### Cluster Overview:
Jobs in the manufacturing career cluster involve planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities, such as production planning and control, maintenance, and manufacturing/process engineering.

### Pathway Options:
- Production
- Manufacturing & Production Process Development
- Maintenance, Installation and Repair
- Quality Assurance
- Logistics and Inventory Control
- Health, Safety and Environmental Assurance

### Occupation Examples:
Assembler, MIG Welder, TIG Welder, Machine Operator, Sheet Metal Worker, Mechanical Engineer, Industrial Engineer, Quality Control Technician, Safety Technician, Safety Engineer, Dispatcher, Production Manager, Purchasing Agent, Logistician

For a complete listing, go to: [http://online.onetcenter.org/find/career?c=13&g=Go](http://online.onetcenter.org/find/career?c=13&g=Go)

### SUGGESTED HIGH SCHOOL COURSES

#### 9th Grade
- **Graduation Requirements**
  - Workforce/2-Year College Prep
- **4-Year MT College/Univ Prep** (Rigorous Core)
- **CTE and/or Electives**
  - Welding I, Industrial Arts, Drafting I

**Recommended CTE Cluster Foundation Course(s):**
- Welding I, Industrial Arts, Marketing, Money Management

#### 10th Grade
- **Graduation Requirements**
  - Workforce/2-Year College Prep
- **4-Year MT College/Univ Prep** (Rigorous Core)
- **CTE and/or Electives**
  - Welding I or II, Drafting I, Carpentry, Automotive

**Recommended CTE Pathway Courses:**
- Welding I, Welding II, Welding III, Welding and Manufacturing IV

#### 11th Grade
- **Graduation Requirements**
  - Workforce/2-Year College Prep
- **4-Year MT College/Univ Prep** (Rigorous Core)
- **CTE and/or Electives**
  - Welding II or Welding III, Drafting I, II, CAD, Carpentry, Automotive, Accounting I (DC)

#### 12th Grade
- **Graduation Requirements**
  - Workforce/2-Year College Prep
- **4-Year MT College/Univ Prep** (Rigorous Core)
- **CTE and/or Electives**
  - Welding III, IV or Welding and Machining Co-op, CAD, Carpentry, Automotive, Accounting Procedures

### ADVANCED LEARNING OPPORTUNITIES
High School to College/Career Linkages

#### CTE START courses:
- Advanced Placement or IB courses:
- **Dual Enrollment courses:** M111T Technical Mathematics; WRIT121T Technical Writing; WRIT 101 College Writing; M121 College Algebra; M151 Pre-Calculus; M171 Calculus, WLDG 112 Cutting Processes
- **Online courses:** M111T Tech Math; WRIT 121T Tech Writing
- **Other:** Job Shadowing; Student Shadowing at HC

### POSTSECONDARY PROGRAM OF STUDY

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Math</th>
<th>English</th>
<th>Major</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M111T Technical Math</td>
<td></td>
<td>WLDG 105 Shop Safety, WLDG 112, Cutting; WLDG 117 Blueprint Reading and Weld Symbols; WLDG 132 Estimating of Job Materials; WLDG 133 GMAW, FCAW, and GMAW-P; WLDG 180 Shielded Metal Arc Welding</td>
<td></td>
</tr>
</tbody>
</table>
### MONTANA POSTSECONDARY OPPORTUNITIES

**Montana University System Degree and Program Inventory:** [http://www.homepage.montana.edu/~mus/drginv/](http://www.homepage.montana.edu/~mus/drginv/)

**Your Guide to Montana’s Certificate and Associate Degree Programs:** [http://mus.edu/twoyear/YourGuide.html](http://mus.edu/twoyear/YourGuide.html)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Course Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 2</td>
<td>WLDG 131</td>
<td>Intro to Layout and Pattern Making</td>
<td>WLDG 131 Intro to Layout and Pattern Making, WLDG 140 Intro Gas Tungsten ARC Welding (GTAW) - Integrated Lab, WLDG 151 Shop Practices, WLDG155 Design and Fabrication, WLDG 160 Rigging for Welders</td>
</tr>
<tr>
<td>Semester 3</td>
<td>WRIT 121T</td>
<td>Introduction to Technical Writing</td>
<td>WLDG 217 Advanced Blueprint, WLDG 225 Structural Fabrication, WLDG 230 Field Welding and Processes, WLDG 243 Advanced Metal Fabrication I, WLDG 255 CNC Burn Table Programming and Operation</td>
</tr>
<tr>
<td>Semester 4</td>
<td>WLDG 213</td>
<td>Pipe Welding Lab I</td>
<td>WLDG 213 Pipe Welding Lab I, WLDG 244 Advanced Metal Fabrication II, WLDG 245 Metal Fabrication Design and Construction, WLDG 265 MSHA Safety Training</td>
</tr>
</tbody>
</table>

**MILITARY**
- Requires diploma or GED
- 17 with parental consent; 18 without
- Air Force, Air Guard, Army, Coast Guard, Marines, and Navy
- For more information: [http://todaysmilitary.com](http://todaysmilitary.com)

**PROFESSIONAL CERTIFICATE**
- Requires diploma or GED
- Less than 30 credits; little/no general ed credits
- Complete in one year or less
- Welding Technology — FVCC
- Electricians
- Sheet Metal Workers
- See the MT Dept of Labor website for more information: [http://wsd.dli.mt.gov/apprenticeship/default.asp](http://wsd.dli.mt.gov/apprenticeship/default.asp)

**APPRENTICESHIP**
- Requires diploma or GED
- Must be at least 18
- Minimum 2,000 hours of supervised experience
- Industrial Machine Technology/CNC — FVCC
- Metals (Fabrication) Technology — CC
- Machine Tool Technology — HC, UMW
- Sustainable Energy Technician — CC, HC Tech, GFC, MSUN
- Water Quality Technology — HC, MSUN
- Welding Technology — HC, MC, GFC, CC, GC, MSUN, DCC, FVCC, FPCC

**CERTIFICATE OF APPLIED SCIENCE**
- Requires diploma or GED
- 30-45 credits; limited general education credits
- Complete in one year or less
- Biofuel Energy — MCC
- Computer-Aided Manufacturing — HC
- Electronics Technology — MC
- Energy Technology — MC
- Metals (Fabrication) Technology — HC, HC Tech, CC
- Machine Tool Technology — HC
- Power Plant Technology — CC
- Process Plant Technology — CC
- Sustainable Energy Technician — CC, HC Tech, GFC, MSUN
- Water Quality Technology — FPCC
- Welding Technology — HC, MC, CC, FVCC

**ASSOCIATE’S OF APPLIED SCIENCE DEGREE**
- Requires diploma or GED
- 60-72 credits; includes 15-25 general ed credits
- Complete in two years (If prepared academically in math and English)
- Biofuel Energy — MCC
- Computer-Aided Manufacturing — HC
- Electronics Technology — MC
- Energy Technology — MC
- Metals (Fabrication) Technology — HC, HC Tech, CC
- Machine Tool Technology — HC
- Power Plant Technology — CC
- Process Plant Technology — CC
- Sustainable Energy Technician — CC, HC Tech, GFC, MSUN
- Water Quality Technology — FPCC
- Welding Technology — HC, MC, CC, FVCC

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**Montana University System Degree and Program Inventory:** [http://www.homepage.montana.edu/~mus/drginv/](http://www.homepage.montana.edu/~mus/drginv/)

**Your Guide to Montana’s Certificate and Associate Degree Programs:** [http://mus.edu/twoyear/YourGuide.html](http://mus.edu/twoyear/YourGuide.html)
| BACCALAUREATE DEGREE | Bioengineering — MSU  
|                      | Electrical Engineering — MT Tech, MSU  
|                      | Civil Engineering — MT Tech, MSU  
|                      | Industrial Engineering — MSU  
|                      | Mechanical Engineering — MT Tech MSU  
|                      | Mining Engineering — MT Tech  
|                      | Occupational Safety & Health — MT Tech  
|                      | Welding Engineering — MT Tech  
|                      | Metallurgical & Materials Engineering — MT Tech  
|                      | Petroleum Engineering — MT Tech  

- Requires 4-year college prep for admission  
- 128 credits (approximately)  
- Complete in four years  

*Degree and Program Inventory above may not be all inclusive*