

Title	Demonstrate and apply knowledge of industrial instrumentation installation		
Level	4	Credits	8

Purpose	<p>This unit standard covers knowledge and skills that can be applied in industrial installations and includes tube bending, use of swaged fittings, termination of shielded cables, and testing of loop wiring.</p> <p>This unit standard does not cover the full installation of transmitters and full panel wiring, which are covered by Unit 9180 <i>Install or replace, test, and commission industrial instrumentation</i>.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> – describe instrument tubing, pipework, and fittings; – prepare instrument tubing, pipework, and fittings; – specify requirements for a differential pressure transmitter installation; – specify requirements for instrument loop cabling and panel wiring, and wire an instrument 4-20 mA loop; – specify installation requirements for a temperature measuring element and associated transmitter; and – test instrumentation.
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Classification	Industrial Measurement and Control > Industrial Measurement and Control - Installation
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Available grade	Achieved
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Guidance Information

1 References

- Electricity Act 1992;
- Electricity (Safety) Regulations 2010;
- Health and Safety at Work Act 2015 and associated regulations;
- ISO 2186:2007 *Fluid flow in closed conduits – Connections for pressure signal transmissions between primary and secondary elements*;
- ISO 5167-1:2003 *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full – Part 1: General principles and requirements*;
- ASME B16.5-2017 *Pipe Flanges and Flanged Fittings*;
- ISO 261:1998 *ISO general purpose metric screw threads – General plan*;
- ASME B1.13M-2005 *Metric Screw Threads: M Profile*
- ASME Section IX, Certified Welding;

ISSN 0114-0663, *New Zealand Electrical codes of practice*, available from Worksafe, <https://worksafe.govt.nz/>; and all subsequent amendments and replacements.

- 2 Definitions
 - HART* – highway addressable remote transducer protocol.
 - Industry requirements* – includes all asset owner requirements; manufacturers' specifications; enterprise requirements which cover the documented workplace policies, procedures, specifications, and business requirements; and quality management requirements relevant to the workplace in which the assessment is carried out.
 - RTD* – resistance temperature detector.
- 3 Safety and proper workshop practices must be maintained at all times. Work carried out within this unit standard may be subject to requirements of the Electricity Act 1992, Electricity (Safety) Regulations 2010 and the Electrical Codes of Practice.
- 4 Recommended skills and knowledge: Unit 9180 *Install or replace, test, and commission industrial instrumentation*.

Outcomes and performance criteria

Outcome 1

Describe instrument tubing, pipework, and fittings.

Performance criteria

- 1.1 Identify and compare pipe threads used in instrument installation to ensure thread types are not mixed.

Range	British Standard Pipe (BSP), British Standard Pipe Parallel (BSPP), British Standard Pipe Taper (BSPT), Unified Fine Threads (UNF), ISO 261 ISO General Purpose Metric Screw Threads – General Plan, ASME B1.13M Metric Screw Threads: M profile.
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- 1.2 State pipe flange types used in instrument pipework installations in accordance with industry requirements.
- 1.3 Identify pipe sizes and internal diameter from outside diameter and pipe schedules.
- 1.4 Identify pipe flange types that require certified ASME IX welding.

Range	ANSI 150, ANSI 300.
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- 1.5 Identify pipe fitting styles used in sanitary and hygienic applications.

Range	Tri-Clamp, 3-A, ASME-BPE standards.
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- 1.6 Describe and compare the advantages and disadvantages of pipework materials in terms of process material compatibility and corrosion resistance.
- Range 316 stainless steel, carbon steel, galvanised steel, brass, copper.
- 1.7 Compare the advantages and disadvantages of tubing over pipework for instrument impulse line installation.
- Range size, ease of bending, strength to weight ratio, number of fittings required.

Outcome 2

Prepare instrument tubing, pipework, and fittings.

- 2.1 Apply installation procedures for compression tube fittings.
- Range ferrule selection, tightening and retightening.
- 2.2 Demonstrate tube cutting, deburring, swaging, and bending techniques in accordance with industry requirements.
- Range bend radius, bending techniques, tools.
- 2.3 Identify tubing best practices.
- Range avoid handrail installation, avoid foot rail installation, tubing support, expansion loops, accessibility of fittings, slope of tubing.

Outcome 3

Specify requirements for a differential pressure transmitter installation.

- Range installation may include but is not limited to – pressure, level, density, flow measurement;
evidence of one installation is required.

Performance criteria

- 3.1 Produce transmitter installation drawings.
- Range gases, steam, vapour, liquids, isolation, filled systems, chemicals, pressure.
- 3.2 Describe transmitter positioning in accordance with manufacturers' recommendations and specifications.
- 3.3 Identify pipework sizing and fittings requirements in accordance with manufacturers' recommendations and installation drawings.
- Range pressure rating, corrosion resistant materials, impulse lines slope requirements.

3.4 Produce a bill of materials detailing all items required for the transmitter installation.

Range items may include but are not limited to – three valve manifold, isolation valves, tubing, tube fittings.

Outcome 4

Specify requirements for instrument loop cabling and panel wiring, and wire an instrument 4-20 mA loop.

Performance criteria

4.1 Identify and describe instrument loop cable types and their requirements.

Range cables isolated from power cables, current loop is not earthed or is earthed at only one point; polarity; armoured cable earthing, cable screen earthing.

4.2 Identify earthing and shielding cabling practices for standard instrument installation in accordance with industry requirements.

4.3 Describe instrument cable installation procedures and best practices.

Range support, ladder, rack, tray, bending radii, glanding; multi-pair inside junction boxes.

4.4 Identify loop resistance requirements and the effects of excessive resistance.

Range 4-20mA, HART protocol, intrinsic safe barriers, indicators, test diode.

4.5 Describe and apply instrument loop cabling termination and identification practices to simple examples.

Range bootlace ferrules, crimp-lugs, cable and core identification.

4.6 Wire an instrument 4-20mA loop in accordance with details specified in drawings.

Outcome 5

Specify installation requirements for a temperature measuring element and associated transmitter.

Range thermocouple, RTD;
evidence of one is required.

Performance criteria

- 5.1 Produce measuring element and transmitter installation drawings in accordance with industry requirements.
- 5.2 Produce a bill of materials detailing all items required for the transmitter and measuring element installation.
- 5.3 Produce installation drawings of temperature elements and their placement in the process in accordance with industry requirements.
- 5.4 Describe cabling methods and connections for temperature elements.
 Range thermocouple extension wires, thermocouple plugs, RTDs 3 and 4 wire elements.

Outcome 6

Test instrumentation.

Range instrumentation refers to the device in outcome 5.

Performance criteria

- 6.1 Select test equipment of the appropriate type and accuracy to meet the requirements of manufacturers' recommendations and process documentation.
 Range digital multimeter, thermocouple simulator, RTD simulator, pressure calibrator, 4-20mA loop calibrator, smart or digital transmitter calibrator, dedicated calibrator.
- 6.2 Conduct tests to confirm that power supplies are within the specified tolerances.
- 6.3 Conduct tests to confirm that the instrumentation operates within specified tolerances.
- 6.4 Record test results in accordance with industry requirements.

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	19 May 2008	31 December 2019
Review	2	28 November 2013	31 December 2027
Rollover and Revision	3	28 June 2018	31 December 2027
Review	4	30 January 2025	31 December 2027

Consent and Moderation Requirements (CMR) reference	0003
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

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