Introduction to manufacturing

Manufacturing is the process of making products, or goods. The businesses that make products are called manufacturers. Manufacturers sell their products to people and companies. Manufacturers take raw materials and turn them into products to sell. Raw materials include wood, steel, plastic, cloth, and many other materials. Using raw materials, manufacturers make cars, electronics, clothing, furniture, home appliances, machinery, ships, airplanes, and many other goods. Manufacturers have many different ways of making goods and doing business. They usually use machines to make large amounts of products. Human workers or computers may operate these machines. Some manufacturers sell their products to the public. Others sell their products to other companies. Different companies may work together to create a single product. For example, a shoe manufacturer may not have the equipment to make shoelaces. Or it may not want to take the time to make them. So, it buys the shoelaces for its shoes from a shoelace manufacturer.

Sources

- https://www.careeronestop.org/ [accessed October 2020]
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### Before & After Quiz

Read each of the following statements. Then decide how strongly you agree or disagree with each. After learning about manufacturing, look back at your ratings. Discuss how your thinking has changed or been confirmed on one or more of the statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Before</th>
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<th>After</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Agree</td>
<td>Disagree</td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td>Everything you touch has been manufactured.</td>
<td></td>
<td></td>
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<tr>
<td>Manufacturing requires high-tech solutions and a highly skilled and qualified work force.</td>
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<tr>
<td>The manufacturing marketplace consists only of human-run assembly lines.</td>
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<tr>
<td>Manufacturers work in dark factories.</td>
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<tr>
<td>When I think of manufacturing it looks like this:</td>
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<tr>
<td>Manufacturers work with robots to build products together.</td>
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<tr>
<td>I would be interested in pursuing a career in advanced manufacturing.</td>
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</tbody>
</table>
**Interest Survey: Can you see yourself in Manufacturing?**

John Holland’s Strong Interest Survey is a tool that guides students toward careers that match their interests. It is based on the theory that career choice is an expression of personality. Your interests suggest a lot about who you are, as well as career fields, activities, and majors you might enjoy.

Review the six personality types below, and rank them from 1-6, with 6 matching the profile that sounds the most like you and 1 matching the profile that sounds the least like you. Then, use the links to explore more about the advanced manufacturing careers that align with each personality type.

<table>
<thead>
<tr>
<th>Personality Type</th>
<th>Rating</th>
<th>Advanced Manufacturing Careers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Realistic</strong></td>
<td></td>
<td>chemical engineers, electrical engineers, industrial engineers, computer engineers, mechanical engineers, environmental engineers, aerospace engineers, and mechanics</td>
</tr>
<tr>
<td><strong>Investigative</strong></td>
<td></td>
<td>materials analyst, robot technician, assembler, plant accountant, electrician, chemical engineers, and design engineers</td>
</tr>
<tr>
<td><strong>Artistic</strong></td>
<td></td>
<td>materials analyst, design engineers, welder, and machinists</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td></td>
<td>plant human resources manager, test engineer, sales support, and quality control</td>
</tr>
<tr>
<td><strong>Enterprising</strong></td>
<td></td>
<td>chief manufacturing executive, chief quality control executive, facilities manager, manufacturing manager, supervisory, and plant operator</td>
</tr>
<tr>
<td><strong>Conventional</strong></td>
<td><strong>assembler</strong>, shift supervisor, accounting, and <strong>manufacturing manager</strong></td>
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<td>-------------------</td>
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<tr>
<td>Someone who is conventional prefers structured tasks and tending to details. He or she is often conservative. This person might be interested in setting up procedures, organizing, using computers, and keeping records and would enjoy working with information and finances.</td>
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</tr>
</tbody>
</table>
**Additional Job Information**

Employees are hired into core positions (e.g. Tool and Die Maker). Each employee will select a development track – technical or leadership - with the help of their supervisor. Both tracks have the ability to reach comparable salary grade levels and compensation, although the educational pathway is different for both.

<table>
<thead>
<tr>
<th>Technical Pathways</th>
<th>Advanced Education included in both Leadership and Technical Pathways</th>
<th>Leadership Pathways</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrician</strong></td>
<td><strong>Chemical Engineer</strong></td>
<td><strong>Manufacturing Manager</strong></td>
</tr>
<tr>
<td><strong>Machinists</strong></td>
<td><strong>Electrical Engineer</strong></td>
<td><strong>Quality Control Managers</strong></td>
</tr>
<tr>
<td><strong>Welder</strong></td>
<td><strong>Automation/Robotics Engineer</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Mechanic</strong></td>
<td><strong>Industrial Engineer</strong></td>
<td></td>
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<tr>
<td><strong>Assembler</strong></td>
<td><strong>Computer Engineer</strong></td>
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</tr>
<tr>
<td><strong>Quality Control Analysts</strong></td>
<td><strong>Mechanical Engineer</strong></td>
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<tr>
<td><strong>Sewing Machine Operator</strong></td>
<td><strong>Environmental Engineer</strong></td>
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<tr>
<td><em>highlighted in the Stormy Kromer Video</em></td>
<td><strong>Aerospace Engineer</strong></td>
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<tr>
<td><strong>Mold Manufacturers</strong></td>
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<tr>
<td>- Extreme Tool/Westfall-Technik in the UP</td>
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<tr>
<td><strong>Structural Metal Fabricators and Fitters</strong></td>
<td></td>
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<tr>
<td>- Superior Fabrication in the UP</td>
<td></td>
<td></td>
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<tr>
<td><strong>Automation/Robotics Technicians</strong></td>
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<tr>
<td>- Extreme Tool/Westfall-Technik in the UP</td>
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<tr>
<td><strong>Mold Makers, Metal &amp; Plastic</strong></td>
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<tr>
<td>- Extreme Tool/Westfall-Technik in the UP</td>
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</tbody>
</table>

This information has been compiled from: [https://www.careeronestop.org/](https://www.careeronestop.org/) provides information about jobs, training, career resources, and unemployment benefits for transitioning Service Members, Veterans, and military spouses. CareerOneStop offers resources targeted for a career changer, laid-off worker, worker with a criminal conviction, entry-level worker, older worker, young adult, workers with disabilities, business, career advisor, and credential seeker.
Chemical Engineer

Chemical engineers apply the principles of chemistry, biology, physics, and math to solve problems that involve the production or use of chemicals, fuel, drugs, food, and many other products. They design processes and equipment for large-scale safe and sustainable manufacturing, plan and test methods of manufacturing products, and treating byproducts, and supervise production.

How could you become a Chemical Engineer?
Chemical Engineer-Bachelors degree

In addition to a bachelor’s degree, this position requires:
• Strong PC skills, including MS Access, Excel, Word, PowerPoint
• In-depth knowledge of engineering economics
• An understanding of systems modeling tools, such as Arena simulation
• Strong analytical and organizational skills
• Oral, written, and problem solving communication skills
• Strong interpersonal skills as the position requires the incumbent to deal with all levels of management; ability to work in a team environment

Chemical engineers must have a bachelor’s degree in chemical engineering. Employers also value practical experience, so cooperative engineering programs, in which students earn college credit for structured job experience, are valuable as well.

It may be helpful to have the degrees, certificates and/or coursework listed below.
• Chemistry
• Physics
• Biology
• Algebra
• Trigonometry
• Calculus

Salary Range (National Wage Range)
$58,830 - $154,840

Job Outlook
Employment of chemical engineers is projected to grow 4 percent from 2012 to 2022.
**Electrical Engineer**

Electrical engineers design, develop, test, and supervise the manufacturing of electrical equipment, such as electric motors, radar and navigation systems, communications systems, and power generation equipment. They also design and develop electronic equipment, such as broadcast and communications systems—from portable music players to global positioning systems (GPS).

**How could you become an Electrical Engineer?**

Electrical Engineer - Bachelors degree

*In addition to a bachelor’s degree, this position requires:*

- Strong computer skills, including MS Access, Excel, Word, PowerPoint
- In-depth knowledge of engineering economics
- An understanding of systems modeling tools, such as Arena simulation
- Strong analytical and organizational skills
- Oral, written, and problem solving communication skills

Electrical and electronics engineers must have a bachelor’s degree. Employers also value practical experience, so participation in cooperative engineering programs, in which students earn academic credit for structured work experience, is valuable as well.

**It may be helpful to have the degrees, certificates and/or coursework listed below.**

- Physics
- Algebra
- Drafting
- Electronics engineering
- Electrical engineering technology
- Digital systems design

**Salary Range  (National Wage Range)**

$56,490-$136,690

**Job Outlook**

Employment of electrical and electronics engineers is projected to grow 4 percent from 2012 to 2022. Job growth is expected because of electrical and electronics engineers’ versatility in developing and applying emerging technologies.
**Automation/Robotics Engineers**

**Description: what do they do?**
Research, design, develop, or test robotic applications.

**Also known as:**
Engineering Manager, Robotics and Systems Lead, Automation Engineering Manager, Engineering Vice President, Design Engineer, Robotic Systems Engineer, Automation Engineer, Autonomous Vehicle Design Engineer, Research Engineer, Factory Automations Engineer

**Education and experience: to get started**
People starting in this career usually have:
- Bachelor's degree
- No work experience
- No on-the-job training

Programs that can prepare you:
- Telecommunications Engineering
- Engineering Mechanics
- Forest Engineering
- Engineering Physics/Applied Physics
- Manufacturing Engineering

**Salary Range** (Michigan Wage Range)
$50,020 - $131,980

**Activities: what you might do in a day**
- Evaluate designs or specifications to ensure quality.
- Interpret design or operational test results.
- Program robotic equipment.
- Test performance of electrical, electronic, mechanical, or integrated systems or equipment.
- Design electromechanical equipment or systems.

**Knowledge**
People in this career often know a lot about:
- **Engineering and Technology** - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- **Design** - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- **Computers and Electronics** - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- **Mathematics** - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- **Mechanical** - Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
Industrial Engineer

Industrial engineers find ways to eliminate wastefulness in production processes. This position acts as a primary resource for accomplishing Industrial Engineering tasks associated with problem solving, data analysis, statistical analysis, business strategy development, capacity planning, inventory/cost reduction, engineering econ analysis, and systems modeling.

How could you become an Industrial Engineer?
Industrial Engineer-Bachelors degree

In addition to a bachelor’s degree, this position requires:
• Strong PC skills, including MS Access, Excel, Word, PowerPoint
• In-depth knowledge of engineering economics
• An understanding of systems modeling tools, such as Arena simulation
• Strong analytical and organizational skills
• Oral, written, and problem solving communication skills
• Strong interpersonal skills as the position requires the incumbent to deal with all levels of management; ability to work in a team environment

Industrial engineers need a bachelor’s degree, typically in industrial engineering. However, many industrial engineers have degrees in mechanical engineering, manufacturing engineering, industrial engineering technology, or general engineering.

It may be helpful to have the degrees, certificates and/or coursework listed below.
• Mechanical engineering
• Manufacturing engineering
• General engineering
• Algebra
• Chemistry
• Physics
• Computer science

Salary Range (National Wage Range)
$51,180-$118,300

Job Outlook
Employment of industrial engineers is projected to grow 5 percent from 2012 to 2022. This occupation is versatile both in the kind of work it does and in the industries in which its expertise can be put to use.
**Computer Engineer**

Computer hardware engineers research, design, develop, and test computer systems and components such as processors, circuit boards, memory devices, networks, and routers. They often work in research laboratories that build and test various types of computer models and most work in high-tech manufacturing firms.

**How could you become a Computer Engineer?**

Computer Engineer- Bachelors degree

*In addition to a bachelor’s degree, this position requires:*

- Strong PC skills, including MS Access, Excel, Word, PowerPoint
- In-depth knowledge of engineering economics
- An understanding of systems modeling tools, such as Arena simulation
- Strong analytical and organizational skills
- Oral, written, and problem solving communication skills
- Strong interpersonal skills as the position requires the incumbent to deal with all levels of management; ability to work in a team environment

Most computer hardware engineers need a bachelor’s degree from an accredited program.

*It may be helpful to have the degrees, certificates and/or coursework listed below.*

- Computer engineering
- Computer science
- Physics
- Algebra
- Calculus

**Salary Range (National Wage Range)**

$63,970-$150,130

**Job Outlook**

Employment of computer hardware engineers is projected to grow 7 percent from 2012 to 2022. A limited number of engineers will be needed to meet the demand for new computer hardware because more of the technology innovation takes place with software than with hardware.
Mechanical Engineer

Mechanical engineers design, develop, build, and test mechanical and thermal devices, including tools, engines, and machines. Mechanical engineers design and oversee the manufacturing of many products ranging from medical devices to new batteries. They provide day-to-day, technical and practical engineering advice, problem solving and support to operations and maintenance.

How could you become a Mechanical Engineer?

Mechanical Engineer - Bachelors degree

In addition to a bachelor’s degree, this position requires:

• Strong PC skills, including MS Access, Excel, Word, PowerPoint
• In-depth knowledge of engineering economics
• An understanding of systems modeling tools, such as Arena simulation
• Strong analytical and organizational skills
• Oral, written, and problem solving communication skills
• Strong interpersonal skills as the position requires the incumbent to deal with all levels of management; ability to work in a team environment

Mechanical engineers need a bachelor’s degree. A graduate degree is typically needed for promotion into managerial positions. Mechanical engineers who sell services publicly must be licensed in all states and the District of Columbia.

It may be helpful to have the degrees, certificates and/or coursework listed below.

• Mechanical engineering
• Mechanical engineering technology
• Life sciences
• Physical sciences
• Basic engineering
• Algebra

Salary Range (National Wage Range)

$52,030-$121,530

Job Outlook

Employment of mechanical engineers is projected to grow 5 percent from 2012 to 2022. Job prospects may be best for those who stay abreast of the most recent advances in technology.
Environmental Engineer

Environmental engineers use the principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems. They are involved in efforts to improve recycling, waste disposal, public health, and water and air pollution control.

How could you become an Environmental Engineer?

Environmental Engineer - Bachelors degree

In addition to a bachelor’s degree, this position requires:

- Strong PC skills, including MS Access, Excel, Word, PowerPoint
- In-depth knowledge of engineering economics
- An understanding of systems modeling tools, such as Arena simulation
- Strong analytical and organizational skills
- Oral, written, and problem solving communication skills
- Strong interpersonal skills as the position requires the incumbent to deal with all levels of management; ability to work in a team environment

Environmental engineers must have a bachelor’s degree in environmental engineering or a related field, such as civil, chemical, or general engineering. Employers also value practical experience. Therefore, cooperative engineering programs, which provide college credit for structured job experience, are valuable as well. Getting a license improves the chances of employment.

It may be helpful to have the degrees, certificates and/or coursework listed below.

- Environmental engineering (or related field such as civil, chemical, or general engineering)
- Life sciences
- Physical sciences
- Algebra

Salary Range (National Wage Range)

$49,150-$122,290

Job Outlook

Employment of environmental engineers is projected to grow 15 percent from 2012 to 2022. State and local government concerns regarding water should lead to efforts to increase the efficiency of water use.
**Aerospace Engineer**

**Aerospace engineers** design aircraft, spacecraft, satellites, and missiles. In addition, they test prototypes to make sure that they function according to design. They collaborate around activities to develop, evaluate and validate advanced structural concepts for improved aircraft structures. The position requires communicating with aerospace customers and working with customer integrated product teams and the work includes all aspects of design, analysis, manufacturing, and testing of advanced structural concepts.

**How can you become an Aerospace Engineer?**
Aerospace or Structural Engineer Bachelor’s degree

**In addition to a bachelor’s degree, this position requires:**
- Strong PC skills, including MS Access, Excel, Word, PowerPoint
- In-depth knowledge of engineering economics
- An understanding of systems modeling tools, such as Arena simulation
- Strong analytical and organizational skills
- Oral, written, and problem solving communication skills
- Strong interpersonal skills as the position requires the incumbent to deal with all levels of management; ability to work in a team environment

Aerospace engineers must have a bachelor’s degree in aerospace engineering or another field of engineering or science related to aerospace systems. Some aerospace engineers work on projects that are related to national defense and thus require security clearances.

**It may be helpful to have the degrees, certificates and/or coursework listed below.**
- Chemistry
- Physics
- Math
- Algebra
- Calculus

**Salary Range (National Wage Range)**
$65,450-$149,120

**Job Outlook**
Employment of aerospace engineers is projected to grow 7 percent from 2012 to 2022. Some aerospace engineers work on projects that are related to national defense and thus require security clearances.
Manufacturing Manager

Industrial production managers oversee the daily operations of manufacturing and related plants. They coordinate, plan, and direct the activities used to create a wide range of goods, such as cars, computer equipment, or paper products. Location Managers will have direct responsibility for the manufacturing organization, manufacturing support, process excellence and quality, with a focus on driving improvements in cost, quality, time, safety and people. They develop manufacturing operating plans in accordance with company policies, goals and objectives and ensure operation plans achieve targeted cost and efficiency results that maximize value for the business unit.

How can you achieve a position as a Manufacturing Manager?

Bachelor’s degree plus 10 years manufacturing leadership

A bachelor’s degree is required for most advertising, promotions, and marketing management positions. These managers typically have work experience in advertising, marketing, promotions, or sales.

It may be helpful to have the degrees, certificates and/or coursework listed below.
• Industrial engineering
• Master of Business Administration
• Business administration

Salary Range (National Wage Range)
$54,250-$150,020

Job Outlook
Employment of industrial production managers is projected to show little or no change from 2012 to 2022.
Quality Control Systems Managers

Description: what do they do?
Plan, direct, or coordinate quality assurance programs. Formulate quality control policies and control quality of laboratory and production efforts.

Also known as:
Associate Director, QA, Quality Control Supervisor (QC Supervisor), Director of Quality, Laboratory Manager, Quality Manager, Quality Control Manager (QC Manager), Lab Manager, Quality Control, Quality Assurance Manager (QA Manager)

Education and experience: to get started
People starting in this career usually have:
- Bachelor's degree
- 5 years or more work experience
- No on-the-job training

Programs that can prepare you:
- Operations Management and Supervision
- Industrial Engineering
- Logistics, Materials, and Supply Chain Management
- Business Administration and Management
- General
- Business/Commerce, General

Salary Range (Michigan Wage Range)
$69,370-$172,390

Activities: what you might do in a day
- Evaluate quality of materials or products.
- Confer with organizational members to accomplish work activities.
- Analyze data to inform operational decisions or activities.
- Monitor organizational procedures to ensure proper functioning.
- Communicate organizational information to customers or other stakeholders.
- Communicate organizational policies and procedures

Knowledge
People in this career often know a lot about:
- Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
- Chemistry - Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.
- Clerical - Knowledge of administrative and clerical procedures and systems such as word processing, managing files and records, stenography and transcription, designing forms, and other office procedures and terminology.
**English Language** - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

**Customer and Personal Service** - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

**Mathematics** - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
Electrician

Electricians install, maintain, operate or repair all electrical equipment. They are familiar with industrial motors and controls; wire and troubleshoot.

How could you become an Electrician?
• High School Graduate
• GED
• Technical/Vocational School
• Two-year associates degree

Although most electricians learn through an apprenticeship, some start out by attending a technical school. Most states require electricians to be licensed.

It may be helpful to have the degrees, certificates and/or coursework listed below.
• Circuitry
• Basic Electrics
• Electrical engineering
• Physics

Salary Range (National Wage Range)
$30,420-$82,930

Job Outlook
Employment of electricians is projected to grow 20 percent from 2012 to 2022, faster than the average for all occupations.
**Machinist**

Machinists study specifications such as blueprints, sketches, models, or descriptions, and visualize product to determine materials required and machines to be used to fabricate parts. They calculate dimensions and tolerances using knowledge of mathematics and instruments such as micrometers and vernier calipers. Machinists’ measure, mark, and scribe dimensions and reference points on metal stock for machining. They set up and operate machine tools such as lathes, milling machines, and grinders, to machine parts, and verifies conformance of machined parts to specifications.

**How could you become a Machinist?**

- High School Graduate
- GED
- Technical/Vocational School
- Two-year associates degree

Machinists train in apprenticeship programs, vocational schools, community and technical colleges, or informally on the job.

**It may be helpful to have the degrees, certificates and/or coursework listed below.**

- Algebra
- Geometry
- Metalworking
- Drafting
- Physics
- Calculus

**Salary Range (National Wage Range)**

$33,380-$76,690

**Job Outlook**

Employment of machinists and tool and die makers is projected to grow 7 percent from 2012 to 2022. Workers with computer skills who can perform multiple tasks in a machine shop will have the best job opportunities.
Welder

Welders weld various thicknesses of round, square, rectangular tubing and support structures. They use wire welding machines, band saw and iron working tools. Welders lay out sheet metal and read blue prints and schematics.

How could you become a Welder?
• High School Graduate
• GED
• Technical/Vocational School
• Two-year associates degree

Training for welding, cutting, soldering, and brazing workers varies. Training ranges from a few weeks of technical school or on-the-job training to several years of combined technical school and on-the-job training.

It may be helpful to have the degrees, certificates and/or coursework listed below.
• Welding, soldering, or brazing certification
• Mechanical drawing
• Physics
• Chemistry
• Shop mathematics
• Basic computer classes

Salary Range (National Wage Range)
$24,720-$56,130

Job Outlook
Employment of welders, cutters, solderers, and brazers is projected to grow 6 percent from 2012 to 2022.
Mechanic

Mechanics analyze malfunctions and repair, rebuild, and maintain equipment. They operate and inspect machines and equipment to diagnose defects. Mechanics dismantle and reassemble equipment using hoists, as well as hand and power tools. They examine parts for damage or excessive wear, using micrometers and gauges. They replace defective engines and subassemblies, such as transmissions, electric motors, drums, seals, hydraulic pumps, valves, pistons, rods, gears, crankshafts, and cylinder blocks. Machinists test overhauled equipment to ensure operating efficiency and must be able to operate all equipment.

How could you become a Mechanic?
• High School Graduate
• GED
• Technical/Vocational School
• Two-year associates degree

A high school diploma or the equivalent is typically the minimum requirement to work as an automotive service technician or mechanic. Because automotive technology is becoming increasingly sophisticated, some employers prefer automotive service technicians and mechanics who have completed a formal training program in a postsecondary institution. Industry certification usually is required once the person is employed.

It may be helpful to have the degrees, certificates and/or coursework listed below.
• Automotive repair
• Electronics
• Computers
• General English courses
• Basic mathematical courses
• Automotive technology services

Salary Range (National Wage Range)
$20,810-$60,070

Job Outlook
Employment of automotive service technicians and mechanics is projected to grow 9 percent from 2012 to 2022.
Engine and Other Machine Assemblers

Description: what do they do?
Construct, assemble, or rebuild machines, such as engines, turbines, and similar equipment used in such industries as construction, extraction, textiles, and paper manufacturing.

Also known as:
Large Engine Assembler, Mechanical Assembler, Cell Technician, Fitter, Machine Assembler, Assembly Line Worker, Field Service Technician, Assembler, Engine Builder, Engine Assembler

Education and experience: to get started
People starting in this career usually have:
- High school diploma or equivalent
- No work experience
- 1 to 12 months on-the-job training

Programs that can prepare you:
- Engine Machinist

Salary Range (Michigan Wage Range)
$34,340-$71,140

Activities: what you might do in a day
- Plan production or operational procedures or sequences.
- Review blueprints or other instructions to determine operational methods or sequences.
- Inspect installed components or assemblies.
- Align parts or workpieces to ensure proper assembly.
- Set equipment guides, stops, spacers, or other fixtures.

Knowledge
People in this career often know a lot about:
- Mechanical - Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- Production and Processing - Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
Quality Control Analysts

Description: what do they do?
Conduct tests to determine quality of raw materials, bulk intermediate and finished products. May conduct stability sample tests.

Also known as:
Quality Control Analyst (QC Analyst), Quality Control Technician (QC Technician), Analytical Lab Analyst, Laboratory Analyst, Ethanol Quality Leader, Micro Lab Analyst, Lab Tech, Quality Assurance Technician (QA Technician), Analyst Microbiology Lab, Lab Technician

Education and experience: to get started
People starting in this career usually have:
- Associate's degree
- No work experience
- No on-the-job training

Programs that can prepare you:
- Science Technologies/Technicians, General
- Chemical Process Technology
- Physical Science Technologies/Technicians, Other
- Science Technologies/Technicians, Other

Salary Range (Michigan Wage Range)
$22,920-$63,350

Activities: what you might do in a day
- Test quality of materials or finished products.
- Interpret research or operational data.
- Evaluate quality of materials or products.
- Record research or operational data.
- Calibrate scientific or technical equipment.
- Maintain laboratory or technical equipment.

Knowledge
People in this career often know a lot about:
- Chemistry - Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.
- Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
Sewing Machine Operators

Description: what do they do?
Operate or tend sewing machines to join, reinforce, decorate, or perform related sewing operations in the manufacture of garment or nongarment products.

Also known as:

Typical education
How much education do most people in this career have?

Salary Range (Michigan Wage Range)
$20,310-$39,060

Activities: what you might do in a day
● Watch operating equipment to detect malfunctions.
● Cut fabrics.
● Feed materials or products into or through equipment.
● Load materials into production equipment.
● Mount materials or workpieces onto production equipment.

Abilities
People in this career often have talent in:
● Arm-Hand Steadiness - Keeping your arm or hand steady.
● Manual Dexterity - Holding or moving items with your hands.
● Control Precision - Quickly changing the controls of a machine, car, truck or boat.
● Near Vision - Seeing details up close.
Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic

Description: what do they do?
Set up, operate, or tend metal or plastic molding, casting, or coremaking machines to mold or cast metal or thermoplastic parts or products.

Also known as:

Typical education
How much education do most people in this career have?

Salary Range (Michigan Wage Range)
$21,970-$47,970

Activities: what you might do in a day
- Inspect metal, plastic, or composite products.
- Measure dimensions of completed products or workpieces to verify conformance to specifications.
- Monitor equipment operation to ensure that products are not flawed.
- Operate metal or plastic forming equipment.
- Adjust temperature controls of ovens or other heating equipment.

Knowledge
People in this career often know a lot about:
- Production and Processing - Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- Mechanical - Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
Structural Metal Fabricators and Fitters

**Description: what do they do?**

Fabricate, position, align, and fit parts of structural metal products.

**Also known as:**
Fitter, Tack Welder, Layout Man, Welder-Fabricator, Structural Steel Fitter, Fitter, Welder, Weld Technician, Ship Fitter, Fabricator, Mill Beam Fitter

**Education and experience: to get started**

People starting in this career usually have:
- High school diploma or equivalent
- No work experience
- 1 to 12 months on-the-job training

Programs that can prepare you:
- Machine Shop Technology/Assistant
- Metal Fabricator

**Salary Range** (Michigan Wage Range)
$27,030-$60,270

**Activities: what you might do in a day**

- Measure dimensions of completed products or workpieces to verify conformance to specifications.
- Align parts or workpieces to ensure proper assembly.
- Lift materials or workpieces using cranes or other lifting equipment.
- Operate welding equipment.
- Read work orders or other instructions to determine product specifications or materials requirements.
- Review blueprints or other instructions to determine operational methods or sequences.

**Knowledge**

People in this career often know a lot about:
- **Mechanical** - Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- **Mathematics** - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- **Building and Construction** - Knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.
- **Design** - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
Automation/Robotics Technicians

Description: what do they do?
Build, install, test, or maintain robotic equipment or related automated production systems.

Also known as:

Education and experience: to get started
People starting in this career usually have:

- Associate's degree
- No work experience
- No on-the-job training

Programs that can prepare you:
- Electromechanical Technology/Electromechanical Engineering Technology
- Electromechanical and Instrumentation and Maintenance Technologies/Technicians, Other
- Instrumentation Technology/Technician
- Automation Engineer Technology/Technician
- Robotics Technology/Technician

Salary Range (Michigan Wage Range)
$35,360 - $77,030

Activities: what you might do in a day
- Maintain electromechanical equipment.
- Repair electronic equipment.
- Assemble equipment or components.
- Determine causes of operational problems or failures.
- Maintain operational records or records systems.
- Program robotic equipment.

Knowledge
People in this career often know a lot about:

- Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- Mechanical - Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- Design - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
Model Makers, Metal and Plastic

Description: what do they do?
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.

Also known as:
Computer Numerical Control Machinist (CNC Machinist), Computer Numerical Control Operator (CNC Operator), Model Builder, Prototype Special Build, Fabricator, Model Maker, Metal Model Maker, Pattern Finisher, Molding Technician

Education and experience: to get started
People starting in this career usually have:
High school diploma or equivalent
No work experience
1 to 12 months on-the-job training

Programs that can prepare you:
Sheet Metal Technology/Sheetworking

Salary Range (Michigan Wage Range)
$35,860 - $81,420

Activities: what you might do in a day
Read work orders or other instructions to determine product specifications or materials requirements.
Review blueprints or other instructions to determine operational methods or sequences.
Inspect metal, plastic, or composite products.
Drill holes in parts, equipment, or materials.
Cut industrial materials in preparation for fabrication or processing.
Shape metal workpieces with hammers or other small hand tools.

Knowledge
People in this career often know a lot about:
Design - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.