

Title	Demonstrate and apply knowledge of welding low carbon steel		
Level	3	Credits	3

Purpose	<p>This unit standard provides a welding introduction that leads to a range of more specialised welding unit standards.</p> <p>People credited with this unit standard are able to demonstrate knowledge of effects of welding and weldability on ferrous metals; the MMAW, GMAW, and FCAW processes for welding low carbon steel; and weld low carbon steel.</p>
----------------	---

Classification	Mechanical Engineering > Welding
-----------------------	----------------------------------

Available grade	Achieved
------------------------	----------

Prerequisites	Unit 29651, <i>Demonstrate knowledge of health and safety when welding and thermal cutting</i> , or demonstrate equivalent knowledge and skills.
----------------------	--

Guidance Information

1 References

Health and Safety at Work Act 2015.

Health and Safety in Welding. Wellington: Department of Labour, 2006. Available from <http://www.worksafe.govt.nz>.

AS/NZS 1554.1:2014 *Structural steel welding – Welding of steel structures*.

2 Definitions

Accepted industry practice – approved codes of practice and standardised procedures accepted by the wider mechanical engineering industry sectors as examples of best practice.

FCAW – Flux Cored Arc Welding.

GMAW – Gas Metal Arc Welding, also referred to as Metal Inert Gas (MIG) welding.

Low carbon steel – weldable low-carbon unalloyed (carbon-manganese) steel, also referred to as *mild steel*.

MMAW – Manual Metal Arc Welding.

Welding procedure – written work instruction providing all the necessary technical detail for a specific welding application.

Workplace procedures – procedures used by the organisation carrying out the work and applicable to the tasks being carried out. Examples are – standard operating procedures, safety procedures, equipment operating procedures, codes of practice, quality management practices and standards, procedures to comply with legislative and local body requirements.

3 Related unit standards

This unit standard is one of a manual metal arc welding set that is intended to be assessed in the following order:

- Unit 22906, *Demonstrate and apply knowledge of welding low carbon steel* (Level 3); an introductory standard for use across all mechanical engineering trades.
- Unit 2682, *Weld steel in the downhand positions to general purpose industry standard using the manual metal arc welding process* (Level 3); a progressive general purpose unit standard suitable for all mechanical engineering trades.
- Unit 2671, *Weld steel in the downhand positions to structural industry standard using the manual metal arc welding process* (Level 3); a structural welding standard for steel fabricators who weld downhand to a certified structural standard.
- Unit 2685, *Weld steel structures in all positions using the manual metal arc welding process* (Level 4); a structural welding standard for steel fabricators who weld in all positions to a certified structural standard.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of the effects of welding and weldability on ferrous metals.

Performance criteria

- 1.1 The effects of welding on mechanical properties are explained for ferrous metals in relation to material composition, section thickness, welding heat input, and cooling rates.
- 1.2 Weldability of different ferrous metals is compared.
- | | |
|-------|---|
| Range | ferrous metals – low carbon steel, structural steel, high strength steel, grey cast iron. |
|-------|---|
- 1.3 Methods of applying preheat and controlling the cooling rate are described for steel.
- 1.4 Weld faults in steel are identified in accordance with accepted industry practice, and remedial and preventative actions described.
- | | |
|-------|---|
| Range | faults – cracks, lack of fusion, incomplete penetration, porosity, undercut, incorrect weld shape and size. |
|-------|---|
- 1.5 General distortion considerations are described for welding ferrous metals.

Outcome 2

Demonstrate knowledge of the MMAW process for welding low carbon steel.

Performance criteria

2.1 The characteristics of the welding power source are described in terms of their effect on MMAW welding.

Range characteristics – constant current, current type (alternating/direct), rating, duty cycle, open circuit voltage, arc voltage, welding current, arc starting aids.

2.2 The advantages and limitations of the MMAW process are explained compared to other welding processes.

Range other welding processes – GMAW, FCAW, GTAW.

2.3 Requirements for selection, handling, and storage of welding consumables are described for rutile electrodes and basic electrodes in accordance with accepted industry practice.

2.4 Process specific distortion considerations are described for MMAW.

Outcome 3

Demonstrate knowledge of the GMAW and FCAW processes for welding low carbon steel.

Performance criteria

3.1 The characteristics of the welding equipment are described in terms of effect on GMAW and FCAW welding.

Range characteristics – constant voltage, current type (alternating/direct), rating, duty cycle, voltage, synergic control, wire feed speed, welding current, burn back control, welding gun set-up.

3.2 The advantages and limitations of GMAW and FCAW welding are compared to MMAW and GTAW.

3.3 Requirements for the selection, handling, and storage of GMAW and FCAW welding consumables are described in accordance with accepted industry practice.

Range consumables – solid wire electrodes, gas-shielded rutile FCAW electrodes, self-shielded FCAW electrodes; shielding gases.

3.4 Process specific distortion considerations are described for GMAW and FCAW.

Outcome 4

Weld low carbon steel.

Range six welds consisting of one lap or tee fillet weld in the horizontal-vertical position and one butt weld in the flat position for each of the MMAW, GMAW, and FCAW processes, using steel plate or sections in the 3-10 mm thickness range.

Performance criteria

4.1 Workplace safety procedures are followed.

Range examples are – use of personal protective equipment, checking of equipment for faults, use of fume extraction equipment, elimination of risk of fire or explosion, protection from arc radiation.

4.2 Equipment is checked, set-up, and used appropriately in accordance with workplace procedures.

4.3 Metals are prepared and welded in accordance with the welding procedure.

4.4 Welds are examined visually and imperfections are identified in accordance with workplace procedures.

4.5 Component damage is minimised and distortion is controlled during welding and handling in accordance with accepted industry practice.

Planned review date	31 December 2022
----------------------------	------------------

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	20 June 2006	31 December 2022
Rollover and Revision	2	17 September 2010	31 December 2022
Review	3	20 July 2017	N/A

Consent and Moderation Requirements (CMR) reference	0013
--	------

This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Comments on this unit standard

Please contact Competenz qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.