

**General Outcomes**

*The student will:*

- list and describe the principal characteristics of all structures
- identify strategies to improve the efficiency of a structure
- apply principles of structural design to fabrication and construction activities

**Standard**

Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- follows instructions accurately
- responds to directed questions and follows necessary steps to find answers
- accesses basic in-school/community information sources
- organizes information in a logical manner
- records information accurately using correct technical terms
- uses time effectively

**Content**

- provides evidence that:
  - structures found in the constructed world share common elements and principles found in nature
  - structural elements provide both shape and support to the structure; e.g., shell, frame
  - forces are dispersed throughout the structure
  - forces must be kept in balance to prevent the structure from failing
- describes the effects of the following forces on a structure:
  - compression
  - tension
  - shear
  - bending
  - twisting

**Investigating**

- designs and builds an appropriate structure to be tested
- tests the load-carrying capability of the structure
- analyzes the test results in terms of:
  - strength to weight ratio
  - cost effectiveness
- lists strategies to improve the efficiency of the structure

**Presenting/Reporting**

- demonstrates effective use of one or more communication media:
  - e.g., *Written:* spelling, punctuation, grammar, basic format
  - Oral:* voice projection, body language
  - Audio-visual:* techniques, tools
- uses correct grammatical conventions and technical terms
- provides an introduction that describes the purpose of the project
- communicates information in a logical sequence

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Content	4	3	2	1	0	2	
Investigating	4	3	2	1	0	2	
Presenting/Reporting	4	3	2	1	0	2	

**General Outcomes**

*The student will:*

- identify and describe the principal components of a print
- demonstrate basic print reading skills

**Standard**

Response rating of 2.

**Rating Scale**

*The student:*

- 4 independently makes explanations, critical judgements based on a superior knowledge base and understanding of content and related issues.
- 3 makes explanations and comparisons of content using more precise terminology. Requires little or no prompting.
- 2 applies knowledge of content to different situations using accurate terminology. May require some prompting.
- 1 relies on simple recall to demonstrate basic knowledge and understanding of content. May require frequent prompting.
- 0 is unable to provide a response at this time.

Sample Questions Item(s)	Sample Response(s)
1. On a given drawing, identify the following lines: <ul style="list-style-type: none"> <li>a) object lines</li> <li>b) dimension</li> <li>c) centre lines</li> <li>d) hidden lines</li> </ul>	
2. What three views are most commonly used to describe an object on a working drawing?	The three views commonly found on a working drawing are: <ul style="list-style-type: none"> <li>- front</li> <li>- top</li> <li>- right side</li> </ul>
3. Explain the difference between unilateral and bilateral tolerances.	A bilateral tolerance may vary from a larger size (+) to a smaller size (-) whereas a unilateral tolerance is in one direction only, either (+) or (-).
4. Provide an example of a symbol used in a typical: <ul style="list-style-type: none"> <li>- electrical</li> <li>- machining</li> <li>- welding</li> <li>- architectural drawing</li> </ul>	
5. Given a working drawing, determine: <ul style="list-style-type: none"> <li>- internal and external dimensions</li> <li>- types of materials and finishes</li> <li>- types of fit and tolerances</li> <li>- fabrication processes</li> </ul>	

For additional sample items and responses refer to:

- *Basic Blueprint Reading and Sketching*. C. Thomas Olivo, 1993. Text

**General Outcomes**

*The student will:*

- describe the essential differences between braze welding and fusion welding
- demonstrate basic braze welding competencies
- demonstrate basic oxyfuel weld (OFW) competencies in the flat, horizontal and vertical positions

**Standard**

Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- interprets and carries out instructions
- understands the important differences between fusion and braze welding
- describes visible indicators of correct metal temperatures for braze welding
- reads weld specifications to determine:
  - weld type and position
  - size and thickness of components
  - tip size and filler metal
  - welding techniques
- identifies appropriate personal protective equipment (PPE) and ventilation controls

**Use of Equipment and Materials**

- wears the proper PPE
- follows accepted start-up, operation and shut-down procedures

**Use of Equipment and Materials (continued)**

- measures accurately
- carries out proper fit-up procedures
- selects appropriate tip
- balances the flame correctly
- demonstrates good rod and flame manipulation
- recognizes potential health and safety hazards
- stores and disposes of materials as instructed
- fulfills given clean-up responsibilities

**Task Performance**

- produces two or more acceptable braze weld applications
- produces two or more acceptable fusion square groove butt and fillet welds in the flat, horizontal and vertical position using available light and heavy gauge mild steel.

**PERFORMANCE ASSESSMENT**

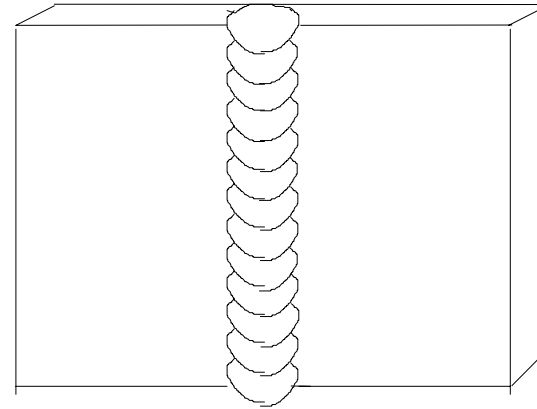
CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Use of Equipment and Materials	4	3	2	1	0	2	
Task Performance	4	3	2	1	0	2	

**General Outcome***The student will:*

- demonstrate basic oxyfuel welding (OFW) competencies in the flat, horizontal and vertical positions

**PROCEDURE**

Weld Type:	Butt Joint Fusion Weld (OFW)
Positions:	vertical
Base Metal:	2 – 2" x 5" (50 mm x 125 mm) 10 or 11 gauge mild steel
Preparation:	cut to size, remove burr and tack ends
Filler Metal:	3/32" M.S. filler rod – RG-60
Equipment Set-up:	#3 tip, neutral flame, mid range
Fit-up:	1/8" (3 mm) gap
Manipulation:	torch angle, ½ included angle with tip inclination of 5°–15° off 90° in the vertical position

**Task Performance Appraisal****Desirable Weld**

Weld profile should be slightly convex and of uniform width and height. Ripples are to be close, bullet shaped and free of voids, evidence of undercutting and overlapping. Good depth of penetration should be evident over the entire length of the weld.

**Acceptable Weld**

Weld profile should be slightly convex with evenly spaced ripples. Evidence of undercutting and overlapping should be minimal. Adequate depth of penetration should be evident over the length of the weld.

**Comments:**

**General Outcomes**

*The student will:*

- identify the appropriate treatment for minor injuries associated with welding processes
- describe the visual characteristics of a desirable weld
- demonstrate basic SMAW competencies in the flat position

**Standard**

Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- thinks through problems before asking for help
- reads weld specification to determine:
  - weld type and position
  - type of weldment
  - type of electrode
  - equipment settings
  - welding techniques
- understands first aid treatment for minor cuts, burns and bruises
- identifies appropriate personal protective equipment (PPE) and ventilation controls

**Use of Equipment and Materials**

- wears the proper PPE
- follows accepted start-up, operation and shut-down procedures
- recognizes potential health and safety hazards
- measures accurately

**Use of Equipment and Materials (continued)**

- carries out proper fit-up procedures
- selects the correct electrodes
- adjusts equipment according to the weld specification
- manipulates the electrode as instructed
- removes slag and cleans weld appropriately
- stores and disposes materials as instructed
- fulfills given clean-up responsibilities

**Task Performance**

- produces two or more acceptable:
  - single and multi-pass flat lap joints on available mild steel using E6010 (E41010) and E7014 (E48014) filler metal
  - single and multi-pass butt joints on available mild steel using E6010 or 11 (E41010/11) and E7018 (E48018) electrodes
- evaluates a given weld according to:
  - overall appearance of beads
  - weld profile
  - plate penetration
  - degree of undercutting and overlapping
  - slag inclusion

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Use of Equipment and Materials	4	3	2	1	0	2	
Task Performance	4	3	2	1	0	2	

**General Outcome**

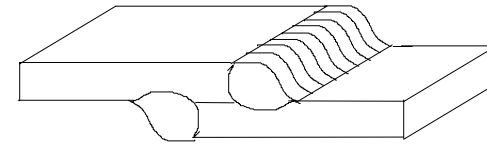
*The student will:*

- demonstrate basic SMAW competencies in the flat position

**PROCEDURE:**

Weld Type:	Lap Joint Fillet Weld
Positions:	flat
Preparation:	wire brush to remove rust, oil and scale
Base Metal:	2 -3/8" x 1½" x 5" (5 mm x 38 mm x 125 mm) mild steel
Filler Material:	1/8" E6010 (E41010) electrodes
Number of Passes:	one
Machine Set-up:	DCRP 90-120 amps
Fit-up:	¼" overlap, tight joint tacked at both ends
Manipulation:	one pass, stringer bead; electrode angle ½ of included joint angle and electrode inclination 5°-30° backhand, weld both sides.

**Task Performance Appraisal**



**Desirable Weld**

Weld profile should be slightly convex and of uniform width and height. Ripples are to be close, bullet shaped and free of voids, slag inclusion, high spots, craters and apparent restarts. Good plate penetration should exist over the entire length of the weld.

**Acceptable Weld**

Weld profile should be slightly convex with uniformly spaced ripples. Evidence of undercutting and overlapping should be minimal. Adequate fusion should exist between the bead and base metal.

**Comments:**

**General Outcome**

*The student will:*

- explain the current systems used to classify electrodes in Canada and the United States

**Standard**

Response rating of 2.

**Rating Scale**

*The student:*

- 4 independently makes explanations, critical judgements based on a superior knowledge base and understanding of content and related issues.
- 3 makes explanations and comparisons of content using more precise terminology. Requires little or no prompting.
- 2 applies knowledge of content to different situations using accurate terminology. May require some prompting.
- 1 relies on simple recall to demonstrate basic knowledge and understanding of content. May require frequent prompting.
- 0 is unable to provide a suitable response at this time.

Sample Question Item(s)	Sample Response(s)
<p>1. What is the difference between the CSA and AWS electrode coding systems?</p> <p>2. Explain the meaning of the following electrode code:</p> <ul style="list-style-type: none"> <li>- CSA - E-48014</li> <li>- AWS - E-7024</li> </ul> <p>3. Given the following electrodes to choose from,</p> <ul style="list-style-type: none"> <li>- E6013 (E41013)</li> <li>- E6018 (E41018)</li> <li>- E6012 (E41012)</li> <li>- E6011 (E41011)</li> </ul> <p>which one will provide:</p> <ul style="list-style-type: none"> <li>a) for general purpose work with poor fit up, produces medium penetration and slag</li> <li>b) for good quality general purpose work, produces heavy slag, medium penetration</li> <li>c) produces deep penetration and light slag, can also be used with AC</li> <li>d) good penetration, good for low alloy and mild steel.</li> </ul>	<p>The essential difference between the CSA and AWS coding system is that the CSA uses megapascals whereas the AWS uses pounds per square inch to indicate the tensile strength of an electrode.</p> <p>E – Electrode                      480 – tensile strength (480,000 M Pa)                      1 – Weld Position                      4 – AC and DC (straight and reverse polarity and flux characteristics)</p> <p>a) E6012                      b) E6013                      c) E6011                      d) E6018</p>

For additional sample items and responses refer to:

- *Welding Technology Fundamentals.* William A. Bowditch, 1991. Text and Laboratory Manual.
- *Modern Welding.* Andrew D. Althouse et. al., 1992. Text and Laboratory Manual.

**General Outcomes**

*The student will:*

- identify strategies to assess and improve weld quality
- demonstrate basic shielded metal arc welding (SMAW) competencies in the horizontal position

**Standard**

Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- thinks through problems before asking for help
- reads weld specification to determine:
  - weld type and position
  - type of weldment
  - type of electrode
  - equipment settings
  - welding techniques
- lists variables that contribute to weld quality
- identifies appropriate personal protective equipment (PPE) and ventilation controls

**Use of Equipment and Materials**

- wears the proper PPE
- follows accepted start-up, operation and shut-down procedures
- recognizes potential health and safety hazards

**Use of Equipment and Materials (continued)**

- measures accurately
- carries out proper fit-up procedures
- selects the correct electrodes
- adjusts equipment according to the weld specification
- manipulates the electrode as instructed
- removes slag and cleans weld appropriately
- stores and disposes materials as instructed
- fulfills given clean-up responsibilities

**Task Performance**

- produces two or more acceptable single and multi-pass horizontal:
  - lap joints using available mild steel and E7014 (E48014) and E7018 (E48018) electrodes
  - tee joints using available mild steel and E6010(41010) and/or E7024 (E48024) electrodes
- analyzes a given weld and takes appropriate measures to improve weld quality

**PERFORMANCE ASSESSMENT**

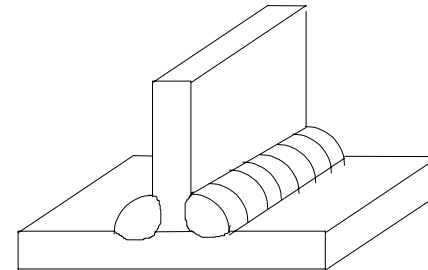
CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Use of Equipment and Materials	4	3	2	1	0	2	
Task Performance	4	3	2	1	0	2	

**General Outcome***The student will:*

- demonstrate basic shielded metal arc welding (SMAW) competencies in the horizontal position

**Procedure**

Weld Type:	Tee Joint Fillet Weld
Position:	horizontal
Preparation:	cut plates to 5" (125 mm) and wire brush joint
Base Metal:	1 – 3/8" x 2" x 5" (10 mm x 50 mm x 125 mm) 1 – 3/8" x 1 1/2" x 5" (10 mm x 38 mm x 125 mm) mild steel plate
Filler Metal:	5/32" E6010 (E41010)
Number of Passes:	one
Machine Set-up:	AC or DCRP, 180–200 amps
Fit-up:	centre tee section, tack at ends
Manipulation:	electrode angle ½ angle of included joint angle with an inclination of 10°–30° backhand.

**Task Performance Appraisal****Desirable Weld**

Beads should be slightly convex and have uniformly spaced, bullet shaped ripples. Restarts are made without creating depressions or high spots. Evidence of slag inclusion, undercutting and overlapping should not be present. Both legs should be equal to the material thickness.

**Acceptable Weld**

Beads should be slightly convex and evenly spaced. Evidence of slag inclusion, undercutting and overlapping should be minimal. Legs should not be less than the thicknesses of the base metal.

**Comments:**

**General Outcome**

*The student will:*

- outline the advantages and disadvantages of gas metal arc welding versus other forms of arc welding processes

**Standard**  
Performance rating of 2 for each applicable task.

**Rating Scale**

- The student:*
- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
  - 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
  - 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
  - 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
  - 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

- The student:*
- Preparation and Planning**
- sets goals and describes steps to achieve them
  - uses personal initiative to formulate questions and find answers
  - accesses a range of relevant in-school/community information sources
  - interprets, organizes and combines information into logical sequence
  - records information accurately with appropriate supporting detail and uses correct technical terms
  - plans and uses time effectively
- Content**
- describes the equipment and process of gas metal arc welding
  - lists four advantages of GMAW; e.g.:
    - welding is continuous, thus much faster
    - minimum weld clean-up
    - can be used with ferrous and non ferrous materials
    - produces less heat affected zone
    - lends itself to automation
- Content (continued)**
- lists three disadvantages of GMAW; e.g.:
    - shielded gas can be blown away in windy conditions
    - greater chance for a 'cold' weld (lack of fusion)
    - maintenance costs of equipment are higher
- Presenting/Reporting**
- demonstrates effective use of one or more communication media:
    - e.g., Written: spelling, punctuation grammar, basic format*
    - Oral: voice projection, language*
    - Audio-visual: techniques, tools*
  - uses correct grammatical conventions and technical terms
  - provides an introduction that describes the purpose of the project
  - communicates information in a logical sequence

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING	STANDARD	COMMENTS
Preparation and Planning	4 3 2 1 0	2	
Content	4 3 2 1 0	2	
Presenting/ Reporting	4 3 2 1 0	2	

**General Outcomes**

*The student will:*

- describe the characteristics of a desirable gas metal arc weld
- demonstrate safe GMAW practices to perform:
  - fillet welds on mild steel plate in the flat, horizontal and vertical positions
  - groove welds on mild steel plate in the flat position

**Standard**

Performance rating of 3 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- thinks through problems before asking for help
- reads weld specifications to determine:
  - weld type and position
  - type of weldment
  - type of filler metal
  - equipment settings
  - welding techniques
- understands first aid treatment for minor cuts, burns and bruises
- identifies appropriate personal protective equipment (PPE) and ventilation controls

**Use of Equipment and Materials**

- wears the proper PPE
- follows accepted start-up, operation and shut-down procedures
- recognizes potential health and safety hazards

**Use of Equipment and Materials (continued)**

- measures accurately
- carries out proper fit-up procedures
- selects the correct type of electrode and wire gauge
- adjusts equipment according to the weld specification and manufacturer’s recommendations
- manipulates the gun and electrode as instructed
- cleans weld appropriately
- stores and disposes materials as instructed
- fulfills given clean-up responsibilities

**Task Performance**

- produces two or more acceptable:
  - lap joints on available light gauge mild steel in the horizontal and vertical positions
  - tee joints on available light gauge mild steel in the horizontal and vertical positions
- evaluates a given weld according to:
  - overall appearance
  - weld profile
  - plate penetration
  - degree of undercutting and coldlapping
  - slag inclusions if using flux core wire

**PERFORMANCE ASSESSMENT**

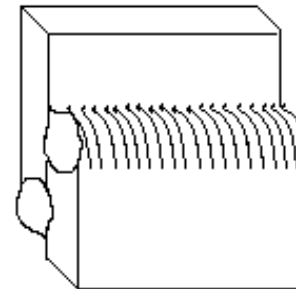
CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	3	
Use of Equipment and Materials	4	3	2	1	0	3	
Task Performance	4	3	2	1	0	3	

**General Outcomes**

*The student will:*

- describe the characteristics of a desirable gas metal arc weld
- demonstrate safe GMAW practices and perform:
  - fillet welds on mild steel plate in the flat, horizontal and vertical positions
  - groove welds on mild steel plate in the flat position

**Task Performance Appraisal**



**Desirable Weld**

Beads should be slightly convex and of uniform width and height. Ripples are to be close, bullet shaped and free of voids, high spots, undercutting and cold lapping. Both legs should be equal to the thickness of the base metal.

**Acceptable Weld**

Beads should be slightly convex and evenly spaced. Evidence of voids, undercutting and cold lapping should be minimal. Legs should not be less than the thickness of the base metal.

**PROCEDURE**

Weld Type:	Lap Joint Fillet Weld
Position:	horizontal
Base Metal:	2 – 1 1/2" x 6" (38 mm x 150 mm) 10–14 gauge mild steel
Preparation:	wire brush to remove rust, oil and scale
Filler Metal:	0.035" (0.9 mm) ER70S
Shielding Gas	CO <sub>2</sub>
Number of Passes:	one
Machine Set-up:	as recommended by manufacturer
Fit-up:	overlap 1/8" (3 mm) tight fitting, tacked at both ends
Manipulation:	weld both sides of joint. Forehand first side and backhand second side.

**Comments:**

**General Outcomes**

*The student will:*

- identify and describe common types of stock sheet metal materials and related tools
- demonstrate approved materials handling and storage practices
- perform basic sheet metal fabrication skills and practices to produce a product

**Standard**  
Performance rating of 2 for each applicable task.

**Rating Scale**

- The student:*
- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
  - 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
  - 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
  - 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
  - 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- adheres to established timelines
- thinks through problems before asking for help

**Content**

- identifies 4 or more different types of sheet metal materials
- explains how thicknesses are measured and stated
- identifies ten common sheet metal tools and joints
- describes three or more types of hems and/or seams

**Fabrication Techniques**

- calculates hem and seam allowances
- lays out, cuts, bends and fastens two or more different seams that can be incorporated into a useful product

**Work Skills**

- prepares self for task
- follows directions with limited prompting
- adheres to established timelines
- minimizes material costs
- works cooperatively with others in both structured and non-structured settings
- uses proper personal protective equipment
- observes proper lifting, handling and storage procedures
- fulfills expected clean-up responsibilities

**Product Presentation**

- describes the purpose of the product
- summarizes and reports on major events
- evaluates the design and production techniques
- suggests way to improve product design and production processes

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Content	4	3	2	1	0	2	
Fabrication Techniques	4	3	2	1	0	2	
Work Skills	4	3	2	1	0	2	
Product Presentation	4	3	2	1	0	2	

**General Outcomes**

*The student will:*

- describe and give examples of parallel line developments
- create a parallel line development, using standard drawing and layout practices
- apply sheet metal fabrication principles skills to fabricate a product, using parallel line development

**Standard**

Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- adheres to established timelines
- thinks through problems before asking for help

**Content**

- lists examples of parallel line and radial line developments
- compares procedures to lay out parallel line and other developments
- identifies common joints and edge treatments associated with parallel line development

**Fabrication Techniques**

- prepares a parallel line development
- transfers patterns to sheet stock
- cuts, bends and fastens stock according to plan and accepted practice

**Work Skills**

- prepares self for task
- follows directions with limited prompting
- adheres to established timelines
- minimizes material waste
- works cooperatively with others in both structured and non-structured settings
- uses proper personal protective equipment
- observes proper lifting, handling and storage procedures
- fulfills expected clean-up responsibilities

**Product Presentation**

- describes the purpose of the product
- summarizes and reports on major events
- evaluates the design and production techniques
- suggests ways to improve product design and production processes

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Content	4	3	2	1	0	2	
Fabrication Techniques	4	3	2	1	0	2	
Work Skills	4	3	2	1	0	2	
Product Presentation	4	3	2	1	0	2	

**General Outcomes**

*The student will:*

- identify health and safety hazards associated with metal forging, and take preventive measures to avoid accidents and personal injury to self and others
- identify and describe the basic tools and processes used in forging
- demonstrate basic metal forging skills and practices

**Standard**  
Performance rating of 2 for each applicable task.

**Rating Scale**

- The student:*
- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
  - 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
  - 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
  - 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
  - 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- adheres to established timelines
- thinks through problems before asking for help

**Content**

- identifies the parts and describes the safe operation of a forge
- describes and demonstrates the processes of drawing, tapering, bending and upsetting
- compares the purpose and process of hardening, tempering, annealing and normalizing

**Fabrication Techniques**

- forges a product to the desired size and shape
- finishes and conditions the product to achieve the specified properties

**Work Skills**

- prepares self for task
- follows directions with limited prompting
- adheres to established timelines
- minimizes material waste
- works cooperatively with others in both structured and nonstructured settings
- uses proper personal protective equipment
- observes proper lifting, handling and storage procedures
- fulfills expected clean-up responsibilities

**Product Presentation**

- describes the purpose of the product
- summarizes and reports on major events
- evaluates the design and production techniques
- suggests ways to improve product design and production processes

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Content	4	3	2	1	0	2	
Fabrication Techniques	4	3	2	1	0	2	
Work Skills	4	3	2	1	0	2	
Product Presentation	4	3	2	1	0	2	

**General Outcome**

*The student will:*

- describe the essential similarities and differences between a one-piece pattern and a split pattern

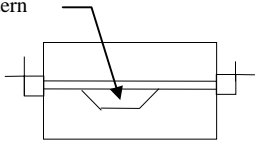
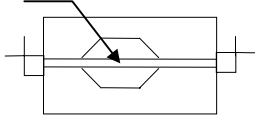
**Standard**

Response rating of 2.

**Rating Scale**

*The student:*

- 4 independently makes explanations, critical judgements based on a superior knowledge base and understanding of content and related issues.
- 3 makes explanations and comparisons of content using more precise terminology. Requires little or no prompting.
- 2 applies knowledge of content to different situations using accurate terminology. May require some prompting.
- 1 relies on simple recall to demonstrate basic knowledge and understanding of content. May require frequent prompting.
- 0 is unable to provide a suitable response at this time.

Sample Question Item(s)	Sample Response(s)
<p>1. Each item one wishes to cast presents its own set of pattern requirements. Patterns must be designed to replicate the product and be easily removed without damaging the mold. Explain the difference between a one piece and split pattern.</p>	<p>A one piece pattern can be used when the upper face of the pattern corresponds to the parting line and the separation point between the cope and drag as shown below.</p> <div style="text-align: center;">  </div> <p>A split pattern is made in two halves, split along the parting line to make it possible to remove the pattern without damaging the mold. See below.</p> <div style="text-align: center;">  </div> <p>Both the one piece and split pattern can be constructed out of the same materials and be aligned using a pattern board and/or drag pins. However, one piece patterns can sometimes be made from the actual object being replicated.</p> <p>Match plate patterns are used in conjunction with on-piece and split patterns to help speed up production. Gate and runner systems are often attached to match plate thus eliminating the need to cut them into the mold by hand.</p>
<p>2. When are match plate patterns used?</p>	<p>Match plate patterns are used in conjunction with on-piece and split patterns to help speed up production. Gate and runner systems are often attached to match plate thus eliminating the need to cut them into the mold by hand.</p>

For additional sample items and responses refer to:

- Metalwork Technology and Practice.* Victor E. Repp, 1994. Text.
- Modern Woodworking.* Willis H. Wagner et. al., 1996. Text.

**General Outcomes**

*The student will:*

- describe and perform safe start-up and shut-down procedures for the operation of a foundry furnace
- demonstrate basic pattern making skills to make a split pattern
- apply sand casting principles and skills to make a casting from a split pattern

**Standard**  
Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals.*

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort.*

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals.*

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively.*

0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- adheres to established timelines
- thinks through problems before asking for help

**Content**

- identifies the parts of a foundry furnace
- describes and demonstrates the safe operation of a foundry furnace
- identifies the hazards related to heating and pouring metal
- outlines an appropriate emergency response in the event of an accident

**Use of Equipment and Materials**

- follows accepted start-up and shut-down practices
- uses proper personal protective equipment
- observes proper lifting, handling and storage procedures

**Use of Equipment and Materials (continued)**

- calculates and measures accurately
- minimizes waste of materials
- fulfills expected clean-up responsibilities
- recognizes and controls potential health and safety hazards

**Fabrication Techniques**

- prepares/produces a split pattern
- creates a sand mold
- produces a finished sand casting according to the design specifications

**Teamwork**

- cooperates with group members in structured and non-structured settings
- shares equipment and work appropriately among group members
- negotiates solutions to problems

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Content	4	3	2	1	0	2	
Use of Equipment and Materials	4	3	2	1	0	2	
Fabrication Techniques	4	3	2	1	0	2	
Teamwork	4	3	2	1	0	2	

**General Outcomes**

*The student will:*

- identify health and safety hazards specific to metal turning, and take preventive measures to avoid accidents and personal injury to self and others
- perform safe metal lathe set-up, operation and shut-down procedures
- demonstrate basic straight turning and finishing skills

**Standard**

Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- adheres to established timelines
- thinks through problems before asking for help
- reads a machine drawing to identify:
  - type of materials
  - overall and detailed dimensions
  - fits and tolerances
  - finishes

**Use of Equipment and Materials**

- selects and uses appropriate equipment/materials safely
- uses proper personal protective equipment
- follows proper lifting, handling and storage procedures
- calculates and measures accurately

**Use of Equipment and Materials** (continued)

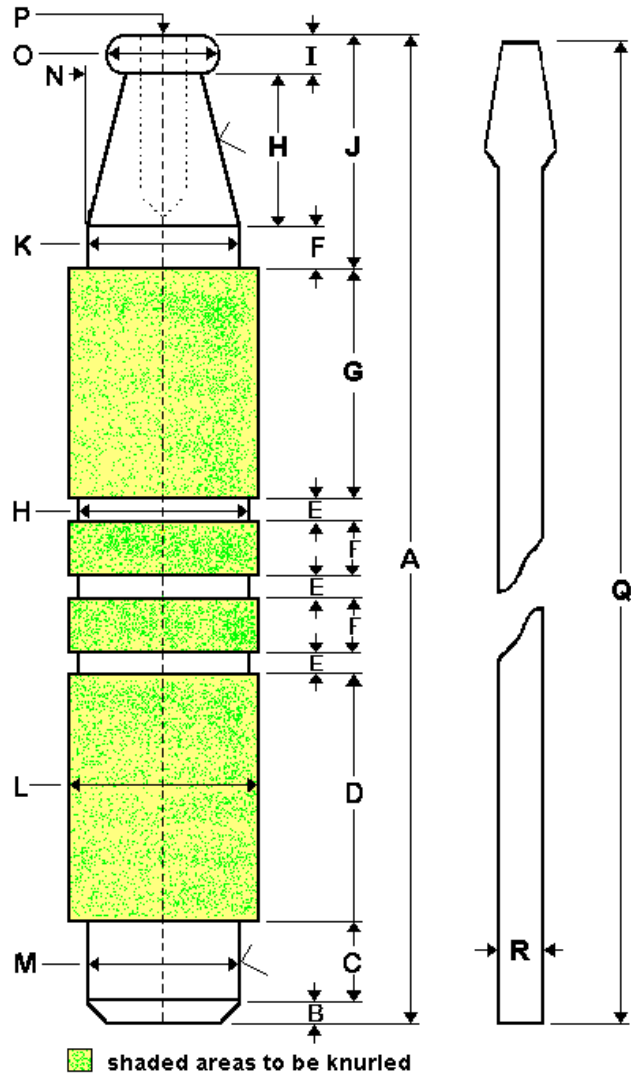
- minimizes waste of materials
- fulfills expected clean-up responsibilities
- recognizes and controls potential health and safety hazards

**Machining Skills**

- demonstrates basic skills related to:
  - facing
  - centre drilling
  - rough and finish sizing
  - drilling
  - finishing
  - knurling
  - parting
  - assembling
- describes procedures to improve product quality and productivity

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Use of Equipment and Materials	4	3	2	1	0	2	
Machining Skills	4	3	2	1	0	2	



A.	128 mm
B.	2 mm
C.	10 mm
D.	32 mm
E.	3 mm
F.	6 mm
G.	30 mm
H.	22 mm
I.	5 mm
J.	33 mm
K.	20 mm
L.	25 mm
M.	19 mm
N.	10 mm
O.	15 mm
P.	'C' x 25
Q.	165 mm
R.	6.4 mm
S.	Demo

Quality Appraisal		
Specific Assessment	Indicators	Actual
1. Dimensioning		
• Diameter "M" - 19 mm	± 1 mm	
• Diameter "L" - 25 mm	± 1 mm	
• Diameter "H" - 22 mm	± 1 mm	
• Diameter "K" - 20 mm	± 1 mm	
• Diameter "O" - 15 mm	± 1 mm	
• Length "A" - 128 mm	± 2 mm	
• Length "D" - 32 mm	± 1 mm	
• Length "G" - 30 mm	± 1 mm	
• Length "J" - 33 mm	± 1 mm	
• Length of Q-P - 145 mm	± 3 mm	
2. Shape of finished tip	• as per drawing	
3. Finishing		
• Knurling	• even diamond pattern	
• Chamfer	• 60° with edges rounded off	
• Finish	• smooth machined surface	
4. Fit, blade to handle	• press fit	

This screwdriver is a good intermediate project that incorporates principles of machining and forging. The handle can be made from recycled aluminium or 1" round bar stock. The project will take between 4 to 6 hours for the beginning student.

*Project prepared by Mike Blackwell, Wetaskiwin Composite High School, Wetaskiwin*

## FABRICATION PROCEDURES

Step	Operation	Precaution	Step	Operation	Precaution
1	Use power hacksaw to cut off aluminium stock 25 mm diameter x 145 mm long <input type="checkbox"/>	Make sure work is secure in saw vise	13.	Using dividers and steel rule mark out length "G" and "F" (cutter width is 3mm), width "E" <input type="checkbox"/> Use cross feed and cut to diameter "H"	All measurements should be made to the <b>tailstock side</b> of the cutter
2	Place stock in 3 Jaw lathe chuck and <b>face off both ends</b> <input type="checkbox"/>	Make sure stock is extended <b>no more</b> than 25 mm out from chuck jaws	14.	<b>Reverse</b> work in lathe and let approximately 25 mm. protrude. Measure out distance "D" of stock to diameter "M" <input type="checkbox"/>	Take two cuts to reduce diameter and use vernier calliper to check for final size <b>before</b> making last cut
3	Centre drill <b>both ends</b> at least ½ way up taper of center drill <input type="checkbox"/>	Tailstock lock must be off	15.	Mark out distance "C" and "B" and face off excess material to finished length <input type="checkbox"/>	Hold handwheel while facing off work
4	Place one end of stock in 3 Jaw Chuck at least 15 mm in and ensure other end is supported by the tailstock <input type="checkbox"/>	Tailstock spindle clamp should be clamped to the lathe bed and spindle locked	16.	Use a <b>single cut</b> file, chamfer end to 60 deg. angle size "B" <input type="checkbox"/>	Keep arms clear of chuck
5	Knurl stock from headstock end, toward tailstock end of lathe <input type="checkbox"/>	Check with teacher <b>before</b> attempting this step	17.	Reverse work in lathe and let 40 mm protrude from chuck jaws. Round distance "T" with single cut file <input type="checkbox"/>	Keep arms clear of chuck
6	<b>Reverse</b> stock in the lathe with a minimum of 15 mm in the lathe chuck <input type="checkbox"/>	Reset the tailstock and engage both clamps	18.	Polish length "J" and "C" and "B" with emery cloth <input type="checkbox"/>	Hold cloth as per demonstration
7	Using dividers and a steel rule, mark out distance "J" and align cutting tool point with divider point <input type="checkbox"/>	Cutting tool <b>SHOULD NOT</b> be touching work before lathe is turned on	19.	Check work with 25 mm protruding from the chuck jaws and drill hole "P". (Use letter drill "C") <input type="checkbox"/>	Use tailstock scale to measure drill depth
8	Turn lathe on and move cross-feed in until tool touches the revolving workpiece and has cut a light ring all the way around <input type="checkbox"/>	Hold handwheel with one hand for this operation	20.	Cut off tip stock to length "Q" <input type="checkbox"/>	Use <b>hand</b> saw
9	Reduce length "J" to diameter "K" taking 2 cuts using automatic feed. Total reduction should be L-K. Stop lathe after 2 mm along length on 2nd cut and check for final size with digital vernier calliper <input type="checkbox"/>	Make sure cutting tool is just touching rotating work before zeroing out cross feed collar	21.	Forge tip to rough size as per demonstration <input type="checkbox"/>	Exercise care using the cutting torch or other heat source
10	Using dividers and a steel rule, mark out length "I" and reduce to diameter "O". Use vernier to check before final cut <input type="checkbox"/>	Same procedures as steps 7, 8, 9. Feed by hand for this cut	22.	Grind tip to shape as per demonstration <input type="checkbox"/>	Keep work supported while grinding
11	Cut taper "H" using taper attachment method, moving from headstock to tailstock end. Take 3 cuts to finish taper <input type="checkbox"/>	Set taper attachment at 10 deg. and hand feed	23.	Draw file and polish as per demonstration <input type="checkbox"/>	Use emery cloth as shown
12	Set up <b>parting tool</b> and turret holder <input type="checkbox"/>	Check with teacher <b>before</b> proceeding with this step	24.	Fit handle to tip <input type="checkbox"/>	Ask teacher to assist with this operation
			25.	Mount handle in lathe and repolish tip <input type="checkbox"/>	

Project Prepared by Mike Blackwell, Wetaskiwin Composite High School

**General Outcomes**

*The student will:*

- identify health and safety hazards specific to milling operations, and take preventive measures to avoid accidents and personal injury to self and others
- demonstrate basic milling machine skills and practices

**Standard**

Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- adheres to established timelines
- thinks through problems before asking for help
- reads a machine drawing to identify:
  - type of materials
  - overall and detailed dimensions
  - finishes

**Machining Skills**

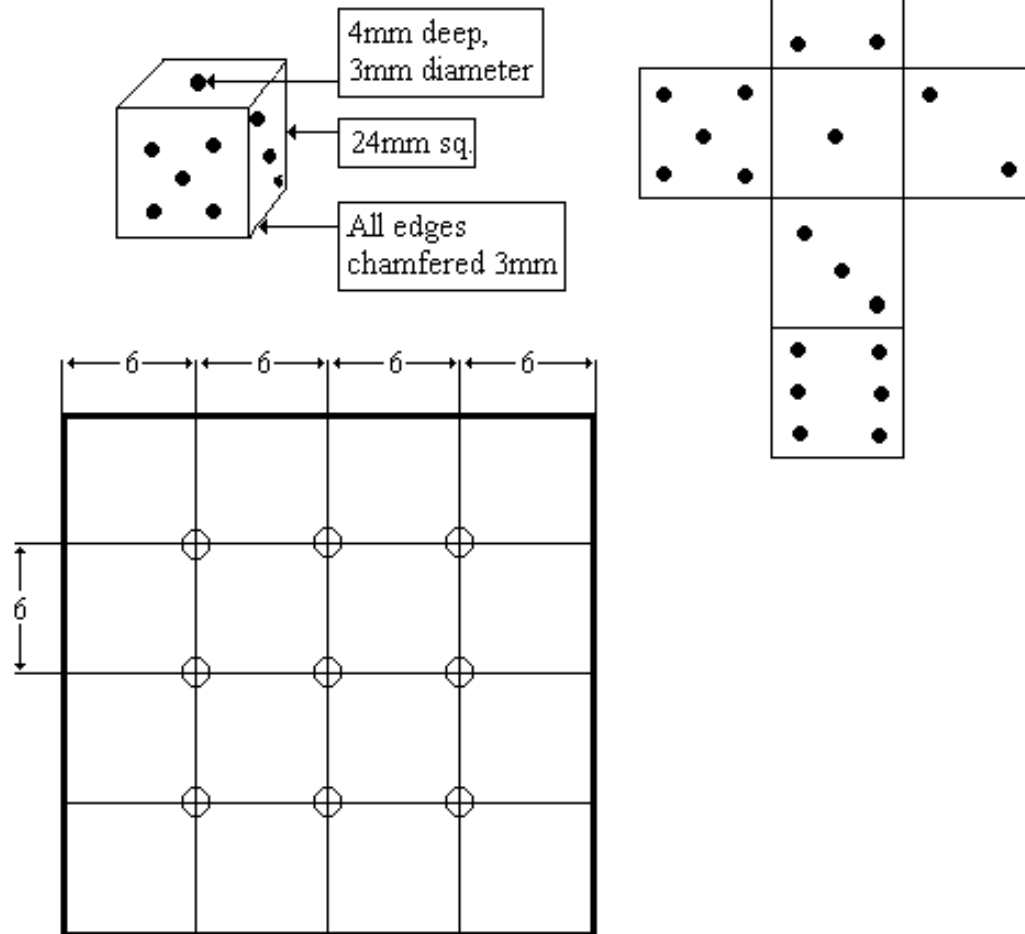
- demonstrates basic skills related to:
  - rough sizing
  - squaring and bevelling
  - finishing
 to the prescribed tolerances and specifications
- describes procedures to improve product quality and productivity

**Use of Equipment and Materials**

- selects and uses appropriate equipment/materials safely
- uses proper personal protective equipment
- follows proper lifting, handling and storage procedures
- calculates and measures accurately
- minimizes waste of materials
- fulfills expected clean-up responsibilities
- recognizes and controls potential health and safety hazards

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Use of Equipment and Materials	4	3	2	1	0	2	
Machining Skills	4	3	2	1	0	2	



Dice are an excellent intermediate project fabricated on a milling machine. The project involves cutting materials with a metal bandsaw, milling to size, filing a chamfer and drilling. This project will take 4-6 hours to complete. As a further quality indicator, a second die can be produced and compared to the first.

Basic Procedure	
1.	Cut material to size by hand or with a metal band saw
2.	With teacher's permission and checked, set up on milling machine, proceed to mill aluminium square stock to specified dimensions.
3.	Proceed to file a 15 degree chamfer on all leading edges as shown on diagram.
4.	Use fine emery cloth to clean up all scratches and milling marks.
5.	Polish each die using #11 tripoli on a metal buffer.
6.	Layout and centre punch all holes to be drilled on die as specified.
7.	With teacher's permission, use drill press to drill all required holes to the specified depth.
8.	Check each die for nicks and scratches and repolish as necessary.
9.	As a further quality indicator, produce a second die and compare the first product.

Quality Indicators		
	Specific Assessment	Standard
1.	Dimensioning Overall height - 24 mm Overall width - 24 mm Overall length - 24 mm	$\pm 2$ mm (1/16") $\pm 2$ mm (1/16") $\pm 2$ mm (1/16")
2.	Squaring All sides are cut square  File 15 degree chamfer on all edges	run out not more than 1 mm (1/32 inch) over each side 3 mm chamfer x 15 degree (1/8 inch)
3.	Finishing Evidence of chipping Evident of file marks Emery cloth marks Polishing - use #11 Tripoli on buffer	minimal  minimal even
4.	Drilling Drill bit size (4 mm - 1/8") All holes drilled to depth of 3 mm (1/8 inch)	holes of even depth, drilled and spaced according to blueprint

*Project prepared by Clint Schwalbe, H.W. Pickup Junior High School, Drayton Valley*

**General Outcomes**

*The student will:*

- demonstrate appropriate communicating and planning skills
- demonstrate effective resource management skills and practices
- demonstrate custom fabrication competencies

**Standard**

Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Planning and Management**

- defines project outcomes
- communicates with the customer to determine:
  - customer needs
  - cost and time restraints
- conducts research pertaining to the task
- generates and considers the suitability of a number of design solutions
- works with the client to select a design that meets their needs
- creates an appropriate event sequence and time line

**Client Service**

- communicates frequently with client
- listens and responds to client requests
- apprises the client of any need to make changes
- fulfills condition of the contract
- follows up after work has been completed

**Work Skills**

- follows directions with limited prompting
- organizes work in an orderly manner
- works cooperatively with others in both structured and non-structured settings
- uses correct personal protective equipment
- follows proper lifting and handling procedures
- fulfills expected clean-up responsibilities
- stores, and disposes materials according to recommended procedures

**Product Presentation**

- describes the purpose of the project
- summarizes and reports on major events
- assesses design processes and production techniques
- suggests possible improvements to the design and production processes to better meet the client needs

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Planning and Management	4	3	2	1	0	2	
Client Services	4	3	2	1	0	2	
Work Skills	4	3	2	1	0	2	
Product Presentation	4	3	2	1	0	2	

**General Outcomes**

*The student will:*

- identify and describe common piping materials and applications.
- research and profile a trade or occupation within the pipe fitting field

**Standard**

Performance rating of 2 for each applicable task.

**Rating Scale**

*The student:*

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals.*
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort.*
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals.*
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively.*
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

**TASK PERFORMANCE CRITERIA**

*The student:*

**Preparation and Planning**

- sets goals and establishes steps to achieve them
- creates and adheres to useful timelines
- creates personal initiative to formulate questions and find answers
- plans and uses time effectively

**Information Gathering and Processing**

- accesses a range of relevant school/community information resources
- uses a range of information-gathering techniques
- interprets, organizes and combines information into a logical sequence
- determines accuracy/currency/reliability of information sources

**Content**

- investigates and describes common types and applications of piping systems
- identifies common materials used to manufacturer pipe

**Content (continued)**

- lists and describes common fittings and components used in piping systems
- describes common methods of joining pipe
- identifies appropriate method of laying, hanging and/or securing pipe
- investigates career and further training opportunities related to pipe work by identifying:
  - present and future career opportunities
  - skill requirements
  - training opportunities

**Information Sharing**

- demonstrates effective use of two or more communication media; e.g., written, oral, audio-visual
- communicates ideas in a logical sequence with sufficient supporting detail
- maintains acceptable grammatical and technical standards

**PERFORMANCE ASSESSMENT**

CRITERIA	STUDENT RATING					STANDARD	COMMENTS
Preparation and Planning	4	3	2	1	0	2	
Information Gathering and Processing	4	3	2	1	0	2	
Content	4	3	2	1	0	2	
Information Sharing	4	3	2	1	0	2	