



WELDING

Welding youth apprentices practice welding fabrication processes in various industry environments. Apprentices must adhere to industry safety and security standards.

Length of Apprenticeship: One or two years

COMPETENCIES

Welding Production Operations youth apprentices must complete a **total of 25** competencies. All **7** Manufacturing Fundamentals Competencies must be complete. No substitutions to this list. **Seventeen** of the 18 Welding competencies listed below must be complete. Employers can substitute up to **1** competency with another occupationally appropriate skill. Substitutions must be added to the competency list for assessment. Note that where necessary, skills can be simulated.

NOTE: Students completing a 2-year welding youth apprenticeship must select different welding processes than the first year.

***Students who completed a previous Manufacturing YA program do *not* need to repeat the Manufacturing Fundamentals Competencies.

Manufacturing Fundamentals Competencies	Welding Competencies
<ol style="list-style-type: none"> 1. Focus on customer needs 2. Use various instruments 3. Operate tools and equipment safely 4. Practice quality assurance principles 5. Follow personal safety requirements 6. Maintain a safe work environment 7. Demonstrate professional role to be used in an emergency 	<ol style="list-style-type: none"> 1. Read welding technical drawings and work orders 2. Interpret welding symbols and procedures 3. Layout and plan work 4. Perform safety checks 5. Prepare base metal 6. Set up to fabricate base metal 7. Set up welding job 8. Fabricate base metal 9. Cut metal thermally/chemically 10. Tack work pieces 11. Weld metal 12. Monitor product and process 13. Assist inspection of completed metal piece 14. Process production documents 15. Clean up 16. Monitor equipment for correct operation 17. Perform routine preventive maintenance (PM)

	18. Document equipment use, PM, and/or operational problems
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REGISTERED APPRENTICESHIP BRIDGING OPPORTUNITIES

Some of the related instruction courses can bridge into the following registered apprenticeship:

- Welding Fabricator
- Industrial Manufacturing Technician

POST-SECONDARY PATHWAY OPPORTUNITIES

There are several post-secondary pathway opportunities in this area. Following is partial list.

- Welding Technical Diploma
- Welding and Metal Fabrication Technical Diploma
- Welding Fabrication Technical Diploma

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Rating Scale

3: Exceeds entry level criteria | Requires minimal supervision | Consistently displays this behavior

2: Meets entry level criteria | Requires some supervision | Often displays this behavior

1: Needs improvement | Requires much assistance and supervision | Rarely displays behavior

Manufacturing Fundamentals – Complete all competencies

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
1. Focus on customer needs <ul style="list-style-type: none"> • Identify internal and external customers impacted by the production process • Satisfy internal and external customer's expectations • Collaborate with team • Assist work site professional to keep internal and/or external customers informed of project progress and decisions that may affect them • Define the impact of the Voice of the Customer • Determine the impact of your work to the internal and external customer 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
<p>2. Use various instruments</p> <ul style="list-style-type: none"> • Consider the degree of precision required by the part feature • Choose correct measuring instrument for task • Verify equipment is available for use and in working order • Verify equipment preventative maintenance and/or calibration • Inspect tools and work area for safety considerations • Clean and adjust measuring instrument prior to use • Use gauges, calipers, and micrometer instruments • Use semi-precision and precision layout tools • Use digital gauges, checking fixtures • Use digital scales, thermometers • Confirm measurement accuracy • Record measurement correctly including unit of measurement at proper interval • Calibrate, clean, and store measuring instruments properly • Convert standard to metric – metric to standard measurement units 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>3. Operate tools and equipment safely</p> <ul style="list-style-type: none"> • Operate only tool/equipment that he/she is trained on • Choose correct tool/equipment for the task • Follow tool check list • Verify tool/equipment is available for use and in working order • Verify tool/equipment is current for preventative maintenance and/or calibration • Wear appropriate Personal Protective Equipment (PPE) • Inspect tool/equipment and work area for safety considerations • Prepare tool/equipment for safe operation • Operate tool/equipment safely with guarding devices • Monitor tool/equipment for safe operation while operating • Compare tool/equipment performance regularly to optimal equipment operations • Follow facility procedures for clean-up and shut down after use • Perform required preventative maintenance procedures • Report abnormal tool/equipment conditions • Properly shuts down and labels any tool/equipment that is not operating as expected • Follow Lock Out/Tag Out procedures as applicable • Document use and maintenance 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
<p>4. Practice quality assurance principles</p> <ul style="list-style-type: none"> • Inspect materials/piece/product at all stages of production • Identify quality or condition of materials/piece/product • Monitor materials, processes, equipment, tools, and products throughout the production process • Inspect final product/piece to ensure it meets specifications • Identify and segregate materials and/or product that do not meet specification • Communicate with work site professional if materials/product do not meet requirements • Document all quality checks • Participate in root-cause analysis of process/product • Take ownership of work • Collaborate with work site professional on corrective action 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>5. Follow personal safety requirements (safety)</p> <ul style="list-style-type: none"> • Participate in required safety training • Follow all worksite guidelines for personal safety • Apply principles of proper body mechanics • Report exposures, injuries, near misses, or accidents, personal or to others immediately • Locate key information on Material Safety Data Sheets (MSDS) • Handle and dispose of any hazardous materials appropriately • Operate equipment that he/she is trained on • Adhere to equipment safety standards • Visually inspect equipment before operation • Wear required Personal Protective Equipment (PPE) at all times • Follow company emergency action plan • Identify hazardous conditions and restricted areas in the workplace • Avoid pinch points • Be aware of surroundings 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
<p>6. Maintain a safe work environment (safety)</p> <ul style="list-style-type: none"> • Comply with posted safety warnings and symbols • Identify unsafe conditions and/or work habits • Report unsafe conditions and/or work habits • Help maintain a clean and safe working environment free of debris and obstacles • Maintain clean, organized work area • Use hazardous materials according to company procedure • Report any indications of insects or pests, if necessary • Follow appropriate Lock out – tag out procedures • Adhere to Occupational Safety and Health Administration (OSHA) Safety guidelines • Follow rules for operating equipment (Powered Industrial Vehicle PIV) • Identify applicable Emergency Stops 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>7. Demonstrate professional role to be used in an emergency (safety)</p> <ul style="list-style-type: none"> • Participate in emergency safety simulations and drills • Describe company’s policy and procedures for work site incidents, accidents, electrical, fire, tornado, bomb threats, robbery, hostage situations, and other emergency situations • Identify the closest fire alarms and emergency exits • Identify the fire extinguishers • Identify appropriate alarms and procedures for using alarms • Contact emergency personnel in the event of an emergency • Contribute to emergency incident documentation 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>Comments:</p>			

Welding

Select welding processes practiced by the Youth Apprentice.

Welding Processes	Thermal /Chemical Cutting Processes
<input type="checkbox"/> Flux-cored Arc Welding (FCAW) <input type="checkbox"/> Gas Metal Arc Welding (GMAW-MIG) <input type="checkbox"/> Gas Tungsten Arc Welding (GTAW-TIG) <input type="checkbox"/> Submerged Arc Welding (SAW) <input type="checkbox"/> Shielded Metal Arc Welding (SMAW-Stick) <input type="checkbox"/> Other: Click or tap here to enter text.	<input type="checkbox"/> Air Carbon Arc <input type="checkbox"/> Laser <input type="checkbox"/> Oxy-fuel Manual <input type="checkbox"/> Oxy-fuel Machine <input type="checkbox"/> Plasma Manual <input type="checkbox"/> Plasma Machine <input type="checkbox"/> Other:

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
1. Read welding technical drawings and work orders <ul style="list-style-type: none"> • Review technical drawing • Gather reference materials • Determine type of weld required • Determine location of weld required • Determine filler metal required • Determine welding process • Analyze supplementary data • Determine product/job instructions and specifications • Interpret welding symbols and procedures 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Interpret welding symbols and procedures <ul style="list-style-type: none"> • Interpret job task technical drawings accurately • Use appropriate terminology • Identify lines, views, symbols, and representations on the drawings • Interpret dimensions, tolerances, and scale on the drawings • Interpret the welding process plan from a technical drawing which includes • Identify required welding tools • Identify required welding equipment • Identify required welding speeds • Identify required welding feeds • Identify required welding fixtures Identify required welding holders 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
<p>3. Layout and plan work</p> <ul style="list-style-type: none"> • Read welding technical drawings and work orders • Interpret welding symbols and procedure • Review appropriate welding, cutting and/or fabricating procedures • Determine equipment, work pieces, and supplies needed • Determine metal type, electrode type, welding position, and metal thickness • Select jigs, holding fixtures, guides and stops • Obtain materials for work • Measure and mark weld or cut points and positions of components on work pieces • Plan sequencing of work • Document measurements and layout 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>4. Perform safety checks</p> <ul style="list-style-type: none"> • Review welding procedure to be used • Review safety requirements of procedure • Verify safety equipment and Personal Protective Equipment (PPE) needed for welding process • Verify equipment is available for use and in working order • Verify equipment is current for preventative maintenance and/or calibration • Conduct required safety checks prior to performing procedure • Ensure area is dry and facilitates circulation of clean air • Ensure workspace is clear and free of flammable materials • Assure safety equipment is close by and operational • Check valves, valve protection, thread type and wrenches • Check grounding, cables, voltage/current transformation components • Check ventilation and fume reduction requirements • Ensure compressed gas protector cap is secure when moving cylinder • Secure compressed gas cylinder in vertical position • Inspect compressed gas valve, regulator and gauges for damage • Connect and adjust compressed gas tank pressure according to manufacturer specifications • Report wear, damage or failure of safety checks to work site professional immediately 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
<p>5. Prepare base metal</p> <ul style="list-style-type: none"> • Review procedures • Determine base metal or work piece preparation requirements • Obtain correct base metal type and thickness • Prepare base metal surfaces as required • Use cleaning solutions if needed • Examine edges of prepared base metal parts • Grind base carbon steel metal to bevel and/or remove surface irregularities • Check uniformity, proper fit-up, and base metal preparation • Pre-heat metal as specified • Fit and preheat parts as specified 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>6. Set up to fabricate base metal</p> <ul style="list-style-type: none"> • Prepare base metal • Set up to fabricate base metal • Add or adjust safety guards • Verify machine settings for material • Verify blades, shears, dies, etc., appropriate for metal fabrication to be completed • Perform equipment pre-check • Make test cuts • Adjust holding devices, blade speeds, and metal positions safely as needed • Operate tools and equipment safely • Fabricate base metal • Use hand tools such as brakes and hammers • Use equipment such as such as grinders, saws, drills, drill presses, or brakes • Complete cuts • Inspect, measure, or test completed metal pieces • Shut down and secure equipment • Clean up • Report any discrepancies or equipment concerns to work site professional immediately • Document cutting process • Layout and plan work • Perform safety checks • Assemble tools and equipment as required • Place parts and assemblies into fixtures • Set up equipment for fabrication • Document set up procedure if required • Locate parts or subassemblies needed 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
<ul style="list-style-type: none"> • Determine the order for the part or subassembly placement • Position, align, and bolt jigs, holding fixtures, guides, and stops onto machines • Position, align and/or clamp work pieces into jigs and/or holding fixtures • Tighten all holding and positioning clamps • Inspect assembly • Select torch tips, alloys, flux, coil, tubing, and wire, according to metal types and thicknesses • Dress electrodes with tip dressers, files, emery cloths, or dressing wheels • Move switch to correct polarity OR change electrode and ground cable positions • Adjust voltage and/or amperage per procedure • Select appropriate program where required • Set wire feed rate OR shielding gas flow/pressure at correct value • Adjust saw safety guards • Adjust saw holding device as needed • Place material in holding device • Allow for proper part ejection • Adjust saw blade velocity 			
<p>7. Set up welding job</p> <ul style="list-style-type: none"> • Select torch tips, alloys, flux, coil, tubing, and wire, according to metal types and thicknesses, data charts, and records • Dress electrodes with tip dressers, files, emery cloths, or dressing wheels • Move switch to correct polarity OR change electrode and ground cable positions • Adjust voltage and/or amperage per procedure • Select appropriate program • Set wire feed rate OR shielding gas flow/pressure at correct value • Fill hoppers and position spouts to direct flow of flux or complete manually • Review technique and weld bead sequence • Determine joint requirements • Determine pre-heat and post-heat requirements 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
<p>8. Fabricate base metal</p> <ul style="list-style-type: none"> • Prepare base metal • Set up to fabricate base metal • Add or adjust safety guards • Verify machine settings for material • Verify blades, shears, dies, etc., appropriate for metal fabrication to be completed • Perform equipment pre-check • Make test cuts • Adjust holding devices, blade speeds, and metal positions safely as needed • Operate tools and equipment safely • Use hand tools such as brakes and hammers • Use equipment such as such as grinders, saws, drills, drill presses, or brakes • Complete cuts • Inspect, measure, or test completed metal pieces • Shut down and secure equipment • Clean up • Report any discrepancies or equipment concerns to worksite professional immediately • Document cutting process if required 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>9. Cut metal thermally/chemically</p> <ul style="list-style-type: none"> • Prepare base metal • Set up to fabricate base metal • Adjust voltage and/or amperage per procedure • Select appropriate program • Set wire feed rate OR shielding gas flow/pressure at correct value • Make test cuts • Adjust pressures, amperage, voltage, flow rates, torch angles, flame sizes, travel speed • Operate tools and equipment safely • Complete cuts • Remove any slag or residue • Inspect, measure, or test completed metal pieces • Shut down and secure equipment • Clean up • Report any discrepancies or equipment concerns to worksite professional immediately • Document cutting process 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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	1	2	3
<p>10. Tack work pieces</p> <ul style="list-style-type: none"> • Position the work pieces • Tack-weld them together lightly • Weld just enough to pin the work pieces together • Adjust and re-align assemblies as needed to keep pieces positioned • Remove slag or other material • Check that all required work pieces are tacked before attempting full welds • Check the pieces for appropriate geometry by measuring 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>11. Weld metal</p> <ul style="list-style-type: none"> • Prepare base metal • Set up to fabricate base metal • Verify and adjust settings for required process • Select appropriate program where required • Make test welds • Adjust pressures, amperage, voltage, flow rates, torch angles, flame sizes, travel speed, etc. • Hold the welding gun appropriately to prevent weld wandering • Operate tools and equipment safely • Make fillet welds on plain carbon steel, stainless steel or aluminum in required positions • Make groove welds on plain carbon steel, stainless steel or aluminum in required positions • Monitor metal for appropriate welds 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>12. Monitor product and process</p> <ul style="list-style-type: none"> • Monitor piece/product produced for specification • Recheck type of metal to be welded • Monitor the process and equipment for performance • Check condition of consumables • Recheck required positioning of the weld gun or torch • Adjust the process for quality and/or productivity as needed • Take corrective actions to resolve problems as they occur • Replenish processing materials as needed • Label pieces/products for compliance or non-compliance • Document quality control checks • Pieces are fabricated to specified tolerances 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
<p>13. Assist inspection of completed metal piece</p> <ul style="list-style-type: none"> • Ensure conformance to specifications, using visual inspection, measuring and testing devices • Examine edges and geometry of cut pieces Examine tacks, root passes, intermediate layers, and completed welds • Check for weld discontinuity and defects visually • Check for proper weld size • Perform destructive or non-destructive checks as required • Label pieces/products for compliance or non-compliance • Document inspection and testing as required 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>14. Process production documents</p> <ul style="list-style-type: none"> • Document processing data on items such as labor, quality, quantity, and time • Verify fabrication and welding documentation is completed • Verify documentation is legible • Verify documentation is complete • Verify documentation is in appropriate format • Verify documentation is stored or forwarded as required • Review documentation with work site professional 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>15. Clean up</p> <ul style="list-style-type: none"> • Select appropriate cleaning tools and equipment • Clean tools/equipment as required • Clean work area as required • Store tools safely in proper location • Store materials in safe manner • Identify unsafe conditions and report them promptly • Take corrective action to correct unsafe conditions • Ensure that workstation is clean and clear of safety hazards • Ensure workstation is organized for efficiency • Dispose of waste appropriately as required 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
<p>16. Monitor equipment for correct operation</p> <ul style="list-style-type: none"> • Review equipment quality measures for trends and problems as required • Compare current equipment performance to optimal equipment operations on a regular basis • Report any noted deviations from expected performance • Assist worksite professional to investigate abnormal equipment conditions in a timely manner • Assist worksite professional to follow up on repaired equipment to ensure that corrective action solved the problem • Document all monitoring activities 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>17. Perform routine preventive maintenance (PM)</p> <ul style="list-style-type: none"> • Perform preventative maintenance (PM) according to facility schedule • Communicate PM to production • Assure that alternative equipment is available if needed by production • Gather supplies to perform PM • Ensure that equipment is properly labeled and pulled from production use • Follow appropriate Lock coil break, wire de-reeler, flowmeter, wire guides, and drive rollers on gas metal arc and flux core welding equipment. • Remove weld spatter and foreign material from guns, torches, and/or electrode holders • Inspect hand tools, fixtures, and/or tables • Mount wire electrode coils if applicable • Inspect and clean work areas • Report any damage, wear, or missing safety equipment to worksite professional • Re-qualify equipment for operation • Document PM and preventative actions taken 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>18. Document equipment use, PM, and/or operational problems</p> <ul style="list-style-type: none"> • Verify all internal and external communication with appropriate parties in a timely manner • Communicate maintenance and repair needs clearly • Use the correct reporting formats for communication • Document use, maintenance, and repair activities accurately • Report back and document any maintenance and repair issues in a timely manner • Maintenance communication is timely and accurate • Maintenance communication is documented 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Competency and Rating Criteria	Minimum Rating of 2 for EACH Check Rating		
	1	2	3
Competency Substitute (if you replaced a competency above, note the competency and rating)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:			

RELATED INSTRUCTION

Indicate which related instruction courses the youth apprentice completed:

Year 1

Course Title	Credits	Location

Year 2 (if applicable)

Course Title	Credits	Location