**NZQA**

**Approved**

Achievement standard: 90936 Version 3

Standard title: Demonstrate understanding of the physics of an application

Level: 1

Credits: 2

Resource title: Manual metal arc welding

Resource reference: Physics VP-1.2 v2

Vocational pathway: Manufacturing and Technology

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| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number A-A-02-2015-90936-02-7286 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.  Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

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Learner instructions

# Introduction

This assessment activity requires you to demonstrate your understanding of how physics is used in the manual metal arc welding process.

You are going to be assessed on how you demonstrate comprehensive understanding of the physics of an application. You need to show that you can process and interpret information, and prepare a report that identifies the key physics used in the manual metal arc welding process and gives a detailed and comprehensive explanation of how the physics that has been identified is integrated within the application.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions, and modify them if necessary to suit their learners.

# Task

Manual metal arc welding (MMAW), also known as shielded metal arc welding, stick welding, or electric arc welding, is an advanced welding process which involves an electric power source which converts electric energy into heat energy for melting materials to be joined. Manual metal arc welding involves low-voltage, high-current arcs between an electrode and the material to be welded.

Report on your understandings of how physics is used in the manual metal arc welding process by doing the following:

* Carry out research into the process of manual metal arc welding. See Resources for useful websites.
* Use your knowledge of physics to produce a report that explains the process of welding using stick electrodes. Examine, if possible, an actual welding machine to see it working, and study the data on the rating plate and in the operating manual.
* Make sure your report clearly demonstrates your understanding of the way physics is used in the electric arc welding process, by identifying aspects of physics related to the correct operation and problems in the following:
  + the type of input power required for the particular welder you are researching, the voltage, and the current rating
  + the type of output power that can be delivered from the machine, and the rated values
  + the sizes of electrodes that can be used, and how that is related to the physics of the machine
  + series and parallel circuits that may exist in the electric arc welding process
  + conducting and insulating materials used in the machine, cables, and fittings manufacture
  + earthing of the power source (welding machine) and return circuit for the welded components
  + the relationship between voltage, current, resistance, and power in a circuit.

You may include equations and calculations.

* Produce your report, which could be:
  + a written report, including illustrations, diagrams, and graphs, if appropriate
  + a poster, including annotations or supporting notes
  + an oral presentation, with written references
  + a project booklet
  + a multi-media report, for example a recorded video report or web page with embedded video, graphics, and text
  + a computer presentation software file.
* Use your own words, unless quoting, and clearly indicate any direct quotes. Your report should be between two and four A4 pages in length, including any illustrations, diagrams, and graphs. If the work is in another format, it should be of equivalent length. All sources of information, images, diagrams, and data must be acknowledged and referenced in a format that enables them to be easily traced.
* Non-text formats, for example an oral report, must be supplemented by a written list of references.

# Resources

Useful websites include:

<http://www.twi.co.uk/technical-knowledge/job-knowledge/job-knowledge-2-the-manual-metal-arc-process-mma-welding/>

<http://science.howstuffworks.com/welding2.htm>

<http://www.physicsclassroom.com/class/estatics/u8l1d.cfm>

<http://www.electronics-tutorials.ws/dccircuits/dcp_1.html>

<http://science.howstuffworks.com/electricity7.htm>

<http://www.diffen.com/difference/Alternating_Current_vs_Direct_Current>

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Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

This activity requires learners to demonstrate comprehensive understanding of the physics used in the manual metal arc welding process. The learner must prepare a report identifying the key physics used and giving a detailed and comprehensive explanation of how the physics that has been used makes the process work.

# Conditions

Learners may collectively examine and observe a working machine; however they must do their own research, and write their reports individually, and will be assessed individually.

You will need to decide on the format of the final report. You may wish to take learners’ preferences into account in deciding on the format.

# Resource requirements

Learners will require access to the internet for research.

# Additional information

None.

# Assessment schedule: Physics 90936 – Manual metal arc welding

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner demonstrates understanding of the physics used in the manual metal arc welding process by:   * identifying the key physics used in the manual metal arc welding process * describing how the physics that has been identified is used   For example, the learner describes:   * the general relationship between voltage, current, and resistance, and how this relates to the process of manual metal arc welding * the nature of conductors and insulators, the nature of series and parallel circuits, and how this relates to the process of manual metal arc welding.   *The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates in-depth understanding of the physics used in the manual metal arc welding process by:   * identifying the key physics used in the manual metal arc welding process * explaining how or why the physics that has been identified makes the process work   For example, the learner explains:   * the power circuits present in the welding machine * how voltage, resistance, current, and power are related, and how they differ in welding circuits and operations * how resistance can be calculated in the welding machine circuits * the role conductors and insulators play in the design of the welding machine.   *The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates comprehensive understanding of the physics used in the manual metal arc welding process by:   * identifying the key physics used in the manual metal arc welding process * giving a detailed and comprehensive explanation of how the physics that has been used makes the process work. A comprehensive explanation may involve elaborating, justifying, relating, evaluating, comparing and contrasting, or analysing   For example, the learner explains:   * how voltage, resistance, and current are related, and how they differ and vary in each welding circuit during operations * how power varies during welding operations, and the calculated values * how the process parameters varies the current and resistance of the circuits, e.g. electrode size and arc gap * the role conductors and insulators play in the design of the welding machine, and the protection insulation and earthing provide for the operator.   *The above expected learner responses are indicative only and relate to just part of what is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.