

# NATIONAL METAL & ENGINEERING CURRICULUM

## 1. Module details

<b>Module name</b>	<b>Pressure</b>
<b>Nominal duration</b>	One module It is anticipated that a student possessing the skills and knowledge developed in the prerequisites will achieve the module purpose in 35 to 40 hours.
<b>Module code</b>	NI202
<b>Discipline code</b>	0703325

## 2. Module purpose

This module aims to provide the student with the knowledge and skills required in application and adjustment of pressure measurement devices.

## 3. Prerequisites

Concepts of Instrumentation (NI201) and  
Electrical Principles 1 (NE160) or  
Introduction to Electricity and Electronics (NBB14)

## 4. Relationship to competency standards

This module provides some of the knowledge and skills underpinning competence in the following standards.

Federal Metals Industry Award Standards, Unit 18.62A.

Electrical Contracting Industry Award Standards  
Instrument Stream Units 5.4, 5.5, 5.6, 5.7, 5.8

## 5. Content

### Summary of content

1. Pressure, density, height, force, area units revision (SI and as applicable for local needs) standards.  
Calculation of pressure required to support liquid columns.  
Calculation of related values of pressure, force and area.

2. Absolute, gauge and differential pressure scales and their interrelationship.  
Reference points for scales. Atmospheric pressure value using all common measurement units.
3. Absolute pressure measurement devices for sub atmospheric range and typical applications of these devices.
4. Gauge pressure measurement by means of U-tube, single limb and inclined liquid columns.  
Calculation of wet leg effects.
5. Gauge pressure measurement by means of elastic deformation type gauges. Bourdon types (C/spiral/helix) and ranges.
6. Other mechanical pressure elements: bellows, capsule, slack/stiff diaphragms.  
Pressure gauge installations: tapping points, valves, (isolation and bleed), loop seals, snubbers.
7. Pressure calibration devices: pneumatic, hydraulic, electronic.  
Precautions in calibrating oxygen and chlorine gauges (no oil).
8. Use of a dead-weight tester to calibrate pressure gauges. Gauge and mechanical recorder adjustments for span, zero and linearity.  
Backlash, hysteresis, repeatability.
9. Electrical sensors for pressure measurements: capacitive, piezo, inductive, strain gauge.  
Calibration adjustments for pneumatic and electrical type pressure measurement and signal transmission devices.
10. Installation requirements for pressure measurement in liquid and gas systems, with and without sealing liquid.  
Isolation, seal, vent, drain and bypass valves location and operation sequence.

## 6. Assessment strategy

<b>Assessment method</b>	Short-answer tests Practical exercises Calculations
<b>Conditions of assessment</b>	Normally learning and assessment will take place in a classroom/laboratory environment.

## 7. Learning outcome details

On completion of this module the learner will be able to:

### Learning outcome 1

Define the terms and perform calculations which relate; (a) applied pressure to the height and density of liquid columns, (b) forces with pressure and area.

#### Assessment criteria

- 1.1 Define the terms and perform calculations which relate the:
  - applied pressure to the height and density of liquid columns
  - force produced by pressure applied to an area.
- 2.2 Solve problems on force and pressure using SI and other units.

### Learning outcome 2

Define absolute and gauge type pressure measurements, their reference points and typical measurement units.

#### Assessment criteria

- 2.1 Define absolute and gauge type pressure measurements, their reference points and typical measurement units.
- 2.2 Define absolute zero pressure.
- 2.3 Define atmospheric pressure and the factors which affect it.

### Learning outcome 3

Describe absolute pressure measurement devices and their applications.

#### Assessment criteria

- 3.1 Explain the operation and demonstrate the use of mercury column and Aneroid barometers.
- 3.2 Use absolute pressure measuring devices as appropriate.

<b>Learning outcome 4</b>	Measure gauge pressure by means of liquid columns and by means of elastic deformation type gauges.
<b>Assessment criteria</b>	<p>4.1 Measure gauge pressure by means of liquid columns and by means of elastic deformation type gauges.</p> <p>4.2 Explain the operating principle of; “U”-tube, single-limb, inclined-limb and curved-limb manometers.</p> <p>4.3 Explain the applications of each class of manometer.</p> <p>4.4 List the limitations of manometer type gauges.</p>
<b>Learning outcome 5</b>	Calculate the effect of wet leg pressures on measurement.
<b>Assessment criteria</b>	<p>5.1 Calculate the effect of wet leg pressures on measurement.</p> <p>5.2 Explain the meaning and need for wet leg corrections.</p>
<b>Learning outcome 6</b>	Describe the operation of and compare the characteristics of various types of mechanical type pressure elements.
<b>Assessment criteria</b>	<p>6.1 List the factors which govern the range of a bourdon tube type gauge.</p> <p>6.2 Explain the reasons for using spiral and helical type bourdon gauges and define their applications.</p> <p>6.3 Define “flexibility” and “spring rate” of a bellows.</p> <p>6.4 Explain stiff and flexible diaphragm gauges and define their applications.</p> <p>6.5 Differentiate between gauge elements for: gauge pressure, differential pressure and absolute pressure.</p>

<b>Learning outcome 7</b>	State the precautions to be observed in oxygen and chlorine gauges and other hazardous fluids.
<b>Assessment criteria</b>	7.1 State the precautions to be observed in calibrating oxygen and chlorine gauges.
<b>Learning outcome 8</b>	Adjust pressure gauges for zero, span and linearity.
<b>Assessment criteria</b>	8.1 Describe the operating principle and the correct application of pressure calibration devices.
	8.2 State the laws of hydraulics.
	8.3 Apply these laws to calculations involving the hydraulic press and the dead-weight tester.
	8.4 List the operating procedure and precautions and method of range changing the dead-weight tester.
<b>Learning outcome 9</b>	Operate the dead weight tester and other devices in calibrating pressure instruments.
<b>Assessment criteria</b>	9.1 Demonstrate the method of zero, span and linearity adjustment on Bourdon type gauges and chart recorders.
	9.2 Calibrate a gauge using a dead-weight tester.
<b>Learning outcome 10</b>	Explain the operating principle and calibration of electrical measuring devices for pressure measurement.
<b>Assessment criteria</b>	10.1 List and explain the operation of typical electrical sensors used for pressure measuring instruments.
	10.2 Test given sensors/devices for serviceability.

<b>Learning outcome 11</b>	Calibrate and install mechanical and electrical pressure measurement devices.
	11.1 Demonstrate correct procedures for the calibration and installation of mechanical and electrical type pressure measurement and signal transmission devices.
	11.2 Demonstrate the correct use of valves in the isolation, filling seal liquid, zeroing and startup of devices.

## 8. Delivery of the module

<b>Delivery strategy</b>	<p>Delivery strategies must be suitable for both theoretical and/or practical learning and module purpose.</p> <p>It is recommended that learning and assessment be facilitated in a holistic manner which may require a learning outcome sequence other than that indicated in the body of this module.</p> <p>Also an integrated theory/practice approach should be used where students learn by experimentation and through research and laboratory reports.</p>
<b>Resource requirements</b>	<p>To complete this module students will need access to sufficient measurement, test and signal generation equipment to allow each student to undertake individually the practical and assessment tasks.</p> <p>Useful references include:</p> <p>Bolton, W. 1991, <i>Instrumentation and Process Measurements</i>, Longman Group UK Limited.</p> <p>Jones, E.B. 1985, <i>Jones' Instrument Technology</i>, Vols. 1 and 2, 4th edition, Butterworths, Borough Green, England.</p> <p>Considine, D.M. 1985, <i>Process Instruments and Controls Handbook</i>, 4th edition, McGraw-Hill, New York.</p> <p>Anderson, N.A. 1980, <i>Instrumentation for Process Measurement and Control</i>, 3rd edition, Chilton Company, Adnor, Pennsylvania.</p> <p>Johnston, C. 1993, <i>Process Control Instrumentation</i>, 4th edition, Regents/Prentice Hall, Englewood Cliffs, New Jersey.</p>
<b>Occupational health and safety requirements</b>	<p>A safe and healthy environment will be provided for students in regards to classroom and laboratory safety.</p>