Perform manual heating and thermal cutting

This learning resource supports the unit of competency MEM05007 Perform manual heating and thermal cutting
Perform manual heating and thermal cutting

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Overview

This resource covers the competencies required for manual heating, thermal cutting and gouging, including the assembly, disassembly and operation of the equipment on a range of materials (e.g. ferrous, non-ferrous and non-metallic) using a variety of methods.

Manual or automatic processes are used to cut and heat to specifications. Cutting may include flame gouging by hand. All work must be carried out to legislative and regulatory requirements. Cutting and heating may be applied to material of various thicknesses and types, including ferrous, non-ferrous and non-metallic materials by a variety of methods, which may include fuel gas, oxy-fuel gas and air-fuel gas. It is applicable in both a learning and assessment pathway and an assessment only pathway.

This unit is performed in the context that all materials and equipment needed to carry out this function have been provided, including learning materials, learning programs and learning resources.

Elements

To achieve competency in this unit you must demonstrate your ability to:

1. Assemble/disassemble plant and equipment for manual heating and thermal cutting
2. Operate heating and thermal cutting equipment.

Prerequisite units of competency

Nil
How to use this resource

For the trainer

This learner's resource contains information in response to the unit of competency. It is designed to stand alone as a resource to help achieve competency.

Using this manual

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

Assessment

To satisfactorily assess the learner against the unit of competency you need to gather sufficient evidence about the person's competence. This may require gathering additional evidence (for instance from the learner's workplace) to that provided by the practical assessment.

You should refer to the Assessment Guidelines contained in the MEM05 Metal and Engineering Training Package as the final authority for assessment against units of competency in this Training Package.
For the learner

This learner's resource contains information in response to the unit of competency and reference material. It is designed to stand alone as a resource to help achieve competency.

Assessment

Assessment against units of competency relies on your trainer/assessor gathering enough evidence to demonstrate that you can meet the requirements of the unit.

To verify that you are competent in this competency unit, an assessment will be carried out using a combination of practical activities and testing of underpinning knowledge identified in the unit. These results will be recorded by the trainer to contribute to evidence of competency.

Alternatively, if you are undertaking this unit in the workplace, you may be assessed by being questioned and observed performing a range of related tasks on the job.

You may also wish to speak to your trainer about supplying evidence of competency you have gained elsewhere (e.g. work pieces you have already produced) which may contribute to your assessment.

Recognition of prior learning

If you believe you can already meet the assessment criteria for a particular unit of competency, or have completed similar training, you may be eligible for recognition of prior learning (RPL). Eligibility for RPL will reduce the learning time or remove the need for you to complete this unit. Contact your trainer to discuss this further.
Manual heating and thermal cutting

1.0 Introduction

1.1 Oxy-fuel gas cutting

Oxy-fuel gas cutting is a group of oxygen cutting processes that uses heat from an oxy-fuel gas flame to raise the temperature of the metal to its kindling temperature before a high-pressure stream of oxygen is directed onto the metal, causing it to be cut. The kindling temperature of a material is the temperature at which rapid oxidation (combustion) can begin. The kindling temperature of steel in pure oxygen is 870 °C to 900 °C. The processes in this group are identified by the type of fuel gas used with oxygen to produce the pre-heat flame. Oxy-fuel gas cutting is most commonly performed with oxygen and acetylene gas.

The following table lists a number of other fuel gases used for oxy-fuel gas cutting. MAPP® gas is increasingly being used today for cutting, and rivals acetylene's popularity in some areas of the country.

<table>
<thead>
<tr>
<th>Fuel gas</th>
<th>Flame (Celsius °)</th>
<th>Flame (Fahrenheit °)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetylene</td>
<td>3087</td>
<td>5589</td>
</tr>
<tr>
<td>MAPP®</td>
<td>2927</td>
<td>5301</td>
</tr>
<tr>
<td>Natural gas</td>
<td>2538</td>
<td>4600</td>
</tr>
<tr>
<td>Propane</td>
<td>2526</td>
<td>4579</td>
</tr>
<tr>
<td>Propylene</td>
<td>2867</td>
<td>5193</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>2660</td>
<td>4820</td>
</tr>
</tbody>
</table>

More people use the oxy-fuel cutting torch than any other welding process. The cutting torch is used by workers in virtually all areas, including manufacturing, maintenance, automotive repair, railroad, farming and more. It is unfortunately one of the most commonly misused processes. Most workers know how to light the
torch and make a cut, but their cuts are very poor quality. Often, in addition to making bad cuts, they use unsafe torch techniques. A good oxy-fuel cut should not only be straight and square, but it also should require little or no post-cut clean-up. Excessive post-cut clean-up results in extra cost, which is an expense that cannot be justified.

Manual, mechanised, and automatic oxy-fuel gas cutting processes are used in industry. Hand-controlled, manual cutting is done in short-run production and one-of-a-kind fabrication, as well as in demolition and scrapping operations. Manual cutting is also used in the field for steel construction. Mechanised or automatic cutting is widely used in production work where a large number of identical cuts are made over and over or where very precise cuts are required. In mechanised or automatic cutting more than one cutting head may be mounted so several cuts can be made at the same time.

Various oxy-fuel cutting specialties are found on the job, including flame cutting, gouging, bevelling, scarfing and the operation of an automated cutting machine. In addition to these cutting jobs, some welders work dismantling scrap metal, such as scrap autos or construction demolition.

1.2 Metals cut by oxy-fuel process

Oxy-fuel gas cutting is used to cut iron-based alloys. Low carbon steels (up to 0.3% carbon) are easy to cut. Any metal that requires pre-heating for welding, such as high alloy and high alloy carbon steels should also be pre-heated before cutting. High nickel steels, cast iron and stainless steel are difficult to cut. Most non-ferrous metals, such as brass, copper and aluminium, cannot be cut by oxy-fuel cutting. A few reactive non-ferrous metals, such as titanium and magnesium, can be cut. These metals are seldom cut with the oxy-fuel gas cutting processes because of the extensive post-cut clean-up required.