

Title	Demonstrate knowledge of heat treatment for engineering steels		
Level	4	Credits	5

Purpose	People credited with this unit standard are able to demonstrate knowledge of: the principles of heat treatment of engineering steels; heat treatment processes; and heat treatment applications.
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Classification	Mechanical Engineering > Engineering - Materials
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Available grade	Achieved
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Guidance Information

- 1 Definitions
Engineering steels – plain carbon steels and alloy steels.
Plain carbon steels – steels with carbon as the only alloying element.
Alloy steels – any steel that has significant additions of any element other than carbon.
- 2 Recommended skills and knowledge:
 Unit 4797, *Demonstrate knowledge of the composition of engineering metals*; or demonstrate equivalent knowledge and skills.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of the principles of heat treatment of engineering steels.

Performance criteria

- 1.1 Heat treatment of engineering steels is described in terms of its purpose.
- 1.2 Iron-carbon equilibrium diagram is interpreted and related to phases and phase changes.
- 1.3 Transformations in microstructure are identified and related to iron-carbon phase changes.

Range austenite, ferrite, pearlite, cementite, martensite.

1.4 The concept of critical temperature is described as it applies to the heat treatment of engineering steels.

Range upper and lower critical temperatures.

1.5 Changes in the microstructure and properties of steel are described in terms of the effects of quenching and tempering.

Outcome 2

Demonstrate knowledge of heat treatment processes.

Performance criteria

2.1 Heat treatment processes are described in terms of the effects they have on microstructure and mechanical properties of engineering steels.

Range processes include but are not limited to – annealing, homogenising, stress relieving, sub-critical annealing, normalising, hardening, tempering, case-hardening; mechanical properties include but are not limited to – hardness, brittleness, machinability, formability, toughness.

2.2 Tempering is described in terms of methods available.

Range includes but is not limited to – colour method, oil, lead bath, sand, furnace/oven, salt.

2.3 Quenching media are identified for specific heat treatment processes.

Range includes but is not limited to – oil, water, brine, air, salt.

2.4 Quenching method and medium are described in terms of the different requirements for plain carbon steels and alloy steels.

2.5 Sectional thickness and quenching medium are described in terms of their influence on hardness of heat-treated steel.

2.6 Cooling curves are used to identify cooling rates for different types of engineering steels.

Range cooling curves – temperature-time-transformation (TTT) and continuous-cooling-transformation (CCT) diagrams, Jominy curves; evidence is required for one plain carbon steel and one alloy steel.

2.7 Steels and heat treatment processes are selected to achieve specified metal properties.

Range mechanical, machinability, and formability properties.

Outcome 3

Demonstrate knowledge of heat treatment applications.

Performance criteria

3.1 Heat treatment processes are related to steel applications.

Range includes but is not limited to – tools and dies, crankshafts, connecting rods, fabrications, springs.

3.2 Martensitic steels are described in terms of their limitations in engineering applications.

Replacement information	This unit standard has been replaced by unit standard 29552.
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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	30 June 1995	31 December 2011
Revision	2	14 April 1997	31 December 2011
Revision	3	5 January 1999	31 December 2011
Revision	4	23 May 2001	31 December 2011
Review	5	26 July 2004	31 December 2014
Review	6	17 June 2011	31 December 2022
Review	7	8 December 2016	31 December 2022
Rollover	8	16 December 2021	31 December 2022

Consent and Moderation Requirements (CMR) reference	0013
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.