



<b>Unit Title</b>	Understanding water sector plant identification, engineering maintenance and operation (D/503/1467)	
<b>Level</b>	3	
<b>Credit Value</b>	6	
<b>Learning Outcomes – the learner will be able to:</b>	<b>Assessment Criteria – the learner can:</b>	
<p>± Understand a range of mechanical plant in the water industry</p>	<p>1.1 describe <b>properties of materials</b> used in water industry plant</p> <p>1.2 explain how to reduce the effects of stress, strain and friction on plant, with reference to:</p> <ul style="list-style-type: none"> <li>(a) choice of material</li> <li>(b) choice of plant</li> <li>(c) arrangement of plant.</li> </ul> <p>1.3 describe <b>properties of fluids</b> used in water industry plant, including:</p> <ul style="list-style-type: none"> <li>(a) water</li> <li>(b) wastewater</li> <li>(c) chemicals.</li> </ul> <p>1.4 explain applications of telemetry in the water industry, including:</p> <ul style="list-style-type: none"> <li>(a) remote monitoring and control of plant status</li> <li>(b) site security.</li> </ul> <p>1.5 explain how hydrostatic pressure and water force affect water retaining structures</p> <p>1.6 explain basic principles of fluid motion and pipe flow, including:</p> <ul style="list-style-type: none"> <li>(a) laminar flow</li> <li>(b) turbulent flow</li> <li>(c) mixing.</li> </ul> <p>1.7 describe the characteristics of pressure and how it varies within a water distribution system, including:</p> <ul style="list-style-type: none"> <li>(a) dynamic head</li> <li>(b) static head</li> <li>(c) friction loss.</li> </ul> <p>1.8 describe the <b>uses of valves</b></p> <p>1.9 explain the benefits and limitations of <b>types of valves</b></p> <p>1.10 explain how to select and install valves</p> <p>1.11 describe when to use actuated valves</p> <p>1.12 explain the effects of chemicals and liquors on plant and equipment, including:</p> <ul style="list-style-type: none"> <li>(a) resistance</li> <li>(b) corrosion</li> <li>(c) abrasion</li> <li>(d) erosion.</li> </ul> <p>1.13 describe how to assess the fitness for purpose of <b>pipeline materials</b></p> <p>1.14 describe when different types of joints are used in pipework, including:</p> <ul style="list-style-type: none"> <li>(a) fusion</li> <li>(b) bolted flange</li> <li>(c) Viking-Johnson</li> <li>(d) lead solder.</li> </ul>	



	<p>1.15 explain joint repair procedures</p> <p>1.16 describe <b>factors that affect types of pipe supports and fixing.</b></p>
<p>2. Understand the use and characteristics of different types of pumps</p>	<p>2.1 explain the difference between <b>rotodynamic</b> and <b>positive displacement</b> pumps</p> <p>2.2 describe types of <b>rotodynamic pumps</b></p> <p>2.3 describe types of <b>positive displacement pumps</b></p> <p>2.4 evaluate where it is appropriate to use variable or fixed speed pumps</p> <p>2.5 describe <b>types of ancillary pumping equipment</b></p> <p>2.6 explain the principle applications of pumps in the sector, including:</p> <ul style="list-style-type: none"><li>(a) low lift</li><li>(b) high lift</li><li>(c) chemical dosing</li><li>(d) sludge.</li></ul> <p>2.7 explain <b>physical factors</b> affecting selection of pumps for water operations</p> <p>2.8 explain <b>electrical factors</b> affecting selection of pumps for water operations</p> <p>2.9 explain the differences between series and parallel pumping</p> <p>2.10 describe the <b>causes of defects in pumping equipment.</b></p>
<p>3. Understand the use and maintenance of compressors and blowers</p>	<p>3.1 explain the differences between compressors and <b>blowers</b></p> <p>3.2 describe different types of compressor, including:</p> <ul style="list-style-type: none"><li>(a) reciprocating</li><li>(b) sliding vane</li><li>(c) centrifugal</li><li>(d) axial.</li></ul> <p>3.3 describe ancillary equipment required to use compressors and blowers, including:</p> <ul style="list-style-type: none"><li>(a) filters</li><li>(b) dryers</li><li>(c) accumulators</li><li>(d) motor.</li></ul> <p>3.4 evaluate the factors affecting the selection of compressors and blowers for operations, including:</p> <ul style="list-style-type: none"><li>(a) pressure capacity</li><li>(b) cost effectiveness</li><li>(c) operating efficiency</li><li>(d) fitness for purpose.</li></ul> <p>3.5 describe the situations when compressed air is used in water operations</p> <p>3.6 explain maintenance procedures for compressors and blowers.</p>
<p>4. Understand the safe use of power supply and distribution.</p>	<p>4.1 describe the instrumentation that is used in the water industry and how it is applied</p> <p>4.2 describe potential risks and hazards when working with power equipment, including:</p> <ul style="list-style-type: none"><li>(a) fire</li><li>(b) electrocution.</li></ul> <p>4.3 describe safety protection features on equipment control panels, including;</p> <ul style="list-style-type: none"><li>(a) warning lamps</li><li>(b) isolation equipment</li></ul>



	<ul style="list-style-type: none"> <li>(c) circuit protection devices</li> <li>(d) fuses</li> <li>(e) overloads</li> <li>(f) interlocks.</li> </ul> <p>4.4 describe the purpose of components of electrical distribution systems, including:</p> <ul style="list-style-type: none"> <li>(a) boards</li> <li>(b) consumer units</li> <li>(c) electric motor starts.</li> </ul> <p>4.5 explain the operation of electrical distribution systems.</p>
5. Apply mechanical engineering and electrical principles to water industry plant	<p>5.1 produce graphs to represent motion of fluids in pipes</p> <p>5.2 calculate stress, strain and friction using specific examples from the water industry.</p>

Additional information about the unit	
<b>Unit purpose and aims</b>	This unit is designed to allow the learner to develop a technical understanding of the functions of a range of plant used in the water industry. The unit will develop the learner's knowledge of the identification, use, understanding and maintenance requirements of mechanical plant. The unit also introduces the learner to basic electrical principles and the safe use of equipment associated with mechanical plant.
<b>Unit expiry date</b>	31/03/2016
<b>Details of the relationship between the unit and relevant national occupational standards or other professional standards or curricula (if appropriate)</b>	-
<b>Terms and definitions applicable to the assessment criteria (agreed with the sector body)</b> <i>(Please note: This section is not replicated on the Regulatory IT System but is required when assessing the unit.)</i>	<p>Some terms, used within the assessment criteria, cover different situations, as follows:</p> <ol style="list-style-type: none"> <li>1. <b>Properties of materials</b> include: <ul style="list-style-type: none"> <li>(a) strength</li> <li>(b) toughness</li> <li>(c) ductility</li> <li>(d) malleability</li> <li>(e) elasticity</li> <li>(f) cost</li> </ul> </li> <li>2. <b>Properties of fluids</b> include: <ul style="list-style-type: none"> <li>(a) mass</li> <li>(b) relative density</li> <li>(c) viscosity</li> </ul> </li> <li>3. <b>Uses of valves</b> include: <ul style="list-style-type: none"> <li>(a) isolation</li> <li>(b) flow control</li> </ul> </li> </ol>



- (c) reflux
- (d) pressure relief
- (e) pressure management
- (f) flushing
- (g) hydrant/washout

4. **Types of valve** include:

- (a) gate
- (b) butterfly
- (c) plug
- (d) penstock
- (e) ball
- (f) solenoid
- (g) non-return
- (h) float-operated
- (i) pressure management
- (j) actuated
- (k) manual

5. **Pipeline materials** include:

- (a) plastics
- (b) ductile iron
- (c) concrete
- (d) asbestos
- (e) steel

6. **Factors that affect types of pipe supports and fixing** include:

- (a) expansion
- (b) contraction
- (c) thrust blocks
- (d) surge pressure
- (e) air removal
- (f) attenuation

7. Types of **rotodynamic pumps** include:

- (a) centrifugal
- (b) mixed
- (c) axial flow
- (d) submersible
- (e) multi-stage.

8. Types of **positive displacement pumps** include:

- (a) reciprocating arm
- (b) diaphragm
- (c) peristaltic
- (d) progressing cavity.

9. **Types of ancillary pumping equipment** include:

- (a) seals



	<ul style="list-style-type: none"><li>(b) gaskets</li><li>(c) filters</li><li>(d) strainers</li><li>(e) pulsation dampers</li><li>(f) pressure gauges</li><li>(g) surge protection valves</li><li>(h) surge vessels</li></ul> <p>10. <b>Physical factors</b> affecting pump selection are:</p> <ul style="list-style-type: none"><li>(a) flow</li><li>(b) pressure</li><li>(c) fluid to be pumped</li><li>(d) cost</li><li>(e) design life</li><li>(f) controllability</li><li>(g) efficiency</li></ul> <p>11. <b>Electrical factors</b> affecting pump selection are::</p> <ul style="list-style-type: none"><li>(a) supply</li><li>(b) type of motor</li><li>(c) protection</li><li>(d) distribution</li><li>(e) 3 phase/ single phase</li><li>(f) LV/HV</li><li>(g) use of inverter for variable speed</li></ul> <p>12. <b>Causes of defects in pumping equipment</b> include:</p> <ul style="list-style-type: none"><li>(a) abrasion</li><li>(b) corrosion</li><li>(c) blockage</li><li>(d) chemicals</li><li>(e) over pressure</li><li>(f) throttling</li><li>(g) cavitation.</li></ul> <p>13. <b>Blowers</b> include:</p> <ul style="list-style-type: none"><li>(a) roots type positive displacement unit</li></ul>
<p><b>Assessment requirements or guidance specified by a sector or regulatory body (if appropriate)</b></p>	<p>Some terms in the assessment criteria cover a range of situations. Refer to the full assessment requirements and guidance for a detailed list of terms and definitions, agreed with Energy &amp; Utility Skills.</p> <p>This unit must be assessed in line with the Energy &amp; Utility Skills assessment strategy for water knowledge qualifications.</p> <p>This unit will be assessed using a knowledge assessment.</p>
<p><b>Location of the unit within the subject/sector classification system</b></p>	<p>4.1 Engineering</p>



<b>Name of the organisation submitting the unit</b>	CABWI Awarding Body
<b>Availability for use</b>	Restricted to CABWI Awarding Body
<b>Unit guided learning hours</b>	60