Title	**Demonstrate knowledge of welding metallurgy**		
Level	**5**	**Credits**	**20**

Purpose	People credited with this unit standard are able to demonstrate knowledge of: the role of carbon and manganese in weldable steels; the effects of welding on steels; and the weldability of metals.

Classification	Mechanical Engineering > Welding

Available grade	Achieved

Guidance Information

1 This unit standard is for people seeking the *International Welding Specialist* qualification from the International Institute of Welding (IIW). Details are available from the Heavy Engineering Research Association, PO Box 76 134, Manukau City.

2 Industry standards/codes relevant to this unit standard include (but are not limited to):
- a AS/NZS 1554.1:2004:*Structural steel welding – Welding of steel structures*.
- b *The 2004 ASME Boiler and Pressure Vessel Code*.
- c ISO 15607:2003:*Specification and qualification of welding procedures for metallic materials – General rules.*

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of the role of carbon and manganese in weldable steels.

Performance criteria

1.1 The methods of manufacture and designation are identified for weldable steels.

1.2 The mechanical properties of iron-carbon alloys are identified and explained in terms of their composition, and time-temperature transformations.

1.3 Plain carbon and carbon-manganese steels are assessed for weldability.

1.4 Heat treatments of weldments are explained in terms of processes and procedures.

1.5 Alloying elements are described in terms of their effects on the properties of steels, and in relation to phase diagrams.

Outcome 2

Demonstrate knowledge of the effects of welding on steels.

Performance criteria

2.1 Heat input and cooling rates are described in terms of their effect on the structures of welded joints.

2.2 Examples of cracking phenomena in welded joints are identified.

Range hydrogen induced cracking, hot cracking, lamellar tearing.

2.3 Methods for the destructive testing of materials and weld joints are described.

Range tensile, bend, notch impact, hardness, fatigue tests.

Outcome 3

Demonstrate knowledge of the weldability of metals.

Performance criteria

3.1 The welding procedures required for fine-grained steels are described in terms of the t8/5 concept.

3.2 The characteristics of thermomechanically treated steels are identified in terms of requiring specific welding procedures.

Range chemical composition, mechanical properties, weldability.

3.3 Welded applications are identified for structural and high strength steels.

Range bridges, cranes, pressure vessels, low temperature applications, vehicles.

3.4 Welding problems and precautions are identified for low alloy steels.

Range low alloy steels include – very low temperature steels, creep resistance steels.

3.5 The parameters required for welding stainless steels are described in terms of the required properties of the joint.

Range parameters – control of heat input, weld metal composition; properties – corrosion resistance, strength, toughness.

3.6 Welding methods that avoid defects are identified for aluminium and aluminium alloys.

Range methods – arc welding using inert shielding gases, suitable joint preparations, correct filler metal composition;
defects – oxidation, cracking, porosity.

This unit standard is expiring. Assessment against the standard must take place by the last date for assessment set out below.

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	4 April 2001	31 December 2025
Rollover and Revision	2	20 April 2006	31 December 2025
Review	3	26 January 2023	31 December 2025

Consent and Moderation Requirements (CMR) reference	0013

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