

COURSE CURRICULUM AND ASSESSMENT STANDARDS:

SECTION D: INTRODUCTORY LEVEL

The following pages define the curriculum and assessment standards for the introductory level of Fabrication Studies.

Introductory level courses help students build daily living skills and form the basis for further learning. Introductory courses are developed for students who have no previous experience in the strand.

General outcomes define the competencies a student must demonstrate to achieve success in a course. Assessment standards define the criteria and conditions to be used for assessing the competencies defined in the general outcomes.

Specific outcomes provide a detailed framework for instruction to help students build the competencies defined in the general outcomes. Additional information and suggestions for instruction are provided in the Notes column; teachers may wish to use this space to record their ideas for instruction or student projects.

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COURSE FAB1010: FABRICATION TOOLS & MATERIALS

Level: Introductory

Theme: Materials and Structures

Prerequisite: None

Description: Students develop knowledge and skills in the use of basic hand tools and materials used in fabrication processes, and safely transform common metals into useful products.

Parameters: Access to a materials work centre complete with basic hand tools.

Curriculum and Assessment Standards

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • identify and describe the safe use of basic hand tools used in fabricating an artifact or structure 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • the identification and description of 20 basic hand tools used in fabrication processes; basic hand tools to include two or more: <ul style="list-style-type: none"> – measurement and layout tools – cutting and boring tools – assembly and dismantling tools – abrading and sharpening tools. <p><i>Assessment Tool</i> <i>Presentations/Reports: Hand Tools, FAB1010–1</i> <i>Illustrative Example: Hand Tool Presentation, FAB1010–2</i></p> <p><i>Standard</i> <i>Correct identification and description of 16 basic hand tools</i> <i>Performance rating of 1 for each applicable task</i></p>	<p>15</p>
<ul style="list-style-type: none"> • identify and compare the properties of common ferrous and nonferrous metals used in fabrication processes 	<ul style="list-style-type: none"> • a presentation or report that explains the properties, applications and different processes used in assembling/fastening: <ul style="list-style-type: none"> – low-, medium- and high-carbon steels – alloy steels – nonferrous metals and their alloys. <p><i>Assessment Tool</i> <i>Presentations/Reports: Material Identification, FAB1010–3</i></p> <p><i>Standard</i> <i>Performance rating of 1 for each applicable task</i></p>	<p>15</p>

COURSE FAB1010: FABRICATION TOOLS & MATERIALS (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • apply fabrication processes and skills in a safe manner to produce a useful product • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • demonstration of safe processes and skills to plan, fabricate, assemble and finish a useful product. <p><i>Assessment Tool</i> <i>Assessment Framework: Product Assessment, FABPRD</i></p> <p><i>Standard</i> <i>The product is made according to the prepared drawing and event sequence; tools and materials are used according to accepted safe practice</i> <i>Performance rating of 1 for each applicable task</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p style="text-align: center;">70</p> <p>Integrated throughout</p>

Concept	Specific Outcomes	Notes
<p>Orientation</p> <ul style="list-style-type: none"> • Tools and Equipment • Materials 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify and describe basic hand tools that are used to measure, mark, hold, cut, form, fasten and finish materials • identify and describe basic tools and equipment used in one or more fabrication processes; e.g.: <ul style="list-style-type: none"> – welding – bar, tubular and sheet fabrication – foundry operations – machining • identify and compare the properties of a variety of ferrous and nonferrous metals used in fabrication processes • identify common shapes, sizes and forms of fabrication materials. 	<p>Introduce students to the safe use of manually operated and power assisted hand tools and equipment.</p> <p>Discuss reasons for choosing one metal over another for a given application.</p>

COURSE FAB1010: FABRICATION TOOLS & MATERIALS (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Health and Safety • Production Systems 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe appropriate methods to handle, recycle, store and dispose of materials • identify and demonstrate the appropriate use of personal protective equipment • identify steps to be taken in the event of an accident • outline the typical phases in a production system; e.g.: <ul style="list-style-type: none"> – planning – fabricating – assembling – finishing – evaluating. 	<p>Help students evaluate the short- and long-term impact of the choice of a material on the health of individuals and the environment.</p> <p>Compare those activities to the input, process, output and feedback mechanisms described in other technological systems.</p>
<p>Planning and Management</p> <ul style="list-style-type: none"> • Product Development 	<ul style="list-style-type: none"> • select or modify a plan for a simple product that will meet a defined need • identify and select the appropriate tools, materials and processes required to make the product • list the steps that are required to make a product in a safe and logical order. 	<p>Students are more highly motivated if they can choose and personalize a project.</p>
<p>Implementation</p> <ul style="list-style-type: none"> • Material Processing 	<ul style="list-style-type: none"> • develop basic fabrication skills by building, assembling and finishing a variety of products. 	
<p>Assessment</p> <ul style="list-style-type: none"> • Product Quality • Career Preparation 	<ul style="list-style-type: none"> • describe ways to improve product quality and productivity • create a record of completed activities within a portfolio. 	<p>Students should be encouraged to make reflective notes and keep a record of their completed work.</p>

COURSE FAB1040: OXYACETYLENE WELDING**Level:** Introductory**Theme:** Fabrication Processes**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students develop basic skills in the safe handling and operation of oxyacetylene equipment.**Parameters:** Access to a materials work centre complete with oxyacetylene welding equipment and fabrication facilities, and to instruction from an individual with formal specialized training in basic oxyacetylene welding.**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> recognize health and safety hazards associated with oxyacetylene welding (OWA), and take preventive measures to avoid accidents and personal injury to self and others perform safe oxyacetylene start-up and shut-down procedures 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> ongoing observed performance related to: <ul style="list-style-type: none"> appropriate selection and use of personal protective equipment maintenance of a clean and tidy workstation safe use of equipment and materials. <p><i>Assessment Tool</i> <i>Fabrication Process: Basic Oxyacetylene Welding, FAB1040-1</i></p> <p><i>Standard</i> <i>Performance rating of 1 for each applicable task</i></p>	10
	<ul style="list-style-type: none"> demonstration of safe start-up and shut-down procedures, using Oxyacetylene Welding (OAW) equipment. <p><i>Assessment Tool</i> <i>Equipment Checklist: OAW Start-up and Shut-down Procedures, FABEQUIP-5</i></p> <p><i>Standard</i> <i>All procedures to be performed correctly</i></p>	20

COURSE FAB1040: OXYACETYLENE WELDING (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Oxyacetylene Welding (continued) • Weld Joints, Position and Types • Health and Safety 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe how welding tips are sized • describe how welding tips are cleaned • describe the characteristics of: <ul style="list-style-type: none"> – an oxidizing flame – a carburizing flame – a neutral flame • identify typical weld types; e.g.: <ul style="list-style-type: none"> – fillet – groove – plug • identify typical weld positions; e.g.: <ul style="list-style-type: none"> – flat – horizontal – vertical – overhead • list and describe the basic weld joints; e.g.: <ul style="list-style-type: none"> – butt – lap – tee – corner – edge • describe the hazards associated with oxyacetylene welding in relation to: <ul style="list-style-type: none"> – use of personal protective equipment – use of flammable gases under pressure – the need to remove or protect all combustible materials around the welding area • describe a plan of action in the event of an accident. 	<p>Review the parts of a flame and demonstrate where the greatest amount of heat is produced.</p> <p>Explain the importance of not allowing pure oxygen to come in contact with oily or greasy materials under any circumstance.</p>

COURSE FAB1040: OXYACETYLENE WELDING (continued)

Concept	Specific Outcomes	Notes
<p>Planning and Management</p> <ul style="list-style-type: none"> • Start-up and Shut-down Procedures 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe and demonstrate the safe start-up and shut-down procedures for oxyacetylene welding • prepare a selection of coupons for welding lap joints • select the appropriate tip for a given application • identify appropriate gas pressure for proper flame control • identify the appropriate fire extinguisher in the event of a fire. 	<p>In this course, students are not expected to set up the welding equipment; however, they are expected to demonstrate safe start-up and shut-down procedures.</p>
<p>Implementation</p> <ul style="list-style-type: none"> • Fusion Welding 	<ul style="list-style-type: none"> • demonstrate proficiency in: <ul style="list-style-type: none"> – creating lines of fusion without using a filler rod – creating lines of fusion with filler rod – welding fillet welds in the flat position. 	<p>Students should gain experience welding various thicknesses of materials using different diameters of filler rods and welding tip sizes.</p>
<p>Assessment</p> <ul style="list-style-type: none"> • Quality Control • Career Preparation 	<ul style="list-style-type: none"> • complete a visual inspection of a weld by considering the overall appearance, size and shape of the beads, plate penetration, fusion and degree of undercutting and overlapping • prepare a record of completed activities within a portfolio. 	<p>Have students identify the defects in unacceptable welds and suggest ways to overcome these imperfections.</p>

COURSE FAB1050: BASIC ELECTRIC WELDING**Level:** Introductory**Theme:** Fabrication Processes**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students develop basic skills related to safe use and operation of one or more common electric welding processes.**Parameters:** Access to a materials work centre complete with electric welding equipment and fabrication facilities, and to instruction from an individual with formal specialized training in basic gas metal and/or shielded metal arc welding.**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> recognize health and safety hazards associated with electric welding processes, and preventive measures to avoid accidents and personal injury to self and others perform safe gas metal and/or shielded metal arc welding start-up and shut-down procedures 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observed performance in a typical work setting, related to: <ul style="list-style-type: none"> appropriate selection and use of personal protective equipment maintenance of a clean and tidy workstation safe use of equipment and materials. <p><i>Assessment Tool</i> <i>Fabrication Process: Electric Welding, FAB1050-1</i></p> <p><i>Standard</i> <i>Performance rating of 1 for each applicable task</i></p>	10
	<ul style="list-style-type: none"> demonstration of consistent safe start-up and shut-down procedures using Shielded Metal Arc Welding (SMAW) and/or Gas Metal Arc Welding (GMAW) equipment. <p><i>Assessment Tool</i> <i>Equipment Checklist: GMAW Start-up and Shut-down Procedures, FABEQUIP-6</i></p> <p><i>Standard</i> <i>All procedures to be performed correctly</i></p>	20

COURSE FAB1050: BASIC ELECTRIC WELDING (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Electric Welding (continued) • Weld Joints Position and Types • Health and Safety • Fire Prevention 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain the purpose of the electrode coating and/or shielding gas in their respective processes • identify the essential components and accessories used in gas metal and/or shielded metal arc welding • identify typical weld types; e.g.: <ul style="list-style-type: none"> – fillet – groove – plug or slot – stud • identify typical weld positions; e.g.: <ul style="list-style-type: none"> – flat – horizontal – vertical – overhead • list and describe the basic weld joint; e.g.: <ul style="list-style-type: none"> – butt – lap – tee – corner – edge • describe the hazards associated with gas metal and shielded metal arc welding • demonstrate how personal protective equipment is used to protect eyes, skin and respiratory system • describe a safety plan in case of an accident • describe the need to remove or protect all combustible materials in the welding area • identify and locate the appropriate fire extinguisher and fire blanket. 	<p>Have the students understand the need to protect the weld from atmospheric contamination.</p> <p>Demonstrate appropriate methods to set up equipment and strike an arc.</p> <p>As part of an ongoing expectation, students should be able to describe a plan of action in the event of a fire or accident.</p>

COURSE FAB1050: BASIC ELECTRIC WELDING (continued)

Concept	Specific Outcomes	Notes
<p>Planning and Management</p> <ul style="list-style-type: none"> • Weld Specifications • Weld Preparation 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe from a weld specification the: <ul style="list-style-type: none"> – type of equipment to be used – size and type of electrode/wire – weld settings – type of weld, joint and weld position – weld dimensions • prepare weld surfaces by removing any: <ul style="list-style-type: none"> – oil and/or grease – paint, rust or scale • describe the start-up and shut-down procedures for a given piece of equipment • locate all pertinent safety equipment and clamping apparatus. 	<p>For students just beginning to arc weld E6013 and/or E7014 electrodes are recommended.</p>
<p>Implementation</p> <ul style="list-style-type: none"> • Electric Welding 	<ul style="list-style-type: none"> • demonstrate basic skills in: <ul style="list-style-type: none"> – selecting equipment and accessories – setting machine parameters – connecting work leads – striking an arc using a tapping and scratching technique – running a stringer and weave bead – performing fillet welds in the flat position using SMAW, GMAW and FCAW processes. 	<p>It is understood that students will require practice time to develop their skills using coupons and scrap material. However, as much as is possible, students should be allowed to develop these skills by fabricating simple products.</p>
<p>Assessment</p> <ul style="list-style-type: none"> • Quality Control • Career Information • Career Preparation 	<ul style="list-style-type: none"> • complete a visual inspection of a weld by considering the overall appearance, size and shape of the bead • research and describe examples of personal and trade-specific application of electric welding • prepare a record of completed activities within a portfolio. 	

COURSE FAB1090: SHEET FABRICATION 1 (HAND PROCESSES)**Level:** Introductory**Theme:** Fabrication Processes**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students use basic tools, materials and processes to fabricate sheet materials into finished products, models or prototypes.**Parameters:** Access to a materials work centre complete with basic hand tools.**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> identify and describe basic tools and processes used to fabricate sheet stock demonstrate basic measurement and layout skills and techniques apply basic sheet stock fabrication skills and techniques to produce a product 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> identification, description and use of a basic set of sheet fabrication tools to include one or more: <ul style="list-style-type: none"> – measurement and marking tools – layout and squaring tools – cutting and drilling tools – fastening and forming tools. <p><i>Standard</i> <i>Accurate identification and description of 10 tools used in sheet stock fabrication</i></p>	10
	<ul style="list-style-type: none"> application of measurement and layout techniques to create a pattern or template that is ± 1 mm of the original plan 	30
	<ul style="list-style-type: none"> successful completion of a sheet stock product that uses appropriate separating, combining and forming techniques associated with a given material. <p><i>Assessment Tool</i> <i>Product Assessment: Working with Sheet Stock, FAB1090–1</i></p> <p><i>Standard</i> <i>The product should be structurally sound, free of surface defects and conform to the overall size and shape requirements</i> <i>Performance rating of 1 for each applicable task</i></p>	60

COURSE FAB1090: SHEET FABRICATION 1 (HAND PROCESSES) (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Outcomes	Notes
<p>Orientation</p> <ul style="list-style-type: none"> Sheet and Board Stock Layout and Marking Processes Cutting Sheet Stock Bending and Forming 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> identify the common types and sources of sheet and board stock; e.g.: <ul style="list-style-type: none"> card stock sheet metal acrylic plastic corrugated card and plastic foam board styrofoam identify and demonstrate the appropriate transfer and marking processes for a variety of sheet and board materials describe the process of separating sheet stock by: <ul style="list-style-type: none"> shearing scoring and snapping sawing hot wire cutting describe the process of forming sheet stock using a: <ul style="list-style-type: none"> strip heater box and pan brake slip roll vacuum former. 	<p>By working with a variety of sheet materials, students can better understand the working properties.</p> <p>Students will require a lab demonstration of these processes.</p>

COURSE FAB1090: SHEET FABRICATION 1 (HAND PROCESSES) (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Combining Sheet Stock 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • research typical joining and fastening techniques related to the use of: <ul style="list-style-type: none"> – mechanical joints and fasteners – adhesive – cohesives. 	
<p>Planning and Management</p> <ul style="list-style-type: none"> • Operation Sequencing 	<ul style="list-style-type: none"> • prepare a pattern or template to transfer folding and cutting lines • create a systematic sequence of operations to fabricate a product. 	
<p>Implementation</p> <ul style="list-style-type: none"> • Material Processing and Fabrication • Finishing 	<ul style="list-style-type: none"> • demonstrate basic skills related to the use of: layout and marking tools <ul style="list-style-type: none"> – cutting tools – forming tools – bonding materials – fastening devices • apply suitable finishes and surface details to a model, prototype or product. 	<p>Consider the use of sheet stock to make models of products</p>
<p>Assessment</p> <ul style="list-style-type: none"> • Quality Control • Career Preparation 	<ul style="list-style-type: none"> • analyze a product for the overall attention to: <ul style="list-style-type: none"> – workmanship – accuracy – structural soundness – quality of finish • prepare a record of completed activities within a portfolio. 	

COURSE FAB1100: FABRICATION PRINCIPLES**Level:** Introductory**Theme:** Fabrication Processes**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students investigate and apply fundamental principles of fabrication to build an artifact or structure from common structural materials.**Parameters:** Access to a materials work centre complete with basic hand tools.**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • identify and describe the principles of separating, forming and combining materials • describe the characteristics and give examples of permanent, semipermanent and temporary fastening systems 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • written or oral response that accurately describes the processes used in fabricating a product, such as separating, forming and combining (joining) techniques. <p><i>Assessment Tool</i> <i>Response Assessment: Principles of Fabrication, FAB1100-1</i></p> <p><i>Standard</i> <i>Response rating of 1</i></p> <ul style="list-style-type: none"> • analysis of a given fastening technique in relation to its: <ul style="list-style-type: none"> – serviceability – strength – appearance – ease and cost of production. <p><i>Assessment Tool</i> <i>Issue Analysis: Fastening Systems, FAB1100-2</i></p> <p><i>Standard</i> <i>Performance rating of 1 for each applicable task</i></p>	<p>10</p> <p>15</p>

COURSE FAB1100: FABRICATION PRINCIPLES (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Shaping Materials • Separating • Forming • Combining • Conditioning 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • list and describe three distinct ways of changing the shape of a material; e.g.: <ul style="list-style-type: none"> – separating – forming – combining (joining) • describe and give examples of tools that: <ul style="list-style-type: none"> – shear – chip – abrade • identify other current and emerging processes that use: <ul style="list-style-type: none"> – heat – light – chemicals to shape a material • outline principal methods of forming materials by: <ul style="list-style-type: none"> – bending or twisting – forging – casting • list and describe common types of mechanical fasteners that are used with metal products • identify and describe typical bonding techniques that are used to combine metals; e.g.: <ul style="list-style-type: none"> – soldering – braze welding – bonding • describe when to use permanent, semipermanent and temporary fastening techniques • explain why it may be necessary to change the physical state of some materials before they can be formed 	<p>Use available equipment to illustrate these processes.</p> <p>This is a good place to introduce students to soldering and resistance welding techniques; conventional welding is covered in other introduction courses.</p> <p>Threaded fasteners are a good example of temporary fasteners. Consider thread cutting using a tap and die set at this point.</p>

COURSE FAB1100: FABRICATION PRINCIPLES (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Finishing 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • research processes that can be used to: <ul style="list-style-type: none"> – polish – coat – plate a surface to protect or improve the appearance of a product. 	
<p>Planning and Management</p> <ul style="list-style-type: none"> • Health and Safety • Process Identification 	<ul style="list-style-type: none"> • describe principles of shop safety • describe a safety plan in case of accident • for a given product design, describe the appropriate processes and tools to measure, layout, shape, condition and finish the materials • prepare a material list and sequence of events to fabricate a given product design. 	<p>Products to consider include:</p> <ul style="list-style-type: none"> – key fob – pendant – trivet – paperweight – tray – box.
<p>Implementation</p> <ul style="list-style-type: none"> • Material processing 	<ul style="list-style-type: none"> • demonstrate basic skills related to separating, combining and forming processes. 	
<p>Assessment</p> <ul style="list-style-type: none"> • Career Information • Career Preparation 	<ul style="list-style-type: none"> • list and describe a variety of occupations and trades related to metal fabrication • prepare a record of completed activities within a portfolio. 	

COURSE FAB1110: BAR & TUBULAR FABRICATION**Level:** Introductory**Theme:** Fabrication Processes**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students use cutting, bending and fastening processes to create a variety of products from bar and tubular stock.**Parameters:** Access to a materials work centre complete with basic hand tools and metal forming equipment.**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> list and describe common shapes and sizes of bar and tubular stock demonstrate approved material handling and storage practices apply basic bar and tubular fabrication skills and techniques to produce a product 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> the presentation of a written report that lists and graphically describes common bar, angle, tube and pipe sizes and shapes. <p><i>Assessment Tool</i> <i>Presentations/Reports: Bar and Tubular Stock, FAB1110-1</i></p> <p><i>Standard</i> <i>Performance rating of 1 for each applicable task</i></p>	10
	<ul style="list-style-type: none"> observed performance related to: <ul style="list-style-type: none"> use of personal protective equipment correct lifting techniques proper storage of materials and cut-offs 	20
	<ul style="list-style-type: none"> successful completion of a bar and/or tubular product that uses one or more common metal bar or tubular forms. <p><i>Assessment Tool</i> <i>Product Assessment: Working with Bar Stock, FAB1110-2</i></p> <p><i>Standard</i> <i>The product should be structurally sound, have tight-fitting joints and meet the stated size, shape and finish specifications</i> <i>Performance rating of 1 for each applicable task</i></p>	70

COURSE FAB1110: BAR & TUBULAR FABRICATION (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Outcomes	Notes
<p>Orientation</p> <ul style="list-style-type: none"> Types of Bar and Tubular Stock Layout Cutting Bending 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> identify common size and shapes of bar pipe and tubular stock identify common methods of laying out and marking stock describe typical methods of cutting bar and tubular stock to length describe the most appropriate way to safely store and handle bar and tubular stock describe how to form: <ul style="list-style-type: none"> eyes circles scrolls square and zero bend radii using a metal bender describe how to calculate the bend allowance for bar and tubular stock 	<p>This course can be combined with other courses, such as FAB1100: Fabrication Principles, FAB2110: Forging Fundamentals and/or a welding course.</p> <p>Discuss the use of:</p> <ul style="list-style-type: none"> – a scribe – soapstone – acid pencil – bluing. <p>Demonstrate or describe processes, such as:</p> <ul style="list-style-type: none"> – flamecutting – abrasive cutting – mechanical cutting – shearing.

COURSE FAB1110: BAR & TUBULAR FABRICATION (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Bending (continued) • Fastening • Finishing 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe when heat is required to bend a bar or tube • research appropriate fastening techniques using: <ul style="list-style-type: none"> – mechanical fasteners – welding processes • describe how to prefinish and finish a bar/tubular product to prevent corrosion and to improve appearance. 	<p>Have the students compare the quality of a spray coating to powder coating.</p>
<p>Planning and Management</p> <ul style="list-style-type: none"> • Bend Allowance • Work Scheduling 	<ul style="list-style-type: none"> • calculate the bend allowance for a given radius • create a material list and work schedule from a shop drawing. 	
<p>Implementation</p> <ul style="list-style-type: none"> • Health and Safety • Material Processing 	<ul style="list-style-type: none"> • demonstrate the safe use of hand and power assisted equipment • describe health and safety issues associated with the use of finishing materials • describe a safety plan in case of accident • demonstrate basic skills related to: <ul style="list-style-type: none"> – laying out and marking stock – cutting stock to length – bending arcs and angles – fastening components – finishing the product. 	<p>Projects suitable for this course include:</p> <ul style="list-style-type: none"> – ornamental furniture, – railings – security bars – racks – brackets.
<p>Assessment</p> <ul style="list-style-type: none"> • Career Preparation 	<ul style="list-style-type: none"> • prepare a record of completed activities within a portfolio. 	

COURSE FAB1120: FOUNDRY 1 (ONE-PIECE PATTERN)**Level:** Introductory**Theme:** Production Systems and Processes**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students develop the basic skills required to produce a simple one-piece pattern, a sand mold and a finished casting.**Parameters:** Access to a materials work centre complete with foundry supplies and equipment, and to instruction from an individual with specialized training in basic foundry.**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<i>The student will:</i> <ul style="list-style-type: none"> recognize health and safety hazards associated with casting metal, and take preventive measures to avoid accidents and personal injury to self and others demonstrate basic pattern making skills to make a one-piece mold 	<i>Assessment of student achievement should be based on:</i> <ul style="list-style-type: none"> observed performance in a typical work setting, related to: <ul style="list-style-type: none"> appropriate selection and use of personal protective equipment maintenance of a clean and tidy workstation safe use of equipment and materials completion of a simple one-piece pattern. 	10
	<i>Assessment Tool</i> <i>Product Assessment: Sand Casting, FAB1120-1</i> <i>Standard</i> <i>The pattern should incorporate the appropriate fillets, sufficient draft to allow for easy extraction and allowance for shrinkage</i> <i>Performance rating of 1 for each applicable task</i>	50

COURSE FAB1120: FOUNDRY 1 (ONE-PIECE PATTERN) (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Foundry Processes and Products (continued) • Mold Making • Health and Safety • Pattern Making 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe the major casting processes; e.g.: <ul style="list-style-type: none"> – sand casting – die casting – investment casting • identify and describe the parts of a sand mold • describe the advantages and disadvantages of a water-moistened sand and an oil-bonded sand • explain why a flux is used when a metal is melted • identify common tools and equipment used in sand casting • outline the basic procedures used to make a mold with a one-piece pattern • describe the operation of a foundry furnace and safe methods of handling and pouring molten metal • list the types of personal protective equipment and the circumstances under which it should be worn • describe a safety plan in case of accident • list and describe the types of patterns that are used to make sand molds • identify the types of materials that are suitable for making a pattern. • design or locate an article that can be cast using a one-piece pattern • select a suitable pattern making material 	<p>Oil-bonded sands are recommended for school use. They produce less gassing and can be left for several days before pouring.</p> <p>Explain the dangers of using a mold that has too much moisture content and is improperly vented and packed.</p> <p>Demonstrate how a pattern is made and explain why it is important for a pattern to have the proper draft and shrinkage allowances.</p>

COURSE FAB1120: FOUNDRY 1 (ONE-PIECE PATTERN) (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Casting 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe the kind and amount of metal that is required for a given casting • describe the melting point and appropriate flux for a specified metal • evaluate the quality of sand and foundry metal. 	<p>Check to see that these conditions have been met before proceeding.</p>
<p>Implementation</p> <ul style="list-style-type: none"> • Material Processing 	<ul style="list-style-type: none"> • use the appropriate tools, materials and process to: <ul style="list-style-type: none"> – make a pattern – condition the sand – create a mold – heat and pour the molten metal – remove and finish the casting. 	<p>Students may need to be reminded not to over pack the mold.</p> <p>Ensure that the heating and pouring of metal takes place in a well ventilated area and that students use the proper personal protective equipment.</p>
<p>Assessment</p> <ul style="list-style-type: none"> • Quality Control • Career Preparation 	<ul style="list-style-type: none"> • research a completed casting and check to see that it is clean, free of voids and finished appropriately • prepare a record of completed activities within a portfolio. 	

COURSE FAB1130: PRINCIPLES OF MACHINING**Level:** Introductory**Theme:** Production Systems and Processes**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students develop basic hand and machine tool knowledge, skills and techniques to mechanically remove materials.**Parameters:** Access to a materials work centre complete with drillpress, bench or pedestal grinder and metal lathe, and to instruction from an individual with specialized training in basic machining.**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> identify and describe common machineable materials and machining processes 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> accurate identification of three machineable materials and four common machining processes and related tools. <p><i>Assessment Tool</i> <i>Response Assessment: Machining Materials and Processes, FAB1130-1</i></p> <p><i>Standard</i> <i>Response rating of 1</i></p>	10
	<ul style="list-style-type: none"> perform safe set up, operation and shut down of equipment used in drilling, grinding and turning operations <p><i>Assessment Tool</i> <i>Equipment Checklist: Drill Press, FABEQUIP-1</i> <i>Equipment Checklist: Grinder – Bench or Pedestal, FABEQUIP-2</i> <i>Equipment Checklist: Metal Lathe, FABEQUIP-3</i></p> <p><i>Standard</i> <i>All procedures to be performed correctly</i></p>	20

COURSE FAB1130: PRINCIPLES OF MACHINING (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • demonstrate basic hand and machine tool knowledge, skills and techniques • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • application of machining principles to drill holes and remove excess material by grinding. Face and turn round and/or hexagonal stock in a universal three-jaw chuck. <p><i>Assessment Tool</i> <i>Product Assessment: Basic Machining, FAB1130-2</i></p> <p><i>Standard</i> <i>Dimensions are to be within stated tolerances and surfaces are to be flat and free of cuts and scratches</i> <i>Performance rating of 1 for each applicable task</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>70</p> <p>Integrated throughout</p>

Concept	Specific Outcomes	Notes
<p>Orientation</p> <ul style="list-style-type: none"> • Principles of Machining 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • list and describe the principal methods of material removed by: <ul style="list-style-type: none"> – sawing – shaping – grinding – turning – milling – drilling – buffing • identify common machineable materials; e.g.: <ul style="list-style-type: none"> – aluminum – mild steel – brass – plastic. 	<p>Compare the principles of separating by chip removal and shearing.</p>

COURSE FAB1130: PRINCIPLES OF MACHINING (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Measurement • Machine Operations • Drilling 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe the current systems of measurement used in machining and explain the advantages and disadvantages of each • list and describe common types of: <ul style="list-style-type: none"> – rules – squares – dividers – calipers – micrometers – gauges that are used in connection with machining • research methods of securing stock for purposes of machining; e.g.: <ul style="list-style-type: none"> – chuck – vise – clamp • analyze common hand and machine tool processes of: <ul style="list-style-type: none"> – cutting and shaping – grinding and polishing – threading metal stock • compare the performance of manually operated and computer-controlled equipment in relation to: <ul style="list-style-type: none"> – accuracy – repeatability – reliability – productivity • identify the major components and describe the operation of a drill press • research the design of a typical twist drill and methods of sizing • explain how the proper drill speeds and feeds rate are determined • describe purpose and list the types of lubrication that are used when drilling • list and describe the safety hazards associated with drilling 	<p>Discuss the purpose of each of these tools and explain why it is important to take special care of these measuring devices.</p> <p>Even if CNC equipment is not available, students should have a basic understanding of how this equipment operates.</p>

COURSE FAB1130: PRINCIPLES OF MACHINING (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Turning • Abrading 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe the major components and operation of a metal lathe • identify the appropriate cutting tool to face metal stock • explain what is meant by cutting speed, feed rate, depth of cut and how these variables are expressed and controlled • list and describe the safety hazards associated with turning • identify the major components and operation of a bench or pedestal grinder • identify and describe different kinds of grinding wheels • explain why it is important not to overheat thin edges or points, nor to grind soft metals • identify the types and uses of cloth abrasives • list and describe the safety hazards associated with grinding. 	<p>The emphasis in this course should be on facing and straight turning.</p> <p>Emphasize the importance of having the tool rest properly adjusted and proper wheel guards and eye shield in place. A wheel that has become cracked or loose should never be used.</p>
<p>Planning and Management</p> <ul style="list-style-type: none"> • Product Design 	<ul style="list-style-type: none"> • select or modify a product that incorporates: <ul style="list-style-type: none"> – drilling – grinding – turning operations • describe the machining operations and sequence them in a logical and efficient manner. 	<p>Suggested products include:</p> <ul style="list-style-type: none"> – pen base – screw driver – simple mallet – simple puller.
<p>Implementation</p> <ul style="list-style-type: none"> • Machining Processes 	<ul style="list-style-type: none"> • demonstrate basic skills in: <ul style="list-style-type: none"> – measurement and layout – drilling, grinding and turning operations to size, shape and finish a complete product. 	

COURSE FAB1130: PRINCIPLES OF MACHINING (continued)

Concept	Specific Outcomes	Notes
Assessment <ul style="list-style-type: none"><li>• Quality Control<li>• Career Preparation	<i>The student should:</i> <ul style="list-style-type: none"><li>• research a completed product to determine whether it meets the specified tolerances and quality of finish<li>• prepare a record of completed activities within a portfolio.	

COURSE FAB1160: PRODUCTION SYSTEMS**Level:** Introductory**Theme:** Production Systems and Processes**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students investigate and compare the principles of production operation and the characteristics of a number of production systems.**Parameters:** Access to a materials work centre complete with basic hand and power tools, and to instruction from an individual with specialized training in the use of basic hand and power tools.**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<i>The student will:</i> <ul style="list-style-type: none"> • list and describe common methods of manufacturing durable products • demonstrate basic production planning and management skills • identify the present and future career opportunities related to the production of durable products 	<i>Assessment of student achievement should be based on:</i> <ul style="list-style-type: none"> • written or oral report that identifies and describes two or more different methods of manufacturing, such as custom, job-lot, continuous and just-in-time 	15
	<ul style="list-style-type: none"> • collaboratively designed and developed production system that includes: <ul style="list-style-type: none"> – rationale for the type of system being used – production flow chart – resource and equipment requirements 	70
	<ul style="list-style-type: none"> • presentation of a career profile that outlines: <ul style="list-style-type: none"> – present and future career opportunities – skill requirements – training opportunities. <p><i>Assessment Tool</i> <i>Presentations/Reports: Planning a Production System, FAB1160-1</i></p> <p><i>Standard</i> <i>Performance rating of 1 for each applicable task</i></p>	15

COURSE FAB1160: PRODUCTION SYSTEMS (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Outcomes	Notes
<p>Orientation</p> <ul style="list-style-type: none"> Types of Manufacturing Systems Health and Safety 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> list and describe the four basic types of manufacturing systems: <ul style="list-style-type: none"> – custom – job-lot – continuous – just-in-time describe safety rules and guidelines associated with the task and working conditions identify common hazards associated with the use of a specific tool, machining material or process inspect for and correct potential hazards within the working environment describe a safety plan in case of an accident. 	<p>Explain how these manufacturing systems differ from each other.</p>
<p>Planning and Management</p> <ul style="list-style-type: none"> Choosing a Manufacturing System 	<ul style="list-style-type: none"> select a manufacturing system based on: <ul style="list-style-type: none"> – number of products to be produced – availability of resources – type of product – life cycle and durability of a product. 	<p>Consider having students work together to produce a product(s) using one of the production systems outlined in this course.</p>

COURSE FAB1160: PRODUCTION SYSTEMS (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> • Product Design • Production Engineering • Production Tooling 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain the importance of: <ul style="list-style-type: none"> – appeal – ease of manufacture – use of standardized parts – quality – cost when selecting a product • describe what tools, materials and processes will be required to manufacture the product • help prepare a flow chart that: <ul style="list-style-type: none"> – combines the worker, machines and materials in an organized unit – requires minimal movement of the worker and materials – identifies specific operations • explain the importance of providing for: <ul style="list-style-type: none"> – personal and environmental safety – easy access to utilities – ventilation – lighting – waste disposal – material and product handling • help design jigs, template and fixtures based on: <ul style="list-style-type: none"> – ease of use – ability to reduce error – cost and safety. 	
<p>Implementation</p> <ul style="list-style-type: none"> • Production Work 	<ul style="list-style-type: none"> • help design, construct, and operate a production system. 	
<p>Assessment</p> <ul style="list-style-type: none"> • Quality Control 	<ul style="list-style-type: none"> • identify when a product is at standard, needs reworking or should be rejected 	<p>Discuss the issue of quality control</p>

COURSE FAB1160: PRODUCTION SYSTEMS (continued)

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none">• Career Information• Career Preparation	<p><i>The student should:</i></p> <ul style="list-style-type: none">• identify the career opportunities in the field of manufacturing durable products• describe the impact of technology on the future of careers in the manufacturing sector• analyze personal interests and abilities related to making realistic career choices• prepare a record of completed activities within a portfolio.	

COURSE FAB1048: SEMI-AUTOMATED/AUTOMATED WELDING**Level:** Introductory**Theme:** Fabrication Processes**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students develop basic knowledge and skills related to the use of gas metal arc welding (GMAW) and flux core arc welding (FCAW) processes in both personal use and commercial applications. They also develop introductory knowledge of submerged arc welding (SAW) processes.**Parameters:** Access to a fabrication work centre complete with gas metal arc welding (GMAW) and/or flux core arc welding (FCAW) equipment and supplies, and to instruction from an individual with formal, specialized training in arc welding practices.**Supporting Course:** FAB1050 Basic Electric Welding**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> identify health and safety hazards associated with GMAW, FCAW and SAW processes, and take preventative measures to avoid accidents and personal injury to self and others 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observed performance related to: <ul style="list-style-type: none"> appropriate selection and use of personal protective equipment maintenance of a clean and tidy work station safe tool/material handling and storage <p><i>Assessment Tool</i> <i>Fabrication Process: Light Gauge Fillet Welds, FAB1048-1</i></p> <p><i>Standard</i> <i>Performance rating of 2 for each applicable task</i></p>	10
<ul style="list-style-type: none"> identify power sources used in GMAW, FCAW and SAW processes 	<ul style="list-style-type: none"> knowledge of basic electrical terms as they relate to GMAW, FCAW and SAW processes <p><i>Assessment Tool</i> <i>Presentations/Reports: Components of Semi-automated/Automated Welding, FAB1048-2</i></p> <p><i>Standard</i> <i>Performance rating of 1 for each applicable task</i></p>	10

COURSE FAB1048: SEMI-AUTOMATED/AUTOMATED WELDING (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • select appropriate electrode wires and shielding gases for use in GMAW and FCAW processes • perform safe start-up and shut-down procedures for GMAW and/or FCAW processes • demonstrate safe GMAW and/or FCAW processes on light gauge mild steel and/or mild steel plate in the flat and horizontal positions • demonstrate basic competencies 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • knowledge and observed performance related to the selection and use of appropriate electrode wires and shielding gases in GMAW and FCAW processes <i>Assessment Tool</i> <i>Presentations/Reports: Components of Semi-automated/Automated Welding, FAB1048-2</i> <i>Standard</i> <i>Performance rating of 1 for each applicable task</i> • demonstration of safe start-up and shut-down procedures using GMAW and/or FCAW equipment <i>Assessment Tools</i> <i>Equipment Checklist: GMAW/FCAW Start-up and Shut-down Procedures, FAB1048-3</i> <i>Standard</i> <i>All procedures to be performed correctly</i> • completion of light gauge fillet welds in the flat and horizontal positions <i>Assessment Tool</i> <i>Fabrication Process: Light Gauge Fillet Welds, FAB1048-1</i> <i>Illustrative Example: Flat Tee Fillet Weld, FAB1048-4</i> <i>Illustrative Example: Horizontal Lap Joint Fillet Weld, FAB1048-5</i> <i>Standard</i> <i>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 coldlapping.</i> <i>Performance rating of 2 for each applicable task.</i> • observations of individual effort and interpersonal interaction during the learning process. <i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i> 	<p>10</p> <p>20</p> <p>50</p> <p>Integrated throughout</p>

COURSE FAB1048: SEMI-AUTOMATED/AUTOMATED WELDING (continued)

Concept	Specific Outcomes	Notes
<p>Orientation</p> <ul style="list-style-type: none"> • Safe Work Practices and Procedures • Power Sources 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify and explain safety issues related to: <ul style="list-style-type: none"> – electrical shock – toxic fumes – radiant energy from the arc • describe a safety plan in case of accident • identify basic components and operation principles for GMAW, FCAW and SAW processes • describe and compare methods of metal transfer in GMAW, FCAW and SAW processes; e.g.: <ul style="list-style-type: none"> – short arc – globular – spray arc • explain the advantages and disadvantages of GMAW, FCAW and SAW processes • demonstrate knowledge of basic electrical terms; e.g.: <ul style="list-style-type: none"> – direct and alternating current – voltage – amperage – resistance – polarity – open circuit voltage and arc voltage • relate knowledge of basic electrical terms to power sources used in GMAW, FCAW and SAW processes • identify the function of slope and inductance in CV power sources. • explain the advantages and disadvantages of different types of wire feed systems; e.g.: <ul style="list-style-type: none"> – push – pull – push-pull • identify different drive roll assemblies • describe welding gun assemblies for GMAW and FCAW processes 	<p>Discuss the importance and increasing use of GMAW and FCAW processes over other welding processes in the workplace.</p> <p>As part of an ongoing expectation, students should be able to describe a plan of action in the event of a fire or accident.</p> <p>Students need to have a good understanding of electrical terms and principles for their own safety and understanding of how the welding equipment operates.</p> <p>Discuss power with respect to:</p> <ul style="list-style-type: none"> • rating by current and duty cycle • constant voltage versus constant current.

COURSE FAB1048: SEMI-AUTOMATED/AUTOMATED WELDING (continued)

Concept	Specific Outcomes	Notes
<p>Planning and Management</p> <ul style="list-style-type: none"> • Equipment Set-up • Preparation 	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe the steps taken to set up GMAW and FCAW equipment; i.e.: <ul style="list-style-type: none"> – fasten cylinders – mount regulator/flowmeter – pressurize/depressurize systems – set/check drive wheel tension • for a given type of weld and/or weldment, select the appropriate: <ul style="list-style-type: none"> – wire type, size and feed rate – current – shielding gas type and flow rate • select the appropriate solid/flux cored wire and machine settings • prepare and clean all surfaces to be welded by removing any: <ul style="list-style-type: none"> – oil and/or grease – paint, rust or scale 	
<p>Implementation</p>	<ul style="list-style-type: none"> • make light gauge fillet welds in the flat and horizontal positions, using GMAW and/or FCAW equipment 	<p>Welds can be made on light gauge mild steel or mild steel plate (3/16" – ¼" thick).</p>
<p>Assessment</p> <ul style="list-style-type: none"> • Quality Control • Career Preparation 	<ul style="list-style-type: none"> • complete a visual inspection of the weld by observing: <ul style="list-style-type: none"> – overall appearance – size and shape of beads – plate penetration – fusion – degree of undercutting and overlapping • prepare a record of completed activities within a portfolio 	

