**NZQA**

**Approved**

Achievement standard: 91349 Version 3

Standard title: Demonstrate understanding of advanced concepts related to machines

Level: 2

Credits: 3

Resource title: Knowing workshop machines

Resource reference: Construction and Mechanical Technologies VP-2.25 v2

Vocational pathway: Construction and Infrastructure

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| Quality assurance status | These materials have been quality assured by NZQA. NZQA Approved number A-A-02-2015-91349-02-8234 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

Achievement standard: 91349

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Vocational pathway: Construction and Infrastructure

Learner instructions

# Introduction

This assessment activity requires you to create a presentation that demonstrates your understanding of advanced concepts related to workshop machines.

You are going to be assessed on how comprehensively you demonstrate your understanding of advanced concepts related to workshop machines. You need to show that you are able to process and interpret information, and prepare a presentation that includes why mechanical components are combined in workshop machines to provide mechanical advantage, relative motion between input and output, and the desired efficiency.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions and modify them if necessary to suit their learners.

# Task

Workshop machines could include a router, a CNC (computer numerical control) machine, a shaping machine, a band saw, a grinding machine, a lathe or a drilling machine.

Create a presentation in which you do the following:

* Explain how mechanical components are combined in workshop machines.
* Describe the efficiencies of workshop machines in relation to their safe use. You could describe:
	+ the efficiency of a selection of components in the horizontal boring machine such as the transfer of energy from the electric motor via a belt and pulley system, and describe a ratio calculated by output energy divided by input energy
	+ how the belt and pulley result in a safe and efficient transfer of motion and energy.
* Discuss why mechanical components were combined in the way they are in workshop machines, and how this enables them to achieve mechanical advantage, relative motion between input and output, and the required efficiency. You could:
	+ discuss how the rotary input motion from an electric motor which drives the machine is converted by components such as driveshafts, crankshafts, gears and pulleys to produce the final motion required by the workshop machine
	+ compare and contrast other components that could be used to achieve the same (or a better) mechanical advantage
	+ discuss desired efficiency calculated in terms of the ratio between outputs achieved and input that enable such things as different chuck rotating speeds on a lathe, or various control mechanisms on a vertical drill press.

Include in your presentation**:**

* annotated photos, drawings, and/or pictures
* tables and/or flow charts
* website links
* practical demonstrations or show models.

Collect evidence that explains the relevant concepts, for example annotated sketches, mock-ups, models, photographs, quotes. Keep a record of all sources so that you can acknowledge them in your presentation.

# Resources

## Resource A: Definitions

These definitions are reprinted from the standard (Construction and Mechanical Technologies 91349).

For the purposes of this standard, a machine will include two or more mechanical components.

Mechanical components include:

* Cams and followers. These include (but are not limited to) cams such as plate and eccentric; followers such as needle, roller, flat, offset.
* Pivots and linkages. These include (but are not limited to) pivots such as fixed and moving; linkages such as: parallel, reverse, and sliding crank motion.
* Gears include (but are not limited to) spur, bevel, helical, rack and pinion, worm, idler.
* Belt or chains and sprockets include (but are not limited to) flat belt, v-belt, duplex chain or double belt, tooth belt.
* Shafts and bearings include (but are not limited to) solid shafts, hollow shafts, ball bearing, roller bearing, and conical bearing.

A machine’s efficiency is determined by the ratio of the energy delivered (or work done) by the machine to the energy needed (or work required) to operate it (i.e. output energy/input energy).

## Resource B: Useful websites

<http://electronics.howstuffworks.com/tech>

<http://www.technologystudent.com/>

<http://www.fi.edu/qa97/spotlight3/>

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Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

This activity requires learners to demonstrate comprehensive understanding of advanced concepts related to workshop machines.

# Conditions

The learners could gather and analyse their evidence independently or in groups, but they need to create their presentation independently, and will be assessed individually. Decide on the format of the final presentation. You may wish to take learners’ preferences into account in deciding on the format.

# Resource requirements

The assessor/educator will provide opportunities for learners to develop their evidence.

Learners require access to:

* the internet
* a camera, presentation materials (for example paper, modelling materials), printer, computer, data projector and/or flow charts.

# Additional information

None.

## Other possible contexts for this vocational pathway

Demonstrating understanding of advanced concepts relating to any machines used in the construction and infrastructure sector, for example engineering, heavy machine operating, landscape construction, plumbing, roading construction or roofing.

# Assessment schedule: Construction and Mechanical Technologies 91349 – Knowing workshop machines

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner demonstrates understanding of advanced concepts related to workshop machines by:* explaining how mechanical components are combined to form workshop machines

For example, the learner:* + includes annotated diagrams and/or photographs that identify the components, their position within the machine, and an explanation of how they work together to produce a desired output (e.g. drill a hole, shape edges).
* describing the efficiencies of workshop machines in relation to their safe application

For example, the learner describes:* + the efficiency of a selection of components in the horizontal boring machine such as the transfer of energy from the electric motor via a belt and pulley system, and describes a ratio calculated by output energy divided by input energy
	+ how the belt and pulley result in a safe and efficient transfer of motion and energy.
* explaining how mechanical components are combined to transfer work and motion in workshop machines

For example, the learner:* + uses diagrams and annotations to explain how, on a drill press, an electric motor results in the final drive of a rotating chuck.

*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates in-depth understanding of advanced concepts related to workshop machines by:* explaining how mechanical components are combined to form workshop machines

For example, the learner:* + includes annotated diagrams and/or photographs that identify the components, their position within the machine, and an explanation of how they work together to produce a desired output (e.g. drill a hole, shape edges).
* describing the efficiencies of workshop machines in relation to their safe application

For example, the learner describes:* + the efficiency of a selection of components in the horizontal boring machine such as the transfer of energy from the electric motor via a belt and pulley system, and describes a ratio calculated by output energy divided by input energy
	+ how the belt and pulley result in a safe and efficient transfer of motion and energy.
* explaining how, in a particular workshop machine, mechanical components combine to provide the desired mechanical advantage, and relative motion between input and output

For example, the learner:* + explains, including diagrams and/or photographs with annotations and calculations, the mechanical advantage achieved between inputs and different outputs. This includes an explanation of how, for a mitre saw, the mechanical advantage of a gear drive is used to turn the blade powerfully and evenly, and what happens when you try to cut too fast. Their explanation also includes how bevel gears are designed for applications where the rotational speed of the input and output drives remains constant but the axis of rotation changes.

*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates comprehensive understanding of advanced concepts related to workshop machines by:* explaining how mechanical components are combined to form workshop machines

For example, the learner:* + includes annotated diagrams and/or photographs that identify the components, their position within the machine, and an explanation of how they work together to produce a desired output (e.g. drill a hole, shape edges).
* describing the efficiencies of workshop machines in relation to their safe application

For example, the learner describes:* + the efficiency of a selection of components in the horizontal boring machine such as the transfer of energy from the electric motor via a belt and pulley system, and describes a ratio calculated by output energy divided by input energy
	+ how the belt and pulley result in a safe and efficient transfer of motion and energy.
* discussing why, in a particular workshop machine, mechanical components were combined the way they were to provide the desired mechanical advantage, relative motion between input and output, and efficiency

For example, the learner discusses:* + why the components were combined the way they were to achieve a mechanical advantage. Discussion could include consideration of other components that could have been used to achieve the same (or a better) mechanical advantage, including diagrams and/or photographs with annotations and calculations
	+ the efficiency desired, in terms of the ratio between outputs achieved and input effort, that enable such things as the drill/router bit to rotate at such a speed to allow a hole or an edge to be made cleanly, and the table to be adjusted for different timbers or angle drilling
	+ what happens when you try to cut a depth that is too great
	+ how variations in mechanical advantage and efficiencies are achieved that account for changes in materials being used (e.g. timbers – thickness; type – metals, plastic); and the required effect (e.g. size of hole, profile).

*The above expected learner responses are indicative only and relate to just part of what is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.