Title	**Determine the inclusion content of steel**		
Level	**5**	**Credits**	**10**

Purpose	People credited with this standard are able to: prepare samples for analysis; select an inspection method; and measure the inclusion content of steel.

Classification	Mechanical Engineering > Metal Forming

Available grade	Achieved

Guidance Information

1 Unit 21911, *Demonstrate knowledge of safety on engineering worksites*; and Unit 21912, *Apply safe working practices on an engineering worksite* are recommended for entry into this unit standard.

2 References and legislation
Health and Safety at Work Act 2015.
ASM Handbook Volume 9, Metallography and Microstructures. Ohio: ASM International, 2004. ISBN: 978-0-87170-706-2.
American Society for Testing Materials (ASTM) E45–13, *Standard Test Methods for Determining the Inclusion Content of Steel*. Available at: http://www.astm.org/Standards/E45.htm.

3 Definitions
Accepted industry practice refers to approved codes of practice and standardised procedures accepted by the wider mechanical engineering industry sectors as examples of best practice.
Workplace procedures refer to procedures used by the organisation carrying out the work and applicable to the tasks being carried out. They may include but are not limited to – 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.

4 Assessment Information
All activities must comply with applicable workplace procedures and must be consistent with accepted industry practice.

Outcomes and performance criteria

Outcome 1

Prepare samples for analysis.

Performance criteria

1.1 Statistical sampling plan is obtained from workplace procedures to meet the production lot size.

1.2 Samples are taken from the production lot in accordance with the statistical sampling plan.

1.3 Sample position and orientation data are recorded.

Outcome 2

Select an inspection method.

Performance criteria

2.1 Test method is selected (based on steel production route and expected end use) in accordance with ASTM E45–11.

Range macroscopic method >40μm – macro-etch, fracture, step down; magnetic particle method and/or microscopic methods <40μm – methods A, B, C, D, E of ASTM E45–11.

2.2 Equipment selected is consistent with sample type and test method.

Range the equipment may include but is not limited to – microscope, stereo microscope, magnetic particle equipment, camera, rating charts.

Outcome 3

Measure the inclusion content of steel.

Performance criteria

3.1 Specimens are checked to verify that sample preparation is in accordance with inspection method requirements.

3.2 Analysis and rating of specimen are consistent with the morphology and likely source of inclusions.

Range morphology – size, shape, location, distribution;
type and/or source of inclusions – deoxidation, exogenous, carbide, reoxidation.

3.3 Rating is recorded for each separate analysis on each specimen.

Planned review date	31 December 2021

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	25 July 1999	31 December 2012
Review	2	19 May 2006	31 December 2016
Rollover and Revision	3	17 November 2011	31 December 2022
Review	4	15 September 2016	N/A
Revision	5	23 November 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.