

# ADVANCED MANUFACTURING SECTOR GUIDE



2020

North Central Workforce Development Area

*Funded by Workforce Solutions for North Central Pennsylvania and the PA Department of Labor and Industry.*

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## *Introduction to the Sector Guide*

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The Career Pathways Sector Guides are designed to provide information about career pathways in the North Central Workforce Development Area in Pennsylvania. Each guide presents information that will benefit workforce development professionals, businesses, and job seekers.

### **Introduction to Career Pathways**

This section of the Sector Guide introduces you to career pathways. The information in this section will inform you about why career pathways are important and how the concept can be beneficial to businesses and job seekers. Information in this section can be shared with clients to help them get a better understanding of why we promote pathways.

### **Sector Description**

The sector descriptions provide a brief overview of the sector that the guide presents. Sector descriptions include information from Pennsylvania's Center for Workforce Information and Analysis <https://www.workstats.dli.pa.gov/Pages/default.aspx> that helps to give a snapshot of the sector as well as general information about education and experience levels associated with jobs in the sector and the types of businesses that employ in the sector.

Use the information in this section of the guide to share general information with job seekers, as more detailed information is provided throughout the guide.

### **Career Pathways Maps**

The jobs illustrated on the career pathway maps were identified using the North Central High Priority Occupations list. Information about the jobs was gathered through research using multiple sources to identify the salary, education required, and related occupations. Additionally, industry specific websites that contain career maps were used to inform the career map development. Most of the maps start with an entry-level job that requires less than a 2-year degree and demonstrate the ability to move up

the pathway by on the job training and work experience or through additional formal education and training.

Some occupations occur in multiple sectors and therefore may create a slightly different map for each sector. For example, janitors and cleaners are in manufacturing, healthcare, education, and hospitality. A worker who starts as a janitor and cleaner in education may move into maintenance and may possess the skills to move into a technical teaching role or departmental supervisory role within a school district or university. A janitor in manufacturing might be less likely to leave the sector to move into education and training of maintenance personnel. Technology and transportation related occupations are others that cross over many sectors and may look a little different.

Notice that some pathways seem to start at a higher “entry-level” than others. These would be appropriate for individuals that may have had some technical training while in high school or chose to do training before entering or reentering the workforce. These maps are also appropriate for places of employment that bring everyone in as a “general worker”, and in order to move up, an individual has to get a specialized training and compare multiple options/maps to make that decision.

These maps can be used with job seekers who are currently employed or choosing a career path. While these maps are general for the sector, they provide information about expected training, experience, and skills needed to move along a career path. This example illustrates the information that you will find about each job on every map.

**Occupation:** First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)

**Education:** postsecondary certificate and/or associate’s degree

**Training:** postsecondary education

**Skills:** understands process and product or service, demonstrates self-management strategies, lifelong learning

**Salary Range:** \$25.50-46/hour

Use this information to assist job seekers with career exploration, career planning, and goal setting. It is important to review each map carefully to understand the requirements needed on all steps of the

career path. Each map shows potential opportunities for advancement that may be achieved through additional education and training and experience on-the-job. Additional ways to use career pathways maps can be found at *20 Ways to Use Career Pathways Maps* at <http://www.paadultedresources.org/wp-content/uploads/2017/02/20-ways-to-use-career-pathway-maps-12-18-17.pdf>.

## **Job Descriptions**

The job descriptions in the guide provide details of every job that is mentioned in each of the career pathways maps. Information from O\*NET Online <https://www.onetonline.org/> was used to inform the descriptions. Another key component of the job descriptions is the *Sample of reported job titles*. These job titles are important because they are examples that employers might use for the same job. For example, an *energy auditor* at ABC Company might have the job title of *Building Performance Specialist* at DEF Company even though they do essentially the same kind of work.

Job descriptions are helpful for job seekers to get a clearer understanding of the jobs in isolation. More importantly, the descriptions help to provide clarity on how a career pathway builds on the skills and knowledge, and abilities of the jobs on the pathways. Use the information in this section to discuss the general qualifications of the job and the alternative names associated with the work that the job requires. Each job's description includes a citation and reference in the bibliography that can easily be accessed to provide additional information about the job. Use the references to assist job seekers in further career exploration when making decisions about any career path.

## **Foundation Skills Framework**

Selected jobs in this section of the guide are aligned to specific workforce preparation skills detailed in the Foundation Skills Framework (FSF). The FSF is a tool developed by workforce development professionals that identifies skills, competencies, and tasks that individuals need to master to get a job, keep a job, and advance in a job.

The jobs in this section are primarily the entry level jobs identified on each map in the guide. Top *skills* for each job that are identified on O\*NET Online were aligned to the FSF and can be used to help job seekers get an understanding of the workforce preparation skills that they will need for a particular job.

While this section provides examples of the workforce preparation skills for some of the jobs in the sector, additional research can be completed for any of the jobs on the pathways. Encourage job seekers to review the skills needed for their jobs of interest and compare them to the FSF. Additional FSF resources, including an assessment and competency lists can be found at <https://www.paadultedresources.org/foundation-skills-framework/>.

## **Bibliography**

This final section of the guide is the bibliography. The bibliography provides a listing of all of the resources that were used to research the information in the guide and can be used to conduct further research on the sector or career pathways.

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## *Introduction to Career Pathways*

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The Workforce Innovation and Opportunity Act (WIOA) moved career pathways from just a good idea to a mandatory component of workforce development programming. While providing a comprehensive definition of and for career pathways, WIOA does little to describe the “how to” for this strategy. From the development of customized mapping tools for employers to integrated education and training programs for customers who are determined basic skills deficient, career pathways strategies are customized to the local labor market.

At a minimum, career pathways strategies for job seekers need to include opportunities to explore careers and occupations that fall within high priority occupation sectors, develop a career pathway plan that includes charting specific and realistic goals, and learn about and practice key employability skills. A concrete plan with established goals and steps to follow can offer guidance and structure to job seekers’ employment goals. This plan may include, for example, obtaining work while exploring careers, identifying and enrolling in educational or training opportunities, identifying, researching, and preparing for occupations so that they may be ready to begin the job search process immediately.

Workforce development professionals can use the information associated with career pathways to further develop opportunities for job seekers to enter a career path rather than just getting a job. To do this; however, career pathways strategies need to be recognized and embraced by workforce development professionals in order to coordinate service delivery so that individuals can become aware of opportunities and have access to what they need to move along a pathway.

While this guide presents the “nuts and bolts” of career pathways, professionals will need to work together to develop strategies to assist job seekers to move along these paths. Which of the illustrated pathways are most essential to the region? How can workforce development professionals work together to promote these essential pathways? What can we do to include postsecondary education and training partners to assist in these career pathways strategies? How can we include Title II adult education into our strategies? There are answers to all these questions when we work together with career pathways innovations.

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## Sector Description

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The Center for Workforce Information and Analysis states:

The Advanced Manufacturing (AM) cluster is made up of mostly durable goods manufacturing but also includes wholesalers, and some retailers such as car dealers. Other industry clusters contain segments of manufacturing within them, while the AM cluster is focused around its four sub-clusters:

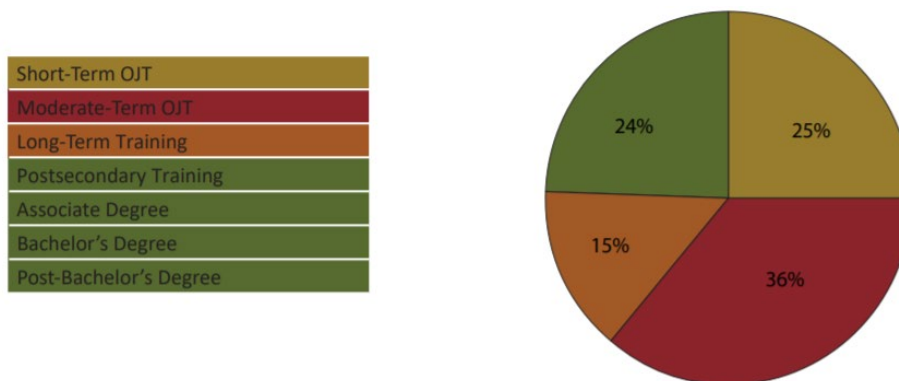
Chemicals, Rubber & Plastics (AM- CRP)

Electronics (AM-E)

Metals (AM-M)

Vehicles & Vehicle Equipment (AM-VVE)

This graph illustrates the minimum educational attainment levels for jobs found in this cluster's various industries. Individuals can start at entry-level positions and gain experience, stack credentials, and/or continue education to build a solid career pathway within this industry. For example, in the metalworking sub-cluster alone there are 52 different credentials spanning from entry-level to master-level (National, 2020).





Additionally, The Center for Workforce Information and Analysis identifies the following top industries:

#### Top Industries Based on Employment

- New Car Dealers
- All Other Plastics Product Manufacturing
- General Automotive Repair
- Machine Shops
- Electronics & Appliance Stores
- Automotive Parts & Accessories Stores
- Iron & Steel Mills & Ferroalloy Manufacturing
- Industrial Machinery Merchant Wholesalers
- Automotive Body & Interior Repair
- New Motor Vehicle Parts Wholesalers
- Elec. Equip. & Wiring Merchant Wholesalers
- Used Car Dealers
- Other Automotive Repair & Maintenance
- Tire Dealers
- Powder Metallurgy Part Manufacturing
- Aircraft Manufacturing
- Sheet Metal Work Manufacturing
- Railroad Rolling Stock Manufacturing
- Motor Vehicle Merchant Wholesalers
- Special Tool, Die, Jig & Fixture Manufacturing

Pennsylvania continues to be a national leader for the industry of Advanced Manufacturing, ranking as the 8<sup>th</sup> largest manufacturing sector in the country and having a Gross Regional Product of \$88.3 billion. Furthermore, the North Central WDA leads Pennsylvania with the highest location quotient for advanced manufacturing.

The North Central 2016 Transitional Plan shows how the region encourages collaborative work which supports the advanced manufacturing industry. Through a project called Fit 4 Manufacturing, “A collaboration of our manufacturers, the Workforce Development Board, PA CareerLink® center staff, the Community Education Center, and the St. Marys Area School District offer a certificate program that includes soft skills training and hands-on training to individuals who are interested in pursuing opportunities along a career pathway in manufacturing. This program has been offered a number of times and results in almost every participant being offered at least one job opportunity on the last day at a “speed dating” type interview.” (Workforce Solutions)

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## *Career Pathways Maps*

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# Advanced Manufacturing-

Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic

Additional training and education

**Occupation:** Electrical Engineers (17-2071)

**Education:** bachelor's degree or higher

**Training:** postsecondary education

**Skills:** demonstrates effective interpersonal relations, understands process or product and service, makes decisions

**Salary Range:** \$18-44/hour

**Occupation:** Electronics Engineering Technicians (17-3023.01)

**Education:** postsecondary certificate and/or associate's degree

**Training:** postsecondary training

**Skills:** uses mathematical concepts and operations, uses technology, observes critically

**Salary Range:** \$16-27.25/hour

**Occupation:** Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic (51-4012)

**Education:** high school diploma or equivalent and postsecondary certificate

**Training:** vocational and/or postsecondary training and/or apprenticeship

**Skills:** solves problems, lifelong learning, makes decisions

**Salary Range:** \$18-25.50/hour

**Occupation:** Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic (51-4081)

**Education:** high school diploma or equivalent

**Training:** vocational training and/or apprenticeship

**Skills:** listens with understanding, solves problems, observes critically

**Salary Range:** \$12-18.25/hour



# Advanced Manufacturing- Industrial Truck and Tractor Operators

Additional training and education



**Occupation:** First-Line Supervisors of Production and Operating Workers (51-1011)

**Education:** high school diploma or equivalent and/or bachelor's degree

**Training:** long-term on-the-job training, postsecondary, and/or apprenticeship

**Skills:** demonstrates effective interpersonal relations, understands process or product and service, makes decisions

**Salary Range:** \$18-29/hour

**Occupation:** Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders (51-9051)

**Education:** high school diploma or equivalent

**Training:** short-term on-the-job training and/or apprenticeship

**Skills:** demonstrates quality consciousness, understands process and product or service, observes critically

**Salary Range:** \$26-27/hour

**Occupation:** Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic (51-4191)

**Education:** high school diploma or equivalent

**Training:** short-term on-the-job training and/or apprenticeship

**Skills:** demonstrates quality consciousness, demonstrates effective interpersonal skills, observes critically

**Salary Range:** \$18-20/hour

**Occupation:** Industrial Truck and Tractor Operators (53-7051)

**Education:** high school diploma or equivalent

**Training:** short-term on-the-job training, forklift operator safety training, and/or apprenticeship

**Skills:** observes critically, uses technology, applies health and safety concepts

**Salary Range:** \$13-17/hour

2019 HPO list retrieved from <https://www.workstats.dli.pa.gov/Products/HPOs/Pages/default.aspx>

U.S. Department of Labor. (2019). O\*NET OnLine. National Center for O\*NET Development. Retrieved from [https://www.onetonline.org/Career in Welding guide](https://www.onetonline.org/Career%20in%20Welding%20guide) retrieved from [https://www.careersinwelding.com/careers-in-welding/?\\_ga=2.107633989.635313544.1576504620-1194528512.1576504620](https://www.careersinwelding.com/careers-in-welding/?_ga=2.107633989.635313544.1576504620-1194528512.1576504620)

# Advanced Manufacturing- Machinists

Additional training and education



**Occupation:** First-Line Supervisors of Production and Operating Workers (51-1011)

**Education:** high school diploma or equivalent and/or bachelor's degree

**Training:** long-term on-the-job training, postsecondary, and/or apprenticeship

**Skills:** demonstrates effective interpersonal relations, understands process or product and service, makes decisions

**Salary Range:** \$18-29/hour

**Occupation:** Manufacturing Production Technicians (17-3029.09)

**Education:** high school diploma or equivalent and/or associate's degree

**Training:** postsecondary training or apprenticeship

**Skills:** listens with understanding, speaks clearly and concisely, demonstrates quality consciousness

**Salary Range:** \$16-25.75/hour

**Occupation:** Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic (51-4012)

**Education:** high school diploma or equivalent and postsecondary certificate

**Training:** vocational and/or postsecondary training and/or apprenticeship

**Skills:** solves problems, lifelong learning, makes decisions

**Salary Range:** \$18-25.50/hour

**Occupation:** Machinists (51-4041)

**Education:** high school diploma or equivalent and postsecondary education

**Training:** vocational training and/or apprenticeship

**Skills:** listens with understanding, solves problems, observes critically

**Salary Range:** \$13.75-21/hour

2019 HPO list retrieved from <https://www.workstats.dli.pa.gov/Products/HPOs/Pages/default.aspx>

U.S. Department of Labor. (2019). O\*NET OnLine. National Center for O\*NET Development. Retrieved from [https://www.onetonline.org/Career in Welding guide](https://www.onetonline.org/Career%20in%20Welding%20guide) retrieved from [https://www.careersinwelding.com/careers-in-welding/?\\_ga=2.107633989.635313544.1576504620-1194528512.1576504620](https://www.careersinwelding.com/careers-in-welding/?_ga=2.107633989.635313544.1576504620-1194528512.1576504620)

# Advanced Manufacturing- Helpers, Production Workers

Additional training and education

**Occupation:** Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders (51-9041)

**Education:** high school diploma or equivalent

**Training:** short-term on-the-job training

**Skills:** reads with understanding, demonstrates quality consciousness, solves problems

**Salary Range:** \$12.25-\$18.25/hour

**Occupation:** Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic (51-4031)

**Education:** high school diploma or equivalent and postsecondary education

**Training:** short-term on-the-job training

**Skills:** speaks clearly and concisely, solves problems, observes critically

**Salary Range:** \$12.50-17.50/hour

**Occupation:** Packaging and Filling Machine Operators and Tenders (51-9111)

**Education:** high school diploma or equivalent

**Training:** short-term on-the-job training

**Skills:** listens with understanding, observes critically, locates and uses resources

**Salary Range:** \$10.25-16.25/hour

**Occupation:** Helpers, Production Workers (51-9198)

**Education:** high school diploma or equivalent

**Training:** short-term on-the-job training

**Skills:** uses technology, applies health and safety concepts, demonstrates self-management strategies

**Salary Range:** \$9.25-13.75/hour



# Advanced Manufacturing-

Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders

Additional training and education



**Occupation:** Industrial Machinery Mechanics (49-9041)

**Education:** high school diploma or equivalent and postsecondary certificate

**Training:** vocational and on-the-job training and/or apprenticeship

**Skills:** solves problems, makes decisions, listens with understanding

**Salary Range:** \$16.50-24.75/hour

**Occupation:** Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders (51-4122)

**Education:** high school diploma or equivalent

**Training:** short-term on-the-job training

**Skills:** listens with understanding, speaks clearly and concisely, solves problems

**Salary Range:** \$13-19/hour

**Occupation:** Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic (51-4031)

**Education:** high school diploma or equivalent

**Training:** short-term on-the-job training

**Skills:** speaks clearly and concisely, solves problems, observes critically

**Salary Range:** \$12.50-17.50/hour

**Occupation:** Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders (51-9041)

**Education:** high school diploma or equivalent

**Training:** short-term on-the-job training

**Skills:** reads with understanding, demonstrates quality consciousness, solves problems

**Salary Range:** \$10.75-17.50/hour

2019 HPO list retrieved from <https://www.workstats.dli.pa.gov/Products/HPOs/Pages/default.aspx>

U.S. Department of Labor. (2019). O\*NET OnLine. National Center for O\*NET Development. Retrieved from [https://www.onetonline.org/Career in Welding guide](https://www.onetonline.org/Career%20in%20Welding%20guide) retrieved from [https://www.careersinwelding.com/careers-in-welding/?\\_ga=2.107633989.635313544.1576504620-1194528512.1576504620](https://www.careersinwelding.com/careers-in-welding/?_ga=2.107633989.635313544.1576504620-1194528512.1576504620)

# Advanced Manufacturing- Tool and Die Makers

Additional training and education

**Occupation:** General and Operations Managers (11-1021)  
**Education:** bachelor's degree  
**Training:** long-term on-the-job training and postsecondary  
**Skills:** understands finances, lifelong learning, demonstrates effective interpersonal relations  
**Salary Range:** \$25-54/hour

**Occupation:** First-Line Supervisors of Production and Operating Workers (51-1011)  
**Education:** high school diploma or equivalent and/or bachelor's degree  
**Training:** long-term on-the-job training, postsecondary, and/or apprenticeship  
**Skills:** demonstrates effective interpersonal relations, understands process or product and service, makes decisions  
**Salary Range:** \$18-29/hour

**Occupation:** Model Makers, Metal and Plastic (51-4061)  
**Education:** high school diploma or equivalent and postsecondary education  
**Training:** postsecondary training and/or apprenticeship  
**Skills:** demonstrate self-management strategies, solves problems, observes critically  
**Salary Range:** \$15.75-25.50/hour

**Occupation:** Tool and Die Makers (51-4111)  
**Education:** postsecondary certificate or associate's degree  
**Training:** vocational training and/or postsecondary  
**Skills:** listens with understanding, uses technology, makes decisions  
**Salary Range:** \$16-23.75/hour





# Advanced Manufacturing- Welders, Cutters, Solderers, and Brazers

Additional training and education



**Occupation:** Career/Technical Education Teachers, Secondary School (25-2032)

**Education:** bachelor's degree or higher

**Training:** long-term on-the-job training and postsecondary

**Skills:** speaks clearly and concisely, lifelong learning, demonstrates effective interpersonal relations

**Salary Range:** \$20-31.25/hour

**Occupation:** First-Line Supervisors of Production and Operating Workers (51-1011)

**Education:** high school diploma or equivalent and/or bachelor's degree

**Training:** long-term on-the-job training, postsecondary, and/or apprenticeship

**Skills:** demonstrates effective interpersonal relations, understands process or product and service, makes decisions

**Salary Range:** \$18-29/hour

**Occupation:** Sheet Metal Workers (47-2211)

**Education:** high school diploma or equivalent and postsecondary education

**Training:** vocational training and/or apprenticeship

**Skills:** uses mathematical concepts and operations, reads with understanding, speaks clearly and concisely

**Salary Range:** \$13.25-25.75/hour

**Occupation:** Welders, Cutters, Solderers, and Brazers (51-4121)

**Education:** high school diploma or equivalent and/or some college

**Training:** vocational training and/or postsecondary

**Skills:** reads with understanding, demonstrates self-management strategies, uses technology

**Salary Range:** \$14-19.50/hour

2019 HPO list retrieved from <https://www.workstats.dli.pa.gov/Products/HPOs/Pages/default.aspx>

U.S. Department of Labor. (2019). O\*NET OnLine. National Center for O\*NET Development. Retrieved from [https://www.onetonline.org/Career in Welding guide](https://www.onetonline.org/Career%20in%20Welding%20guide) retrieved from [https://www.careersinwelding.com/careers-in-welding/?\\_ga=2.107633989.635313544.1576504620-1194528512.1576504620](https://www.careersinwelding.com/careers-in-welding/?_ga=2.107633989.635313544.1576504620-1194528512.1576504620)

### **Career/Technical Education Teachers, Secondary School**

Teach occupational, career and technical, or vocational subjects at the secondary school level in public or private schools.

*Sample of reported job titles:* Agricultural Education Teacher, Allied Health Teacher, Business Education Teacher, Cosmetology Teacher, Drafting Instructor, Family and Consumer Sciences Teacher (FACS Teacher), Instructor, Teacher, Technology Education Teacher, Vocational Teacher (U.S. Department of Labor, O\*NET, Career/Technical Education Teachers, Secondary School, 2020a)

### **Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic**

Develop programs to control machining or processing of metal or plastic parts by automatic machine tools, equipment, or systems.

*Sample of reported job titles:* CAD CAM Programmer (Computer-Aided Design Computer-Aided Manufacturing Programmer), Computer Numerical Control Machine Operator (CNC Machine Operator), Computer Numerical Control Machining Center Operator (CNC Machining Center Operator), Computer Numerical Control Machinist (CNC Machinist), Computer Numerical Control Operator (CNC Operator), Computer Numerical Control Programmer (CNC Programmer), Machine Shop Lead Man, Machining Manager, Process Engineer, Programmer (U.S. Department of Labor, O\*NET, Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic, 2020b)

### **Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic**

Set up, operate, or tend machines to saw, cut, shear, slit, punch, crimp, notch, bend, or straighten metal or plastic material.

*Sample of reported job titles:* Die Setter, Fabrication Operator, Machine Operator, Machine Setter, Operator, Press Operator, Punch Press Operator, Saw Operator, Set-Up Operator, Slitter Operator (U.S. Department of Labor, O\*NET, Cutting, Punching, and Press Machine Setters, Operators, and tenders, Metal and Plastic, 2020c)

## **Electrical Engineers**

Research, design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use.

*Sample of reported job titles:* Circuits Engineer, Design Engineer, Electrical Controls Engineer, Electrical Design Engineer, Electrical Engineer, Electrical Project Engineer, Instrumentation and Electrical Reliability Engineer (I&E Reliability Engineer), Power Systems Engineer, Project Engineer, Test Engineer (U.S. Department of Labor, O\*NET, Electrical Engineers, 2020d)

## **Electronics Engineering Technicians**

Lay out, build, test, troubleshoot, repair, and modify developmental and production electronic components, parts, equipment, and systems, such as computer equipment, missile control instrumentation, electron tubes, test equipment, and machine tool numerical controls, applying principles and theories of electronics, electrical circuitry, engineering mathematics, electronic and electrical testing, and physics. Usually work under direction of engineering staff.

*Sample of reported job titles:* Digital Tech (Digital Technician), Electrical Technician, Electronics Engineering Technician, Electronics Technician, Engineering Technician (Engineering Tech), Failure Analysis Technician (FA Technician), Refurbish Technician (Refurb Tech), Senior Electronics Technician, Technician, Test Technician (U.S. Department of Labor, O\*NET, Electronics Engineering Technicians, 2020e)

## **Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders**

Set up, operate, or tend machines, such as glass forming machines, plodder machines, and tuber machines, to shape and form products, such as glassware, food, rubber, soap, brick, tile, clay, wax, tobacco, or cosmetics.

*Sample of reported job titles:* Extruder Operator, Extrusion Operator, Glass Forming Crew Member, Job Change Crew Member, Machine Operator, Operator, Press Operator, Production Operator, Tuber Operator, Upkeep Mechanic (U.S. Department of Labor, O\*NET, Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders, 2020f)

## **First-Line Supervisors of Production and Operating Workers**

Directly supervise and coordinate the activities of production and operating workers, such as inspectors, precision workers, machine setters and operators, assemblers, fabricators, and plant and system operators.

*Sample of reported job titles:* Assembly Supervisor, Department Manager, Manufacturing Supervisor, Molding Supervisor, Production Manager, Production Supervisor, Quality Assurance Supervisor (QA Supervisor), Shift Supervisor, Supervisor, Team Leader (U.S. Department of Labor, O\*NET, First-Line Supervisors of Production and Operating Workers, 2020g)

## **Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders**

Operate or tend heating equipment other than basic metal, plastic, or food processing equipment. Includes activities, such as annealing glass, drying lumber, curing rubber, removing moisture from materials, or boiling soap.

*Sample of reported job titles:* Annealing Operator, Control Room Operator, Dry Kiln Operator, Dryer Feeder, Evaporator Operator, Furnace Operator, Kiln Fireman, Kiln Operator, Lime Kiln and Recausticizing Operator, Oven Operator (U.S. Department of Labor, O\*NET, Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders, 2020h)

## **General and Operations Managers**

Plan, direct, or coordinate the operations of public or private sector organizations. Duties and responsibilities include formulating policies, managing daily operations, and planning the use of materials and human resources, but are too diverse and general in nature to be classified in any one functional area of management or administration, such as personnel, purchasing, or administrative services.

*Sample of reported job titles:* Business Manager, Facilities Manager, Facility Manager, General Manager (GM), Operations Director, Operations Manager, Plant Manager, Plant Superintendent, Production Manager, Store Manager (U.S. Department of Labor, O\*NET, General and Operations Manager, 2020i)

## **Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic**

Set up, operate, or tend heating equipment, such as heat-treating furnaces, flame-hardening machines, induction machines, soaking pits, or vacuum equipment to temper, harden, anneal, or heat-treat metal or plastic objects.

*Sample of reported job titles:* Batch Heat Treat Operator, Burner, Coating Line Worker, Furnace Operator, Heat Treat Furnace Operator, Heat Treat Operator, Heat Treat Technician, Heat Treater, Machine Operator, Scarf and Anneal Operator (U.S. Department of Labor, O\*NET, Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic, 2020j)

## **Helpers, Production Workers**

Help production workers by performing duties requiring less skill. Duties include supplying or holding materials or tools, and cleaning work area and equipment.

*Sample of reported job titles:* Assistant Operator, Helper, Laborer, Machine Operator, Material Handler, Press Helper, Production Worker, Service Person, Support Team Member, Utility Worker (U.S. Department of Labor, O\*NET, Helpers, Production Workers, 2020k)

## **Industrial Machinery Mechanics**

Repair, install, adjust, or maintain industrial production and processing machinery or refinery and pipeline distribution systems.

*Sample of reported job titles:* Fixer, Industrial Machinery Mechanic, Industrial Mechanic, Loom Fixer, Machine Adjuster, Maintenance Mechanic, Maintenance Technician, Master Mechanic, Mechanic, Overhauler (U.S. Department of Labor, O\*NET, Industrial Machinery Mechanics, 2020l)

## **Industrial Truck and Tractor Operators**

Operate industrial trucks or tractors equipped to move materials around a warehouse, storage yard, factory, construction site, or similar location.

*Sample of reported job titles:* Checker Loader, Fork Lift Technician, Fork Truck Driver, Forklift Driver, Forklift Operator, Lift Truck Operator, Shag Truck Driver, Spotter Driver, Tow Motor Operator, Truck Driver (U.S. Department of Labor, O\*NET, Industrial Truck and Tractor Operators, 2020m)

## **Machinists**

Set up and operate a variety of machine tools to produce precision parts and instruments. Includes precision instrument makers who fabricate, modify, or repair mechanical instruments. May also fabricate and modify parts to make or repair machine tools or maintain industrial machines, applying knowledge of mechanics, mathematics, metal properties, layout, and machining procedures.

*Sample of reported job titles:* Gear Machinist, Journeyman Machinist, Machine Operator, Machine Repair Person, Machinist, Maintenance Machinist, Maintenance Specialist, Production Machinist, Set-Up Machinist, Tool Room Machinist (U.S. Department of Labor, O\*NET, Machinists, 2020n)

## **Manufacturing Production Technicians**

Set up, test, and adjust manufacturing machinery or equipment, using any combination of electrical, electronic, mechanical, hydraulic, pneumatic, or computer technologies.

*Sample of reported job titles:* Engineering Technician, Experimental Machining Lab Manager, Final Operations Technician, Metallurgical Lab Technician, Quality Assurance Technician, Quality Technician, Service Technician, Support Technician, Tool Room Supervisor, Value Stream Manager (U.S. Department of Labor, O\*NET, Manufacturing Production Technicians, 2020o)

## **Model Makers, Metal and Plastic**

Set up and operate machines, such as lathes, milling and engraving machines, and jig borers to make working models of metal or plastic objects. Includes template makers.

*Sample of reported job titles:* Catalytic Converter Special Build Prototype, Computer Numerical Control Machinist (CNC Machinist), Computer Numerical Control Operator (CNC Operator), Fabricator, Metal Model Maker, Model Builder, Model Maker, Molding Technician, Pattern Finisher, Prototype Special Build (U.S. Department of Labor, O\*NET, Model makers, Metal and Plastic, 2020p)

### **Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic**

Set up, operate, or tend more than one type of cutting or forming machine tool or robot.

*Sample of reported job titles:* Cell Technician, CNC Machine Setter (Computer Numerically Controlled Machine Setter), CNC Machinist (Computer Numerically Controlled Machinist), CNC Operator (Computer Numerically Controlled Operator), Die Setter, Machine Operator, Machine Technician, Machinist, Operator, Set-Up Person (U.S. Department of Labor, O\*NET, Multiple Machine Tool Setters, Operators, and tenders, metal and Plastic, 2020q)

### **Packaging and Filling Machine Operators and Tenders**

Operate or tend machines to prepare industrial or consumer products for storage or shipment. Includes cannery workers who pack food products.

*Sample of reported job titles:* A-Operator, Bundler, Closing Machine Operator, Computer Numerical Control Machine Operator (CNC Machine Operator), Fabrication Technician, Filler Operator, Machine Operator, Packaging Operator, Packing Attendant, Packing Machine Operator (U.S. Department of Labor, O\*NET, Packaging and Filling Machine Operators and Tenders, 2020r)

### **Sheet Metal Workers**

Fabricate, assemble, install, and repair sheet metal products and equipment, such as ducts, control boxes, drainpipes, and furnace casings. Work may involve any of the following: setting up and operating fabricating machines to cut, bend, and straighten sheet metal; shaping metal over anvils, blocks, or forms using hammer; operating soldering and welding equipment to join sheet metal parts; or inspecting, assembling, and smoothing seams and joints of burred surfaces. Includes sheet metal duct installers who install prefabricated sheet metal ducts used for heating, air conditioning, or other purposes.

*Sample of reported job titles:* Field Installer; HVAC Sheet Metal Installer (Heating, Ventilation, and Air Conditioning Sheet Metal Installer); Journeyman Sheet Metal Worker; Sheet Metal Apprentice; Sheet Metal Fabricator; Sheet Metal Foreman; Sheet Metal Installer; Sheet Metal Layout Mechanic; Sheet Metal Mechanic; Sheet Metal Worker (U.S. Department of Labor, O\*NET, Sheet Metal Workers, 2020s)

## **Tool and Die Makers**

Analyze specifications, lay out metal stock, set up and operate machine tools, and fit and assemble parts to make and repair dies, cutting tools, jigs, fixtures, gauges, and machinists' hand tools.

*Sample of reported job titles:* Aircraft Tool Maker, Carbide Tool Die Maker, Die Maker, Jig and Fixture Builder, Jig and Fixture Repairer, Tool and Die Machinist, Tool and Die Maker, Tool Repairer, Toolmaker, Trim Die Maker (U.S. Department of Labor, O\*NET, Tool and Die Makers, 2020t)

## **Welders, Cutters, Solderers, and Brazers**

Use hand-welding or flame-cutting equipment to weld or join metal components or to fill holes, indentations, or seams of fabricated metal products.

*Sample of reported job titles:* Aluminum Welder, Fabrication Welder, Fabricator, Fitter/Welder, Maintenance Welder, MIG Welder (Metal Inert Gas Welder), Sub Arc Operator, Welder, Welder-Fitter, Welder/Fabricator (U.S. Department of Labor, O\*NET, Welders, Cutters, Solderers, and Brazers, 2020u)

## **Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders**

Set up, operate, or tend welding, soldering, or brazing machines or robots that weld, braze, solder, or heat treat metal products, components, or assemblies. Includes workers who operate laser cutters or laser-beam machines.

*Sample of reported job titles:* Braze Operator, Fabricator, Finishing Technician, Fitter-Welder, Machine Operator, Mig Welder, Operator, Robot Operator, Spot Welder, Technical Associate (TA) (U.S. Department of Labor, O\*NET, Welders, Soldering, and Brazing Machine Setters, Operators, and Tenders, 2020v)



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*Top Foundation Skills Required for Jobs in the  
Advanced Manufacturing Sector*

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Using information from O\*NET job summaries, the following skills from the Foundation Skills Framework were identified as important skills for jobs in the advanced manufacturing sector.

***Industrial Truck and Tractor Operators***

***Observes Critically***

Critical and reflective thinking and discrimination skills needed to notice, analyze, and respond to visual information, especially in irregular or unusual situations

***Demonstrates Self-Management Strategies***

Skills and knowledge needed to understand how personal factors contribute to employability and how to manage time and tasks effectively.

***Machinists***

***Observes Critically***

Critical and reflective thinking and discrimination skills needed to notice, analyze, and respond to visual information, especially in irregular or unusual situations

***Listens with Understanding***

Skills needed to comprehend, analyze, and interpret orally presented communications and directions on familiar and unfamiliar topics

***Reads with Understanding***

Skills needed to read and understand written work-related information, such as reading for various purposes - reading to complete a task, locate specific information, or critically analyze information

### ***Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders***

#### *Observes Critically*

Critical and reflective thinking and discrimination skills needed to notice, analyze, and respond to visual information, especially in irregular or unusual situations

#### *Listens with Understanding*

Skills needed to comprehend, analyze, and interpret orally presented communications and directions on familiar and unfamiliar topics

#### *Reads with Understanding*

Skills needed to read and understand written work-related information, such as reading for various purposes - reading to complete a task, locate specific information, or critically analyze information

#### *Speaks Clearly and Concisely*

Skills needed to express ideas and information orally in a clear and understandable manner while sustaining interest and attention

### ***Tool and Die Makers***

#### *Observes Critically*

Critical and reflective thinking and discrimination skills needed to notice, analyze, and respond to visual information, especially in irregular or unusual situations

#### *Listens with Understanding*

Skills needed to comprehend, analyze, and interpret orally presented communications and directions on familiar and unfamiliar topics

#### *Makes Decisions*

Critical, creative, and reflective thinking skills needed to consider relevant facts and opinions, evaluate potential risks and benefits of various decisions, make a decision, and analyze its outcome

### ***Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic***

#### *Observes Critically*

Critical and reflective thinking and discrimination skills needed to notice, analyze, and respond to visual information, especially in irregular or unusual situations

*Makes Decisions*

Critical, creative, and reflective thinking skills needed to consider relevant facts and opinions, evaluate potential risks and benefits of various decisions, make a decision, and analyze its outcome

*Solves Problems*

Critical, creative, and reflective thinking skills needed to identify problems, analyze and evaluate various solutions, implement solutions and monitor their effectiveness

*Speaks Clearly and Concisely*

Skills needed to express ideas and information orally in a clear and understandable manner while sustaining interest and attention

***Welders, Cutters, Solderers, and Brazers***

*Observes Critically*

Critical and reflective thinking and discrimination skills needed to notice, analyze, and respond to visual information, especially in irregular or unusual situations

*Reads with Understanding*

Skills needed to read and understand written work-related information, such as reading for various purposes - reading to complete a task, locate specific information, or critically analyze information

*NOTE: All the information on pages 25-27 of this guide is taken verbatim from the Foundation Skills Framework Competency Lists (2016) accessed at [http://www.paadultedresources.org/wp-content/uploads/2016/05/FSF-competency\\_list-12-18-17.pdf](http://www.paadultedresources.org/wp-content/uploads/2016/05/FSF-competency_list-12-18-17.pdf)*

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