are not to be left across access ways.

### 3.4.2 Welding Categories

Australian Standard 1674.2:2007 Safety in welding and allied processes- Electrical classifies welding environments into three categories, A, B and C and details their identified control measures.

#### Category A Welding Environments

Category A Welding environments are environments where:

- the risk of an electric shock or electrocution by arc welding is low;
- normal work practice is used; and
- it is not possible for a welder or any other worker to be in contact with the work piece, in the event of being in contact with a live part of the welding circuit.

Category A welding environments require considerable effort to insulate the welder and others from the work piece. The type of work would typically be bench-top welding where the work piece is small and /or is a repetitive operation in an area such as a workshop. Under some conditions a category A environment could become a category B environment. E.g. change of weather conditions – cool at start (in the morning) and increased temperature during the day causing the welder to sweat freely.

For Category A Environments, the general control measures listed in 3.4.1 above apply.

#### Category B Welding Environments

Category B welding environments are those where there is a significant risk of the welder contacting the work piece or other parts of the welding circuit and where the ambient temperature is less than 32°C (reduced likelihood of clothing being damp due to moisture or perspiration) and:

- freedom of movement is restricted, so that an operator is forced to perform welding activities in a cramped position (e.g. kneeling, sitting, lying), with physical contact with conductive parts (e.g., the work piece); or
- there is a high risk of accidental or unavoidable contact by the operator with conductive element, which may or may not be in a confined space.

In Category B environments it is recognised that there is an increased risk of electric shock and include general fabrication activities, large work pieces, steel structures, inside pressure vessels, processing tanks and conductive confined spaces. Under some conditions, e.g. hot weather and/ or working in direct sun light, a Category B environment could become a Category C environment.

For Category B welding environments, in addition to the general controls listed above the following apply:

- where practicable, SCL is to attempt to convert a Category B Environment to a Category A Environment;

- open circuit voltage is not to exceed 113 V d.c. and 48 V a.c. (hazard-reduction device to be fitted where required);
- safety observer required (or other person capable of necessary emergency / rescue response such as a fire watch/monitor); or
- where there is no safety observer – open circuit voltage is not to exceed 35 V d.c. or 25 V a.c. (voltage-reduction device is typically required which will need a Category C welder);
- where the environment is a confined space, the provisions of AS 2865: 2009 - Safe Working in a Confined Space, apply (refer to OHS-PROC-18 Confined Space, for further information regarding work in a confined space).

### Category C Welding Environments

Category C welding environments are those where the risk of an electric shock or electrocution by arc welding is greatly increased due to reduced body impedance of the welder (clothing damp due to moisture or perspiration) and there is a significant risk of the welder contacting the work piece or other parts of the welding circuit.

Category C environments include, but are not limited to, trenches, underground welding tasks, splash zones, wet work areas or where the ambient temperature is 32C or greater.

For Category C Environments, in addition to the controls listed in Category B Welding Environment, the following apply:

- where practicable, SCL is to attempt to convert a Category C Environment to a Category B Environment;
- environment to be made as cool and dry as possible;
- safety observer required (or other person capable of necessary emergency / rescue response such as a fire watch/monitor);
- no welding equipment maintenance to be undertaken; and
- voltage between the electrode holder and the work piece, while an arc is not present, is not to exceed 35 V dc. or 25 V ac.

For further information on the selection, installation, testing and verification of welding machines refer to:

- Electrical Compliance for Welding Machines, Generating Sets and Temporary Supplies ASM-PROC-ENG-MAN-12
- AS1674.2:2007 Safety in welding and allied processes-Electrical
- Welding Technology Institute of Australia Tech Note 22-02
- Welding Technology of Australia Tech Note 7-13

## 3.5 Personal Protective Equipment (PPE)

The level of PPE required is to be determined through the risk assessment process, however the following minimum PPE is to be worn at all times by workers when undertaking welding tasks on site:

- welding gloves - dry and hole free;
- fireproof / protective clothing;
- welding helmet or face shield;
- goggles or safety glasses with side shields;
- Half Face respirator or PAPR; and
- rubber soled boots (without bare steel toe caps).

Note: Refer also to Personal Protective Equipment (PPE) OHS-PROC-30, for further information regarding PPE requirements.

## 3.6 Training and Competency

All workers involved with welding and welding tasks including those assessing and inspecting finished welding and welding standards are to be deemed competent. This may be evident through the verification of completed trade / welding certificates and training courses.

## 4.0 Review, Consultation and Communication

### Review:

This Document is required to be reviewed, as a minimum, every 5 years.

### Consultation:

Personnel consulted during the review of this document include Health, Safety and Environment professionals, Strategic and Operational services representatives any other personnel who have an interest in the process.

### Communication/Requirements after Update:

This Business Procedure will made available to all personnel on GenNet.

## 5.0 References

Source	Reference
<b>Legislation</b>	<ul style="list-style-type: none"> <li>Work Health and Safety Regulation 2011 (Qld), Chapter 7, 9</li> <li>Queensland Managing Risks of Hazardous Chemicals in the Workplace Code of Practice 2013</li> <li>Queensland Welding Processes Code of Practice 2013</li> <li>Australian Dangerous Goods Code 2011</li> <li>Queensland Electrical Safety Regulation 2013</li> <li>Welding Processes Code of Practice 2013</li> </ul>
<b>Standards</b>	<ul style="list-style-type: none"> <li>AS 1674.1:1997 Safety in Welding and Allied Processes– Fire Precautions</li> <li>AS 1674.2:2003 Safety in Welding and Allied Processes– Electrical</li> <li>AS 60974.1:2006 Arc welding equipment: Welding Power Sources</li> <li>AS1674.2:2007 Safety in welding and allied processes- Electrical</li> <li>AS 2865: 2009 Safe Working in a Confined Space</li> <li>Welding Technology Institute of Australia Tech Note 22-02</li> <li>Welding Technology of Australia Tech Note 7-13</li> </ul>
<b>Business Procedures</b>	<ul style="list-style-type: none"> <li>Confined Space OHS-PROC-18</li> <li>Hot Work OHS-PROC-128</li> <li>Hazardous Chemicals OHS-PROC-108</li> <li>Personal Protective Equipment OHS-PROC-30</li> <li>Electrical Compliance for Welding Machines, Generating Sets and Temporary Supplies ASM-PROC-ENG-MAN-12</li> </ul>
<b>Stay Safe</b>	<ul style="list-style-type: none"> <li>Stay Safe - Welding Safety OHS-PROC-137A</li> </ul>
<b>Tools</b>	<ul style="list-style-type: none"> <li>T-3840: Hot Work Area Assessment</li> <li>T-3841: Hot Work Are Re-Assessment Form</li> </ul>

## 6.0 Definitions

Term	Meaning
<b>Allied process</b>	Includes cutting, grinding and gouging associated with welding.
<b>Competent Person</b>	A person who has through a combination of training, education and experience, acquired knowledge and skills enabling that person to perform correctly the specified task.
<b>Category A welding environment</b>	An environment where- <ul style="list-style-type: none"> <li>the risk of electric shock or electrocution by arc welding is low;</li> <li>normal work practice is used; and</li> </ul>

Term	Meaning
	<ul style="list-style-type: none"> <li>it is not possible for a welder or any other worker to be in contact with the work piece, in the event of being in contact with a live part of the welding circuit.</li> </ul>
<b>Category B welding environment</b>	<p>An environment where there is a significant risk of the welder contacting the work piece or other parts of the welding circuit. Such an environment may be found where the ambient temperature is less than 32°C and:</p> <ul style="list-style-type: none"> <li>freedom of movement is restricted, so that an operator is forced to perform welding in a cramped position (e.g. kneeling, sitting, lying), with physical contact with conductive parts (e.g. the work piece); or</li> <li>there is a high risk of accidental or unavoidable contact by the operator with conductive elements, which may or may not be a confined space as defined in OHS-PROC-18 Confined Space.</li> </ul> <p><i>Note: Category B environments include general fabrication tasks, large work pieces, steel building structures, inside pressure vessels, processing tanks, storage tanks, conductive confined spaces and inside ships.</i></p>
<b>Category C welding environment</b>	<p>An environment where the risk of an electric shock or electrocution by arc welding is greatly increased due to the presence of water, moisture or heat, particularly where the ambient temperature is above 32°C.</p> <p><i>Note: Category C environments include coffer dams, trenches, in rain, underwater, partially submerged areas and splash zones.</i></p>
<b>Hazardous Area</b>	<p>An area in which an explosive atmosphere is present or may be expected to be present, in quantities such as to require special precautions for:</p> <ul style="list-style-type: none"> <li>any access or activity that presents an ignition source; or</li> <li>the construction, installation and use of electrical equipment.</li> </ul>
<b>Hazardous Chemical</b>	<p>A hazardous chemical is a substance, mixture or article that satisfies the criteria for a hazard class in the <i>Globally Harmonised System of Classification and Labelling of Chemicals</i> (including a classification referred to in <i>Schedule 6 of the WHS Regulation</i>), but does not include a substance, mixture or article that satisfies the criteria solely for one of the following hazard classes:</p> <ul style="list-style-type: none"> <li>acute toxicity—oral—category 5;</li> <li>acute toxicity—dermal—category 5;</li> <li>acute toxicity—inhalation—category 5;</li> <li>skin corrosion/irritation—category 3;</li> <li>serious eye damage/eye irritation— category 2B;</li> <li>aspiration hazard—category 2;</li> <li>flammable gas—category 2;</li> <li>acute hazard to the aquatic environment—category 1, 2 or 3;</li> <li>chronic hazard to the aquatic environment—category 1, 2, 3 or 4;</li> <li>hazardous to the ozone layer.</li> </ul> <p><i>Notes:</i>  <i>The Schedule 6 tables replace some tables in the GHS.</i>  <i>Most substances and mixtures that are dangerous goods under the ADG Code are hazardous chemicals, except those that have only radioactive hazards (class 7 dangerous goods), infectious substances (division 6.2) and most class 9 (miscellaneous) dangerous goods.</i></p>
<b>Safety Data Sheet (SDS)</b>	<p>A document that provides information on the properties of hazardous chemicals and how they affect health and safety in the workplaces. A</p>



Term	Meaning
	<p>SDS shall:</p> <ul style="list-style-type: none"> <li>• be in English</li> <li>• contain unit measures expressed in Australian legal units of measurement under the <i>National Measurement Act 1960</i> (Commonwealth)</li> <li>• state that date it was last reviewed, or if it has not been reviewed, the date it was prepared</li> <li>• state the name, Australian address and business telephone numbers of: <ul style="list-style-type: none"> <li>○ the manufacturer, or</li> <li>○ the importer</li> </ul> </li> <li>• state an Australian business telephone number from which information about the chemical can be obtained in an emergency.</li> </ul>
<b>Welding</b>	<p>The making of a joint between parts, by means of heat or pressure or both, in such a way that there is continuity in the nature of the material of the parts. A filler material may or may not be used.</p> <p><i>Note: Welding techniques number over 80 different processes with Manual Metal Arc (MMA) being far the most common. Other commonly encountered types include:</i></p> <p>Welding</p> <ul style="list-style-type: none"> <li>• Metal-Inert Gas (MIG)</li> <li>• Tungsten-Inert Gas (TIG)</li> <li>• Spot (Resistance)</li> </ul> <p>Allied processes: brazing, soldering, cutting and gouging</p> <ul style="list-style-type: none"> <li>• Gas cutting</li> <li>• Plasma cutting</li> <li>• Gas gouging</li> <li>• Carbon arc air gouging</li> <li>• Oxygen lance</li> </ul>

## 7.0 Revision History

Rev. No.	Rev. Date	Revision Description	Author	Endorse/Check	Approved By
0	15.03.2016	Document issued as part of the consolidation of legacy documentation.	Jan Fullard	Michael Joy / Trevor Hooper	Ian Gilbar
1	04.03.2024	Document Due for Review	Kieran Carney	Carl Rothman	Letitia Lucke

## 8.0 Appendices

### Appendix A: Welding Safety Document Flowchart

