**NZQA**

**Approved**

Achievement standard: 91344 Version 3

Standard title: Implement advanced procedures using resistant materials to make a specified product with special features

Level: 2

Credits: 6

Resource title: Plumbing product

Resource reference: Construction and Mechanical Technologies VP-2.20 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-02-2015-91344-02-8225 |
| 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

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Learner instructions

# Introduction

This assessment activity requires you to implement advanced procedures using resistant materials to make a curved connection for a water filter. This plumbing product must include at least two special features and meet particular product specifications.

You are going to be assessed on how efficiently you select, schedule and apply techniques and tests to independently, accurately and safely develop your plumbing product.

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

## Confirm your product specifications

This assessment activity requires you to make a plumbing product consisting of a curved copper pipe and jointing mechanisms to connect the mains water supply to a water filter situated underneath a sink. You will need to make the joints that allow the system to be watertight and function correctly.

You must work to a set of product specifications. Confirm, with your assessor/educator, the specifications for the plumbing product you will make. Your assessor/educator may provide these or you may develop them independently and then confirm them with your assessor/educator. These specifications will not be directly assessed. See Resource A for sample specifications.

Your plumbing product must have at least two special features that rely on the application of advanced craft skills.

You must include at least one structural special feature and at least one aesthetic special feature that rely on the consistent applications of accepted conventions in construction and mechanical technologies.

You could achieve a structural special feature by annealing, sand casting or milling components, for example. The machining of components for end faces and the fabrication of the jointing mechanisms to allow for the pipe to be fitted to the water supply and water filter and maintain watertight integrity would also be ways to satisfy the requirement for structural special features.

You could achieve an aesthetic special feature by shaping and bending the pipe to avoid any kinks around the curve and create smooth contours or by polishing or applying a coating, for example.

## Select and schedule techniques and tests

Create an overall construction plan that sets out what you will do, and in what order you will do it, to complete your plumbing product to specification. You will do the following:

* Decide what techniques you will use to make your special features. For example, these could be special welding and brazing techniques.
* Decide what tests you will use to monitor the construction of your special features and to demonstrate that your water filter connection meets the specifications. For example, you could check that the joins are accurate, strong and meet safety requirements by testing them using normal household water pressure and then test to failure point by increasing the water pressure. You may want to develop a specification checklist that includes testing procedures such as measuring, trialling, fitting and visual checks.
* Review the relevant health and safety regulations and decide what techniques you will apply to comply with these. For example, you may always wear suitable footwear and clothing, use safety glasses when machining and leather gloves when welding, and follow other procedures such as ensuring that machine guards are fitted and functioning properly and welding curtains are drawn before you begin working, and always turning machines off before using measuring instruments.
* Confirm the order in which you will do the various steps involved in the construction of the water filter connection.
* Consider how you can best economise time, effort and materials through the techniques and tests you select and the order in which you schedule them.
* Keep a brief record of your decisions in your portfolio.

## Make your specified product

Manufacture your water filter connection by following your construction plan. Accurately and independently:

* use your selected construction techniques, modifying them as needed
* apply scheduled techniques to comply with relevant health and safety regulations
* undertake ongoing testing to ensure that the product meets your specifications.

Keep a record, in your portfolio, of what you did and any problems you overcame. For example, you could annotate your construction plan, take photographs and complete a testing checklist. Your record should show how you implemented the techniques and tests accurately and in a way that economises time, effort and materials. See Resource B for examples of efficient work habits.

When you have completed your plumbing product, photograph it to show the detail of its special features and other aspects to demonstrate how it meets the specifications.

At the completion of this activity, you will submit:

* your finished plumbing product
* a portfolio that shows how you have selected, scheduled and applied techniques, undertaken testing and made efficient use of time, effort and materials.

Your assessor/educator will provide guidance as to how you can demonstrate what you have done and explain why you have done it. Your portfolio could contain, for example:

* an annotated construction plan, showing any modifications you made
* a list of materials ordered and used, and costs incurred
* a schedule of tests, showing what tests will be done and when they will be done and recording the outcome of these tests
* checklists and annotated photographs to show accurate execution of techniques and testing procedures
* annotated photographs to show economic use of materials (for example by photographing materials, the pieces cut, and any material not used)
* brief written comments or explanations (for example as a dated log)
* annotated photographs of the finished product.

# Resource A

## Sample specifications for a connection for a water filter

Product specifications must be measurable, for example the product:

* is manufactured and assembled to the tolerances indicated in the drawings
* provides a watertight connection and allows for a smooth flow of water to the water filter
* does not contaminate the drinking water
* withstands in-situ seasonal temperature differences
* is manufactured and assembled in accordance with the code of conduct for plumbing products.

# Resource B

## Examples of efficient work habits

When working efficiently, you could be expected to:

* have all of your resources available when you need them, organising this with your assessor/educator beforehand if necessary
* be organised in your workplace and have alternatives when you can’t get on a particular machine at the time you may need it
* store all materials safely between work sessions so you can easily find them and start work quickly when you come to your workplace
* be lean and mean with your materials, for example cutting from the end rather than the middle of a length of material when you only require a small piece
* have a plan of what you want to achieve each day before you arrive at your workplace and get on and do this
* know and practise the most efficient techniques to construct the plumbing product.

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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 efficiently implement advanced procedures to make a connection for a water filter using copper.

The specified product must include two special features: one or more aesthetic special feature and one or more structural special feature. These special features must require the consistent application of accepted conventions in advanced craft skills, which may relate to things such as flush, parallel, perpendicular, offset, symmetry, tolerance, ease, press fit, clearances, eccentricity and taper, for example.

# Conditions

Since the standard requires you to assess the ways in which the techniques and tests are implemented, learners should complete their practical in the presence of their assessor/educator.

While learners are engaged in the assessment it is acceptable to conference with and to support them. For example, dealing with mechanical or electrical faults is not intended to be part of the task.

Before the learner begins to make their product, ensure that:

* they have a set of approved product specifications, either provided by you or developed by the learner in negotiation with you
* the selected materials and special features provide sufficient scope for the learner to meet the requirements of the standard
* they are familiar with the techniques they will need to use to construct the special features, and have had the opportunity to practise different techniques
* they trial and select techniques that will enable them to achieve optimal quality in their special features
* they have practised scheduling construction techniques and tests in a construction plan
* they know the accepted codes of practice to develop and test their product and its special features in order to construct it accurately to specifications, including the relevant health and safety regulations
* they know how to plan and implement their techniques and testing procedures in ways that economise time, effort and materials.

Specific jointing and machining techniques your learners could practice include:

* machining techniques on a centre lathe and milling machine, such as machining to fine tolerances to face the ends of the pipe and produce the jointing mechanisms
* using dies and tapping tools to produce the jointing pieces
* using tools to provide the necessary fabrication techniques, such as by annealing the copper tube and using sand or a coiled spring to reduce kinking in the pipe during fabrication of the curve
* finishing techniques such as spray painting to get a quality finish and applied design techniques using masking tape or templates.

# Resource requirements

Learners require access to an appropriate work environment and to suitable tools and materials to safely implement the special features and complete their product. These could include normal fixed machine tools, marking out equipment, basic hand tools and a spray-painting booth. Suggested materials include copper pipe and copper.

Learners developing their own product specifications may require examples of these to refer to.

Learners also require access to a camera to document their progress.

# Additional information

This standard requires you to make judgements about the ways in which techniques are implemented, as well as the quality of the finished product. For example, you are required to notice (for Merit) whether the learner has shown ‘independence and accuracy in the execution of the techniques and tests’ and (for Excellence) whether the learner has worked ‘in a manner that economises time, effort and materials’. You must be able to justify your judgements by providing evidence derived from learner and/or assessor/educator recording, work session observations and/or discussion with learners.

## Learner portfolio

This assessment activity requires learners to keep a brief record of their progress in a portfolio to provide evidence for assessment. This ensures that learners understand the basis on which they are being judged, and confirms that the assessor/educator’s judgements are made on a sound basis. You could add your own observations to the learners’ records.

Guide learners on what to include in the portfolio. The recording of evidence is not intended to become unduly arduous.

## Assessor/educator observation and assessment

When assessing learners during the course of this activity, you may want to consider, but are not limited to, the following questions:

* Independence: What level of assessor/educator input did the learner require? From work session observation of learner interactions with other learners, how independently did they work?
* Accuracy:How accurately has the learner executed the scheduled techniques and tests? How accurately have they followed through on information gained from testing?How accurate is the finished product?
* Economy of time:How effectively did the learner organise themselves and manage their resources so that they could quickly pick up where they had left off in a previous work session? Did they organise the order in which they undertook techniques to minimise downtime?
* Economy of effort: From the learner’s data log entries and work session observation, to what extent did the learner know what to do, rather than relying on trial and error? Did the learner use data from testing to guide next practice and the choice of the correct tool for the task?
* Economy of materials:To whatextent did the learner minimise the use of materials?

# Assessment schedule: Construction and Mechanical Technologies 91344 – Plumbing product

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner implements advanced procedures using resistant materials to make a specified plumbing product with special features by:   * selecting techniques to achieve at least two special features (one structural and one aesthetic)   For example, the learner:   * + follows their construction plan and with some assessor/educator guidance, selects the correct fabricating process of annealing   + fills the tube with sand to ensure it retains its shape and doesn’t develop kinks. * undertaking testing to monitor special feature construction and to demonstrate the plumbing product meets specifications   For example, the learner:   * + when bending the pipe, tests different methods to see which give the best shape and uniformity to the pipe   + tests what temperature the copper had to be heated to for annealing   + with some prompting, checks the pipe has limited kinks in it. * applying techniques to comply with relevant health and safety regulations   For example, the learner:   * + follows the working environment health and safety rules   + wears a welding helmet and leather gloves when welding, and uses safety glasses when machining   + makes sure the welding curtains are drawn, and that machine guards are fitted and working properly   + rolls up their sleeves when using machines, and turns the machine off before using measuring instruments.   *The above expected learner responses are indicative only and relate to just part of what is required.* | The learner skilfully implements advanced procedures using resistant materials to make a specified plumbing product with special features by:   * selecting techniques to achieve at least two special features (one structural and one aesthetic)   For example, the learner:   * + follows their construction plan, independently shapes the component pieces of the design using appropriate tools   + produces a connection for a water filter with a logo branded on the side of the pipe. * showing independence and accuracy in the execution of the techniques and tests to monitor special feature construction and to demonstrate the plumbing product meets specifications   For example, the learner:   * + monitors their own progress and manages their time to complete the techniques and tests as scheduled   + executes the testing and techniques used are accurate, and as a result of their testing, achieves a smooth transition around the curve of the pipe, a watertight product, and a good connection between the water filter and the mains water supply. * applying techniques to comply with relevant health and safety regulations   For example, the learner:   * + follows the working environment health and safety rules   + wears a welding helmet and leather gloves when welding, and uses safety glasses when machining   + makes sure the welding curtains are drawn, and that machine guards are fitted and working properly   + rolls up their sleeves when using machines, and turns the machine off before using measuring instruments.   *The above expected learner responses are indicative only and relate to just part of what is required.* | The learner efficiently implements advanced procedures using resistant materials to make a specified plumbing product with special features by:   * selecting techniques to achieve at least two special features (one structural and one aesthetic)   For example:  The learner develops and follows a construction plan that describes an efficient approach to making the plumbing product.   * showing independence and accuracy in the execution of the techniques and tests to monitor special feature construction and to demonstrate the plumbing product meets specifications, economising time, effort and materials   For example, the learner:   * + with limited assessor/educator support, makes the plumbing product to meet the specifications   + uses testing and techniques accurately, and as a result of their testing, achieves a smooth transition around the curve of the pipe, a watertight product, and a good connection between the water filter and the mains water supply   + is mindful of resource use, carefully plans out the cutting of the copper and composite materials, and follows their plan accurately; there is minimal wastage of materials, materials are measured accurately and cut once with minimal effort, using the correct cutting tool for the material and the cut being made   + identifies the correct tools for each process, including boring and turning; due to correct tool selection, time and effort are minimised during these processes   + is organised with their materials and in their workspace, allowing easy transitions from one work session to another. * applying techniques to comply with relevant health and safety regulations   For example, the learner:   * + follows the working environment health and safety rules   + wears a welding helmet and leather gloves when welding, and uses safety glasses when machining   + makes sure the welding curtains are drawn, and that machine guards are fitted and working properly   + rolls up their sleeves when using machines, and turns the machine off before using measuring instruments.   *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.