

---

## Production Occupations

Bakers and Food Batchmakers  
Chemical Technicians  
Chemists  
Computer-Controlled Machine Tool Operators  
Cutting, Punching, and Press Machine Setters, Operators, and Tenders  
Drilling and Boring Machine Tool Setters, Operators, and Tenders  
Electrical and Electronics Repairers  
Extruding and Drawing Machine Setters, Operators, and Tenders  
First-Line Supervisors/Managers of Production and Operating Workers  
Forging Machine Setters, Operators, and Tenders  
Grinding and Polishing Workers  
Grinding, Lapping, Polishing, and Buffing Machine Tool Setters,  
Operators, and Tenders  
Heat Treating Equipment Setters, Operators, and Tenders  
Industrial Machinery Mechanics  
Lathe and Turning Machine Tool Setters, Operators, and Tenders  
Lay-Out Workers  
Machinists  
Meat, Poultry, and Fish Processing Workers  
Milling and Planing Machine Setters, Operators, and Tenders  
Millwrights  
Mixing and Blending Machine Setters, Operators, and Tenders  
Molding, Coremaking, and Casting Machine Operators  
Multiple Machine Tool Setters, Operators, and Tenders  
Numerical Tool and Process Control Programmers  
Painting and Coating Workers (except Construction and Maintenance)  
Painting, Coating, and Decorating Workers  
Printing Machine Operators  
Rolling Machine Setters, Operators, and Tenders  
Semiconductor Processors  
Sheet Metal Workers  
Structural Metal Fabricators and Fitters  
Tool and Die Makers  
Tool Grinders, Filers, and Sharpeners  
Welders, Cutters, Solderers, and Brazers



### Table of Contents *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |



[View Career Video](#)

### What They Do

Bakers mix and bake ingredients according to recipes to produce breads, pastries, and other baked goods. Retail Bakers are employed in grocery stores and specialty shops and produce small quantities of breads, pastries, and other baked goods for consumption on premises or for sale as specialty baked goods. In manufacturing, bakers produce goods in large quantities, using high-volume mixing machines, ovens, and other equipment. Goods produced in large quantities usually are available for sale through distributors, grocery stores, or manufacturer's outlets.

The most modern commercial bakeries have adopted a system of 'continuous mixing,' which allows for the continuous production of pre-baked products with virtually no human involvement in the baking process. This has resulted in a single machine performing all the steps of dough preparation in a continuous operation.

Food Batchmakers set up and operate equipment that mixes or blends ingredients used in the manufacturing of a wide variety of food products. Some work in candy factories or in cheese and ice cream plants. Many are employed in commercial bakeries making bread, cookie, doughnut, and tortilla doughs, as well as cake batters. Others operate machines that mix and blend spices or seasonings, peanut butter, mayonnaise, or mustards. In addition to food products, these workers are also found in the tobacco and beverage industry.

### Tasks

#### *Bread and Pastry Bakers*

- ▶ Weigh and measure ingredients, using measuring cups and spoons.
- ▶ Mix ingredients to form dough or batter by hand or using electric mixer.
- ▶ Roll and shape dough, using rolling pin, and cut dough in uniform portions with knife, divider, or cookie cutter.
- ▶ Mold dough in desired shapes, place dough in greased or floured pans, and trim overlapping edges with knife.
- ▶ Mix and cook pie fillings, pour fillings into pie shells, and top filling with meringue or cream.
- ▶ Check production schedule to determine variety and quantity of goods to bake.
- ▶ Spread or sprinkle toppings on loaves or specialties and place dough in oven, using long-handled paddle (peel).

## Bakers and Food Batchmakers

- ▶ Cover filling with top crust; place pies in oven; and adjust drafts or thermostatic controls to regulate oven temperatures.
- ▶ Mix ingredients to make icings, decorate cakes and pastries, and blend colors for icings, shaped ornaments, and statuaries.
- ▶ Cut, peel, and prepare fruit for pie fillings.

### *Manufacturing Bakers*

- ▶ Measure flour and other ingredients to prepare batters, dough, fillings, and icings, using scale and graduated containers.
- ▶ Place dough in pans, molds, or on sheets, and bake dough in oven or on grill.
- ▶ Dump ingredients into mixing-machine bowl or steam kettle to mix or cook ingredients according to specific instructions.
- ▶ Decorate cakes.
- ▶ Apply glaze, icing, or other topping to baked goods, using spatula or brush.
- ▶ Roll, cut, and shape dough to form sweet rolls, pie crusts, tarts, cookies, and related products prior to baking.
- ▶ Observe color of products being baked and adjust oven temperature.
- ▶ Develop new recipes for cakes and icings.

### *Food Batchmakers*

- ▶ Set up, operate, and tend equipment that cooks, mixes, blends, or processes ingredients in the manufacturing of food products, according to formulas or recipes.
- ▶ Record production and test data for each food product batch, such as the ingredients used, temperature, test results, and time cycle.
- ▶ Observe gauges and thermometers to determine if the mixing chamber temperature is within specified limits, and turn valves to control the temperature.
- ▶ Clean and sterilize vats and factory processing areas.
- ▶ Observe and listen to equipment in order to detect possible malfunctions, such as leaks or plugging, and report malfunctions or undesirable tastes to supervisors.
- ▶ Mix or blend ingredients, according to recipes, using a paddle or an agitator, or by controlling vats that heat and mix ingredients.
- ▶ Follow recipes to produce food products of specified flavor, texture, clarity, bouquet, and/or color.
- ▶ Select and measure or weigh ingredients, using English or metric measures and balance scales.
- ▶ Turn valve controls to start equipment and to adjust operation in order to maintain product quality.

Detailed descriptions of these occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

## Bakers and Food Batchmakers

### Important Skills, Knowledge, and Abilities

- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ Active Listening — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- ▶ Operations Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Production and processing — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Visual Color Discrimination — The ability to match or detect differences between colors, including shades of color and brightness.

### Work Environment

Bakeries are kept spotlessly clean, and personal cleanliness is very important. Work areas can be uncomfortably hot and noisy. Employers who require uniforms or aprons also furnish and launder them. Oven mitts are also supplied to employees when necessary. Bakery production jobs are usually performed at a fast, steady pace while standing. Many plant jobs involve strenuous physical work, including heavy lifting, despite the use of machinery. Work hours typically begin early in the day, sometimes around 4 a.m.. Large firms have around-the-clock production. Most Bakers and Food Batchmakers work a standard 40-hour week.

Many large bakeries and some small shops have contracts with the Bakery, Confectionery, and Tobacco Workers' International Union of America, AFL-CIO.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupations across all industries.

| Standard Occupational Classification | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Bakers</b>                        |                                  |                                  |                         |                            |
| 51-3011                              | 21,000                           | 24,600                           | 850                     | \$8.72 to \$14.71          |
| <b>Food Batchmakers</b>              |                                  |                                  |                         |                            |
| 51-3092                              | 11,200                           | 12,300                           | 390                     | \$8.36 to \$14.18          |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

## Bakers and Food Batchmakers

### Trends

The number of Bakers is expected to grow at an average rate compared with all occupations in California through 2014; in addition, an estimated 4,900 replacement workers needed assures a continued need for these workers. The need for Food Batchmakers will be slower than average for all occupations. There will be an estimated 2,800 workers needed during 2004-2014 to replace those leaving for other types of work or retirement.

Baking is one of the nation's most stable industries with employment little affected by seasonal variations. New and improved labor-saving technologies and mechanization in processing food products may curb some job growth, but to what extent is not known.

### Training/Requirements/Apprenticeships

Bakers often start as apprentices or trainees. Apprentice Bakers usually start in smaller craft bakeries, while in-store bakeries, such as those in supermarkets, often use the title, "Trainee." Apprenticeship programs currently last three years. Certificate or other formal training programs are typically less than one year.

Applicants should be at least 18 years old and have the ability to read and write. They must pass a basic arithmetic test since math skills are needed to modify baking formulas. Good health is essential. A physical examination is required, as well as a health certificate indicating freedom from communicable diseases.

Postsecondary schools and community colleges in California offer certificate programs in Baking and Pastry Arts. Correspondent courses, such as those offered by the American Institute of Baking or the Retail Bakers Association, are gaining in popularity.

Food Batchmakers typically train on the job in most food processing plants. Those who work with dairy products may attend specialized training. Workers are required to be in good health and free from communicable diseases.

#### Recommended High School Course Work

High school students interested in this kind of work should take home economics, if offered, general science or chemistry, and mathematics.

### Where Do I Find the Job?

Jobseekers should apply directly to employers who hire Bakers and Food Batchmakers. Community colleges offer assistance in finding jobs to those taking classes or completing a certificate program.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ All Other Miscellaneous Food
- ▶ Commercial Bakeries
- ▶ Convenience Stores
- ▶ Cookie and Cracker
- ▶ General Line Grocery Merchant Whsle
- ▶ Other Grocery Product Merchant Whsle
- ▶ Limited-Service Restaurants
- ▶ Retail Bakeries

## Bakers and Food Batchmakers

- ▶ Dry Pasta
- ▶ Fruit & Vegetable Merchant Wholesalers
- ▶ Full-Service Restaurants
- ▶ Snack and Nonalcoholic Beverage Bars
- ▶ Supermarkets and Other Grocery Stores

Search these **yellow page** headings for listings of private firms:

- ▶ Bakers, Retail
- ▶ Bakers, Wholesale
- ▶ Candy, Wholesale & Mfg.
- ▶ Cheese, Wholesale & Mfg.
- ▶ Grocers, Retail
- ▶ Grocers, Wholesale
- ▶ Hotels
- ▶ Ice Cream and Frozen Desserts
- ▶ Milk and Milk Products
- ▶ Restaurants
- ▶ Tortillas

### Where Can the Job Lead?

Bakers who begin as new graduates of training programs, as apprentices, or trainees eventually learn the more complicated and artistic aspects of the craft, and, with time and expertise, earn higher wages. Some Bakers who show leadership qualities become supervisors or move to hotels or restaurants as Bread and Pastry Chefs, while a few leave to start their own bakery business.

Food Batchmakers with journey-level experience and interest can advance to shift supervisor.

### Other Sources of Information

California Apprenticeship Coordinators Association, Culinary Program  
[www.calapprenticeship.org](http://www.calapprenticeship.org)

Retail Bakers of America  
[www.rbanet.com](http://www.rbanet.com)

AIB International  
[www.aibonline.org](http://www.aibonline.org)



**Table of Contents** *(scroll or use links below to navigate document)*

|   |                                 |
|---|---------------------------------|
| <b>What They Do</b>                       | <b>Trends</b>                   |
| <b>Tasks</b>                              | <b>Training</b>                 |
| <b>Skills, Knowledge, and Abilities</b>   | <b>Where Do I Find the Job?</b> |
| <b>Work Environment</b>                   | <b>Where Can the Job Lead?</b>  |
| <b>California's Job Outlook and Wages</b> | <b>Other Sources</b>            |

**What They Do**

Chemical Technicians work with Chemists, Chemical Engineers, and Scientists, developing and using chemicals and related products and equipment. There are two types of Chemical Technicians: Research and Development Technicians, who work in experimental laboratories, and Process Control Technicians, who work in manufacturing or other industrial plants. Many Research and Development Technicians conduct a variety of laboratory procedures, from routine process control to complex research projects. For example, they may collect and analyze samples of air and water to monitor pollution levels or produce compounds through complex organic synthesis. Most Process Control Technicians work in manufacturing, where they test packaging for design, integrity of material, and environmental acceptability. Often, Process Control Technicians who work in plants focus on quality assurance, where they monitor product quality or production processes and develop new production techniques.

**Tasks**

- ▶ Monitor product quality to ensure compliance to standards and specifications.
- ▶ Set up and conduct chemical experiments, tests, and analyses using techniques such as chromatography, spectroscopy, physical and chemical separation techniques, and microscopy.
- ▶ Conduct chemical and physical laboratory tests to assist scientists in making qualitative and quantitative analyses of solids, liquids, and gaseous materials.
- ▶ Compile and interpret results of tests and analyses.
- ▶ Provide technical support and assistance to chemists and engineers.
- ▶ Prepare chemical solutions for products and processes following standardized formulas, or create experimental formulas.
- ▶ Maintain, clean, and sterilize laboratory instruments and equipment.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

**Important Skills, Knowledge, and Abilities**

- ▶ Science — Using scientific rules and methods to solve problems.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.

## Chemical Technicians

- ▶ 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.
- ▶ English Language — Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- ▶ Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Deductive Reasoning — The ability to apply general rules to specific problems to produce answers that make sense.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.

### Work Environment

Chemical Technicians may work outdoors collecting samples. However, most work indoors in well-lit, well-equipped laboratories. They are exposed to health and safety hazards from equipment, chemicals, or toxic materials. However, risks are minimal when protective gear is worn and proper safety procedures are followed.

Most Chemical Technicians work regular hours. Some occasionally work irregular hours to monitor experiments that cannot be completed during regular working hours.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Chemical Technicians</b>          |                                  |                                  |                         |                            |
| 19-4031                              | 4,700                            | 5,400                            | 190                     | \$14.31 to \$22.84         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Employment of Chemical Technicians is expected to grow at about an average rate compared to all occupations over the 2004–2014 period. However, the continued growth of scientific and medical research, particularly research related to biotechnology, as well as the development and production of technical products, should stimulate demand for Chemical Technicians in many industries.

## Training/Requirements/Apprenticeships

Chemical Technicians usually follow one of the following training paths:

- ▶ Associate degree
- ▶ Vocational school
- ▶ Community College programs or certificates
- ▶ Extensive on-the-job training

Most employers prefer to hire Chemical Technicians with an associate degree in a science discipline. Numerous community colleges offer two-year programs for Chemical Technicians.

### Recommended High School Course Work

High school preparation courses in chemistry, biology, physics, algebra, geometry, trigonometry, statistics, and computer technology are helpful.

## Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Architectural Services
- ▶ Biological Product
- ▶ Building Inspection Services
- ▶ Drafting Services
- ▶ Engineering Services
- ▶ In-Vitro Diagnostic Substance
- ▶ Landscape Architectural Services
- ▶ Other Surveying and Mapping Services
- ▶ Pharmaceutical Preparation
- ▶ Physical/Engineering/Biological Research
- ▶ Social Science and Humanities Research
- ▶ Testing Laboratories

Search these **yellow page** headings for listings of private firms:

- ▶ Biotechnology, Products and Services
- ▶ Chemicals Wholesale & Manufacturers
- ▶ Laboratories, Analytical
- ▶ Laboratories, Biological
- ▶ Laboratories, Research
- ▶ Laboratories, Testing

## Where Can the Job Lead?

Chemical Technicians usually begin work as trainees in routine positions, under the direct supervision of a scientist or a more experienced technician. As they gain experience, technicians take on more responsibility and carry out assignments under only general supervision. Chemical Technicians may advance to become supervisors. Advancement opportunities are best for those who obtain a bachelor's degree and additional work experience.

## Chemical Technicians

### Other Sources of Information

American Chemical Society

[www.acs.org](http://www.acs.org)

American Chemical Society, Division of Chemical Technicians

<http://membership.acs.org/t/tech>

National Association of Manufacturers

[www.nam.org](http://www.nam.org)

Society for Industrial Microbiology

[www.simhq.org](http://www.simhq.org)

**Table of Contents** *(scroll or use links below to navigate document)*[What They Do](#)[Tasks](#)[Skills, Knowledge, and Abilities](#)[Work Environment](#)[California's Job Outlook and Wages](#)[Trends](#)[Training](#)[Where Do I Find the Job?](#)[Where Can the Job Lead?](#)[Other Sources](#)[View Career Video](#)**What They Do**

Most Chemists are involved in either research and development or production. In research and development, Chemists study the composition, structure, and properties of substances and the interactions between them. They search for new information about materials and look for ways to put this knowledge to practical use. They apply scientific principles and techniques using specialized instruments to measure, identify, and evaluate changes in matter. Chemists working in applied research use their knowledge to improve and create new products.

Chemists also work in production and quality control in manufacturing plants. They prepare instructions for plant workers that specify ingredients, mixing times, and temperatures for each stage in the manufacturing process. They also monitor automated processes to ensure proper product yield, and test samples of raw materials or finished products to make certain that they meet industry or government standards.

Chemists often specialize in one of the following areas:

- ▶ Organic Chemists work with carbon and its compounds, mostly derived from animals and plants. These Chemists develop commercial products such as pharmaceuticals, plastics, and fertilizers.
- ▶ Inorganic Chemists work with compounds of non-carbon structure, including most of the metals and minerals. In the electronics industry, they work on ways to build solid state electronic components.
- ▶ Physical Chemists study the relationships between the chemical and physical properties of substances. These chemists are helping to develop new energy sources.
- ▶ Analytical Chemists examine the content of substances and measure the amount of each component present. These chemists also identify the presence of chemical pollutants in air, water, and soil.
- ▶ Cereal Chemists are specialists in the use of cereal grains in foods. They examine raw materials and products using cereals such as corn, wheat, oats, rice, and rye.

## Chemists

### Tasks

- ▶ Analyze organic and inorganic compounds to determine chemical and physical properties, composition, structure, relationships, and reactions, utilizing chromatography, spectroscopy, and spectrophotometry techniques.
- ▶ Develop, improve, and customize products, equipment, formulas, processes, and analytical methods.
- ▶ Compile and analyze test information to determine process or equipment operating efficiency and to diagnose malfunctions.
- ▶ Confer with scientists and engineers to conduct analyses of research projects, interpret test results, or develop nonstandard tests.
- ▶ Direct, coordinate, and advise personnel in test procedures for analyzing components and physical properties of materials.
- ▶ Induce changes in composition of substances by introducing heat, light, energy, and chemical catalysts for quantitative analysis.
- ▶ Write technical papers and reports; prepare standards and specifications for processes, facilities, products, and tests.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Science — Using scientific rules and methods to solve problems.
- ▶ Complex Problem Solving — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ 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.
- ▶ Deductive Reasoning — The ability to apply general rules to specific problems to produce answers that make sense.
- ▶ Inductive Reasoning — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
- ▶ Oral Comprehension — The ability to listen to and understand information and ideas presented through spoken words and sentences.
- ▶ Oral Expression — The ability to communicate information and ideas in speaking so others will understand.

## Work Environment

Chemists usually work regular hours in well-lit, well-equipped laboratories, offices, or classrooms. They may work additional or irregular hours when working on special research projects. Chemists may perform some of their research in a chemical plant or outdoors, while gathering water samples to test for pollutants, for example. Chemists are exposed to health or safety hazards when handling certain chemicals such as highly caustic or potentially explosive chemicals. However, risks are minimal when protective gear is worn and proper safety procedures are followed.

## California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| Chemists<br>19-2031                  | 9,300                            | 10,600                           | 430                     | \$22.24 to \$40.25         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

## Trends

Employment of Chemists is expected to grow at about an average rate for all occupations over the 2004–2014 period. Within the chemical industry, job opportunities are expected to be most plentiful in pharmaceutical and biotechnology firms. Stronger competition among drug companies and an aging population are contributing to the need for innovative and improved drugs discovered through scientific research.

## Training/Requirements/Apprenticeships

Chemists usually follow one of the following training paths:

- ▶ Bachelor's degree, in chemistry
- ▶ Master's degree
- ▶ Doctorate degree
- ▶ Extensive on-the-job training, in addition to a college degree

A bachelor's degree in chemistry or a related science discipline usually is the minimum educational requirement for entry-level chemist jobs. However, many research jobs require a master's degree or, more frequently, a Ph.D.

In government or industry, beginning Chemists work in quality control, perform analytical testing, or assist senior Chemists in research and development laboratories. Many employers prefer Chemists with a Ph.D., or at least a master's degree, to lead basic and applied research. Relevant work experience is also a helpful asset.

## Chemists

### Recommended High School Course Work

High school preparation courses in chemistry, biology, physics, environmental studies, algebra, geometry, trigonometry, statistics, and computer technology are helpful.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ Architectural Services
- ▶ Building Inspection Services
- ▶ Drafting Services
- ▶ Engineering Services
- ▶ In-Vitro Diagnostic Substance
- ▶ Landscape Architectural Services
- ▶ Other Biological Product
- ▶ Other Surveying and Mapping Services
- ▶ Pharmaceutical Preparation
- ▶ Physical/Engineering/Biological Research
- ▶ Social Science/Humanities Research
- ▶ Testing Laboratories

Search these **yellow page** headings for listings of private firms:

- ▶ Biotechnology, Products and Services
- ▶ Chemicals, Wholesale & Manufacturers
- ▶ Laboratories, Analytical
- ▶ Laboratories, Biological
- ▶ Laboratories, Research
- ▶ Laboratories, Testing

### Where Can the Job Lead?

In private industry, Chemists with a bachelor's degree have the opportunity, with experience and additional training, to advance to a more responsible position. People with advanced degrees have greater opportunities for advancement. Chemists with a master's degree usually qualify for applied research positions and teaching positions in two-year colleges. A doctorate offers the best opportunities for higher levels of research and four-year college teaching positions.

### Other Sources of Information

AACC International  
[www.aaccnet.org](http://www.aaccnet.org)

American Chemical Society  
[www.acs.org](http://www.acs.org)

National Association of Manufacturers  
[www.nam.org](http://www.nam.org)

Pharmaceutical Research and Manufacturers of America  
[www.phrma.org](http://www.phrma.org)

Society of Industrial Microbiology  
[www.simhq.org](http://www.simhq.org)

## Computer-Controlled Machine Tool Operators

**Table of Contents** *(scroll or use links below to navigate document)*

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find the Job?](#)

[Where Can the Job Lead?](#)

[Other Sources](#)



[View Career Video](#)

### What They Do

A computer-controlled module now carries out many machinist functions formerly performed by human operators. Computer-Controlled Machine Tool Operators, also known as Computer Numerically-Controlled (CNC) Operators, run computer-controlled machines or robots to perform one or more machine functions on metal or plastic work pieces. After the CNC Programmer completes the programming work, CNC Operators perform the necessary machining operations. They transfer the commands from the server to the CNC control module using a computer network link or floppy disk. Many advanced control modules are “conversational,” meaning they ask the operator a series of questions about the nature of the task.

CNC machines cut away material from a solid block of metal, plastic, or glass known as a work piece to form a finished part. Computer Controlled Operators normally produce large quantities of one part, although they may produce small batches or one-of-a-kind items. They use their knowledge of the working properties of metals, and their skill with CNC machines, to carry out the operations needed to make machined products that meet precise specifications.

Alternate titles for these workers include: Senior Machinist and CNC Operator.

### Tasks

- ▶ Determine specifications or procedures for tooling set-up, machine operation, workpiece dimensions, or numerical control sequences, using blueprints, instructions, and machine knowledge.
- ▶ Calculate and set machine controls to position tools, synchronize tape and tool, or regulate cutting depth, speed, feed, or coolant flow.
- ▶ Load control media, such as tape, card, or disk, in machine controller or enter commands to retrieve programmed instructions.
- ▶ Lay out and mark areas of part to be shot-peened, and fills hopper with shot.
- ▶ Select, measure, assemble, and set machine tools, such as drill bits and milling or cutting tools, using precision gauges and instruments.
- ▶ Lift workpiece to machine manually, with hoist or crane, or with tweezers.
- ▶ Mount, install, align, and secure tools, attachments, fixtures, and workpiece on machine, using hand tools and precision measuring instruments.

## Computer-Controlled Machine Tool Operators

- ▶ Start automatic operation of numerical control machine to machine parts or test setup, workpiece dimensions, or programming.
- ▶ Confer with supervisor or programmer to resolve machine malfunctions and production errors and obtains approval to continue production.
- ▶ Maintain machines and remove and replace broken or worn machine tools, using hand tools.
- ▶ Operate lathe, drill-press, jig-boring machine, or other machines manually or semiautomatically.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ 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.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Equipment Maintenance — Performing routine maintenance on equipment and determining when and what kind of maintenance is needed.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Number Facility — The ability to add, subtract, multiply, or divide quickly and correctly.
- ▶ Reaction Time — The ability to quickly respond (with the hand, finger, or foot) to a signal (sound, light, picture) when it appears.
- ▶ Wrist-Finger Speed — The ability to make fast, simple, repeated movements of the fingers, hands, and wrists.

### Work Environment

Computer-Controlled Machine Tool Operators wear protective equipment, such as safety goggles to shield against bits of flying metal, and earplugs to dampen machinery noise. They also must exercise caution when handling hazardous coolants and lubricants. The job requires stamina because Operators stand most of the day, and at times, may need to lift moderately heavy workpieces.

Most work a 40-hour week; however, Operators increasingly work evening and weekend shifts as companies justify investments in more expensive machinery by extending hours of operation. Overtime is common during peak production periods.

## Computer-Controlled Machine Tool Operators

### California's Job Outlook and Wages

The California outlook and wage below represent the occupation across all industries.

| Standard Occupational Classification                                  | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Computer-Controlled Machine Tool Operators (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4011   | 10,700                           | 11,200                           | 230                     | \$11.31 to \$19.56         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

While employment of Computer-Controlled Machine Tool Operators is projected to grow more slowly than the average for all occupations through 2014, the number of replacement workers needed as workers retire or leave for other kinds of work will be significant. In the ten-year period, 1,800 replacement workers will be needed, in addition to the 500 new jobs expected.

The demand for Computer-Controlled Machine Tool Operators is influenced by economic cycles—as the demand for machined goods falls, Operators involved in production may be laid off or forced to work fewer hours.

### Training/Requirements/Apprenticeships

Computer-Controlled Machine Tool Operators usually follow one of the following training paths:

- ▶ Formal apprenticeship programs
- ▶ Vocational and post-secondary school programs
- ▶ Community college certificate programs
- ▶ Extensive on-the-job training

Many entrants to this occupation have previously worked as machinists or machine setters, operators, and tenders and have a basic knowledge of computers and electronics. Training program titles in California include Machine Shop Technology or Manufacturing Technology, and generally last between one and two years. For information about apprenticeship programs, go to: [www.dir.ca.gov/das](http://www.dir.ca.gov/das).

### Recommended High School Course Work

Mathematics courses such as trigonometry and algebra, blueprint reading, computer programming, metalworking, and drafting are recommended for high school students.

## Computer-Controlled Machine Tool Operators

### Where Do I Find the Job?

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Aircraft Engine and Engine Parts
- ▶ Aircraft Manufacturing
- ▶ All Other Motor Vehicle Parts Manufacturing
- ▶ All Other Plastics Product Manufacturing
- ▶ Bolts, Nuts, Screws, Rivets, and Washers
- ▶ Machine Shops
- ▶ Motor Vehicle Power Train Components
- ▶ Motor Vehicle Seating and Interior Trim
- ▶ Other Motor Vehicle Electrical Equipment
- ▶ Precision Turned Product Manufacturing
- ▶ Urethane and Other Foam Product Mfg.

Search these **yellow page** headings for listings of private firms:

- ▶ Machine Shops
- ▶ Machine Tools
- ▶ Metal Fabricators
- ▶ Sheet Metal Work

### Where Can the Job Lead?

Experienced Computer-Controlled Machine Tool Operators can become Numerical Tool and Process Control Programmers, and some are promoted to supervisory or administrative positions in their firms. A few open their own shops.

### Other Sources of Information

Precision Machined Products Association  
[www.pmpa.org](http://www.pmpa.org)

National Tooling & Machining Association  
[www.ntma.org](http://www.ntma.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

## Cutting, Punching, and Press Machine Setters, Operators, and Tenders

**Table of Contents** (*scroll or use links below to navigate document*)

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find the Job?](#)

[Where Can the Job Lead?](#)

[Other Sources](#)

### What They Do

*Sawing Machine Tool Setters and Set-Up Operators (Metal and Plastic)* set up and operate metal or plastic sawing machines to cut straight, curved, irregular, or internal patterns in metal or plastic stock or to trim edges of metal or plastic objects. This involves the use of such machines as band saws, circular saws, friction saws, hacksawing machines, and jigsaws.

*Punching Machine Setters and Set-Up Operators (Metal and Plastic)* set up and operate machines to punch, crimp, cut blanks, or notch metal or plastic workpieces between preset dies, according to specifications.

*Press and Press Brake Machine Setters and Set-Up Operators (Metal and Plastic)* set up and operate power-press machines or power-brake machines to bend, form, stretch, notch, punch, or straighten metal or plastic plate and structural shapes, as specified by work order, blueprints, drawing, templates, or layout.

*Shear and Slitter Machine Setters and Set-Up Operators (Metal and Plastic)* set up and operate power-shear or slitting machines to cut metal or plastic material, such as plates, sheets, slabs, billets, or bars, to specified dimensions and angles.

### Tasks

- ▶ Read work order for specifications, such as materials to be used, location of holes or cutting lines, and dimensions and tolerances; or production schedule to determine setup or adjustment of equipment.
- ▶ Mark identifying data on workpiece.
- ▶ Activate machine, adjust blade and controls to set cutting speed, feed rate, and table angle, using wrenches, rule, gauge, or template, and observe operation to detect misalignment or malfunction.
- ▶ Inspect workpiece for defects and measure for conformance to specifications using micrometer, tape, gauge, caliper, template, scale, compass, or ruler.
- ▶ Clean and lubricate machine.

#### *Sawing Machine Tool Setters and Operators*

- ▶ Place workpiece on cutting table, manually or using hoist, and clamp workpiece into position.
- ▶ Feed workpiece against blade, guiding along layout lines, to cut workpiece to specified dimensions.

## Cutting, Punching, and Press Machine Setters, Operators, and Tenders

- ▶ Turn valves to start flow of coolant against cutting area and to start airflow which blows cuttings away from kerf.
- ▶ Position guides, stops, holding blocks, or other fixtures to secure and direct workpiece, using hand tools and measuring devices.
- ▶ Remove housings, feed tubes, tool holders, and other accessories to replace worn or broken parts, such as springs and bushings.
- ▶ Sharpen dulled blades, using bench grinder, abrasive wheel, or lathe.

### *Punching Machine Setters and Operators*

- ▶ Position, align, and secure workpiece against fixtures or stops on machine bed or on die.
- ▶ Set stops or guides or install jigs or fixtures for positioning successive workpieces.
- ▶ Install, align, and lock specified punches, dies, and cutting blades in ram or bed of machine, using gauges and hand tools.
- ▶ Adjust ram stroke of press to specified length, using hand tools.
- ▶ Install gears to synchronize action of feed bar or rollers.

### *Press and Press Brake Machine Setters and Operators*

- ▶ Plan sequence of operations, applying knowledge of physical properties of metal.
- ▶ Select and position flat, block, radius, or special purpose die sets into ram and bed of machine, using hoist, crane, measuring instruments and hand tools.
- ▶ Install, align, and secure gears, holding fixtures and dies to machine bed, using gauges, templates, feelers, shims, and hand tools.
- ▶ Set stops on machine bed, change dies, and adjust components, such as ram or power press, when making multiple or successive passes.
- ▶ Operate power press, power brake, apron brake, swagging machine, foot-powered press, hydraulic press, or arbor press according to specifications.
- ▶ Preheat workpiece, using heating furnace or hand torch.
- ▶ Hand form, cut, or finish workpiece, using tools, such as table saw, hand sledge and anvil, flaring tool, and gauge.
- ▶ Grind out burrs and sharp edges, using portable grinder, speed lathe, and polishing jack.

### *Shear and Slitter Machine Setters and Operators*

- ▶ Lift workpiece manually or by hoist, and position and secure against guides and stops.
- ▶ Install and align knives, disk cutters or fixtures to shear, bevel, or trim fabricated items.
- ▶ Select, clean, and install spacers, rubber sleeves, and cutter on arbors.

Detailed descriptions of these occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

## Important Skills, Knowledge, and Abilities

- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.

## Cutting, Punching, and Press Machine Setters, Operators, and Tenders

- ▶ Mathematics — Using mathematics to solve problems.
- ▶ Installation — Installing equipment, machines, wiring, or programs to meet specifications.
- ▶ Science — Using scientific rules and methods to solve problems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ 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.
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Arm-Hand Steadiness — The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Visualization — The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.

### Work Environment

Most Cutting, Punching, and Press Machine Setters, Operators, and Tenders (Metal and Plastic) work in clean spaces that are well lit and ventilated. Many workers are on their feet much of the day and may do moderately heavy lifting. Following strict safety precautions, like wearing safety glasses, earplugs, and other protective equipment is critical when operating powerful, high-speed machines. The enclosure of many modern machines minimizes the exposure of workers to noise, dust, and lubricants used during machining. Most work a 40-hour week, but overtime is common during high production times. Many metalworking and plastics shops have more than one shift, so night and weekend shifts may also be worked.

Many Cutting, Punching, and Press Machine Setters, Operators, and Tenders (Metal and Plastic) belong to a union such as the International Association of Machinists and Aerospace Workers; International Union of Electronic, Electrical, Salaried Machine, and Furniture Workers; the International Brotherhood of Electrical Workers; and the United Steelworkers of America.

## Cutting, Punching, and Press Machine Setters, Operators, and Tenders

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification  | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Cutting, Punching, and Press Machine Setters, Operators, and Tenders (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4031   | 20,600                           | 18,300                           | 480                     | \$9.55 to \$15.40          |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Overall employment growth in the various Cutting, Punching, and Press Machine Setters, Operators, and Tenders occupations will decline slightly between 2004-2014. However employment trends among these occupations will vary over the next several years. Employment of workers will be affected by the rate of technological implementation, the demand for the goods they produce, the effects of trade, and the reorganization of production processes. Despite these factors, a large number of these jobs will become available due to an increase in baby boomer retirements. Temporary employees are being hired in greater numbers and usually get paid less than company-employed workers.

### Training/Requirements/Apprenticeships

A few weeks of on-the-job training is sufficient for most workers to learn basic machine operations, but several years are required to become a highly skilled operator or setter. Community colleges and other educational institutions offer courses and certifications in operating metal and plastics machines. Programs accredited to the National Institute for Metalworking Skills (NIMS) and the Society of the Plastics Industry are listed at their respective Web sites. Some employers send promising machine tenders to operator classes and others prefer to hire workers who have completed, or are currently enrolled in, a training program. Many employers require a high school diploma and the ability to read, write, and speak English.

#### Recommended High School Course Work

High school students interested in this kind of work should take courses in metal shop and blueprint reading, gain a working knowledge of the properties of metals and plastics, and have a solid math background with course work in algebra and geometry.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following industry names to get a list of private firms and their addresses:

- ▶ All Other Plastics Products
- ▶ Aluminum Foundries (except Die-Casting)
- ▶ Employment Placement Agencies
- ▶ Ornamental and Architectural Metal Work
- ▶ Professional Employer Organizations
- ▶ Sheet Metal Work

## Cutting, Punching, and Press Machine Setters, Operators, and Tenders

- ▶ Fabricated Structural Metal
- ▶ Iron and Steel Mills
- ▶ Nonpackaging Plastics, Film and Sheet
- ▶ Steel Foundries (except Investment)
- ▶ Temporary Help Services
- ▶ Urethane and Other Foam Products

Search these **yellow page** headings for listings of private firms:

- ▶ Foundries
- ▶ Metal Fabricators
- ▶ Ornamental Metal Work
- ▶ Plastic Fabricators
- ▶ Sheet Metal
- ▶ Steel Fabricators

### Where Can the Job Lead?

Advancement for Cutting, Punching, and Press Machine Setters, Operators, and Tenders usually takes the form of higher pay. There are some limited opportunities to move up to higher level positions which may be enhanced by becoming certified in a particular machining skill. Some set-up workers may advance to supervisory positions.

### Other Sources of Information

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

The National Institute for Metalworking Skills (NIMS)  
[www.nims-skills.org](http://www.nims-skills.org)

National Tooling & Machining Association (NTMA)  
[www.ntma.org](http://www.ntma.org)

Precision Machined Products Association (PMPA)  
[www.pmpa.org](http://www.pmpa.org)

Precision Metalforming Association (PMA) Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

The Society of the Plastics Industry  
[www.socplas.org](http://www.socplas.org)



## Drilling and Boring Machine Tool Setters, Operators, and Tenders

**Table of Contents** *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Drilling and Boring Machine Tool Setters, Operators, and Tenders set up, run, and tend drilling machines that drill, bore, ream, mill, or countersink metal or plastic workpieces. Job duties usually vary with the type of machine being operated and the overall size of the business. Although some workers specialize in one or two types of machinery, many are trained to set up or operate a variety of machines. These workers are found in the automotive, aerospace, marine, and construction industries. For example, a worker in the aerospace industry may drill slots or holes in airplane turbine blades.

### Tasks

- ▶ Study machining instructions to determine dimensional and finish specifications, sequence of operation, setup, and tooling requirements.
- ▶ Lift workpiece either manually or with hoist onto machine table, or directs crane operator to lift and position workpiece.
- ▶ Position and secure workpiece on table with bolts, jigs, clamps, shims, or other holding devices, using machining hand tools.
- ▶ Lay out reference lines and machining locations on work, applying knowledge of shop math and layout techniques, using layout tools.
- ▶ Select cutting tool according to instructions and knowledge of metal or plastic properties.
- ▶ Install tool in spindle.
- ▶ Operate single or multiple-spindle drill press to bore holes to perform machining operations on metal, nonmetallic, or plastic workpieces.
- ▶ Operate tracing attachment to duplicate contours from templates or models.
- ▶ Verify conformance of machined work to specifications, using measuring instruments, such as calipers, micrometers, and fixed and telescoping gauges.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

### Important Skills, Knowledge, and Abilities

- ▶ Installation — Installing equipment, machines, wiring, or programs to meet specifications.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.

## Drilling and Boring Machine Tool Setters, Operators, and Tenders

- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Visualization — The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.

### Work Environment

Most Drilling and Boring Machine Tool Setters, Operators, and Tenders (Metal and Plastic) work in clean areas with good lighting and ventilation. Operating high-speed machines can be dangerous if strict safety precautions are not taken. Most Operators wear protective equipment like safety glasses and earplugs, to protect the worker from flying particles and machine noise. Many modern machines are enclosed, which minimizes the exposure to noise, dust, and lubricants.

Most workers in this occupation work 40 hours per week with overtime common during periods of peak production. Many metal and plastics working shops operate around the clock, so night and weekend shifts are also common. Many Drilling and Boring Machine Tool Setters, Operators, and Tenders (Metal and Plastic) belong to a union, such as the International Association of Machinists and Aerospace Workers.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification  | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Drilling and Boring Machine Tool Setters, Operators, and Tenders (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4032   | 3,200                            | 3,100                            | 100                     | \$9.95 to \$16.47          |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

## Drilling and Boring Machine Tool Setters, Operators, and Tenders

### Trends

All job opportunities for Drilling and Boring Machine Tool Setters, Operators, and Tenders during the 2004–2014 period will come from the need to replace existing workers who retire or leave for other kinds of work. The slight decline expected for this occupation is partly due to strong foreign competition, which has pushed some production operations offshore to countries where costs are lower. Other reasons include the increased use of computer-controlled equipment and robots, which speed productivity and require more skilled machinists.

### Training/Requirements/Apprenticeships

Drilling and Boring Machine Tool Setters, Operators, and Tenders usually follow one of the following training paths:

- ▶ Vocational school
- ▶ Community College programs or certificates
- ▶ Extensive on-the-job training

A few weeks of on-the-job training is sufficient for most workers to learn basic machine operations, but several years are required to become a highly skilled operator or setter. Community colleges and other educational institutions offer courses and certifications in operating metal and plastics machines. Programs accredited by the National Institute for Metalworking Skills (NIMS) and the Society of the Plastics Industry are listed at their respective Web sites. Some employers send promising machine tenders to operator classes and others prefer to hire workers who have completed, or are currently enrolled in, a training program. Many employers require a high school diploma and the ability to read, write, and speak English.

### Recommended High School Course Work

High school students interested in this kind of work should take courses in metal shop and blueprint reading, gain a working knowledge of the properties of metals and plastics, and have a solid math background with course work in algebra and geometry.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- |   |   |
|---|---|
| ▶ Aircraft                                | ▶ Machine Shops                           |
| ▶ All Other Motor Vehicle Parts           | ▶ Other Aircraft Parts and Equipment      |
| ▶ Aluminum Foundries (except Die-Casting) | ▶ Other Engine Equipment                  |
| ▶ Bare Printed Circuit Board              | ▶ Precision Turned Product                |
| ▶ Gasoline Engines and Engine Parts       | ▶ Semiconductor and Related Devices       |
| ▶ Iron and Steel Mills                    | ▶ Turbine Generator & Generator Set Units |

## Drilling and Boring Machine Tool Setters, Operators, and Tenders

Search these **yellow page** headings for listings of private firms:

- ▶ Aircraft Parts and Supplies
- ▶ Automobile Parts, Whsle & Manufacturers
- ▶ Foundries
- ▶ Generators
- ▶ Machine Shops
- ▶ Printed and Etched Circuits
- ▶ Screw Machine Products
- ▶ Semiconductor Devices

### Where Can the Job Lead?

Advancement for workers in this occupation usually takes the form of higher pay. Some workers may advance to supervisory positions. Opportunities for advancement can be increased by becoming certified in a particular machining skill.

### Other Sources of Information

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

Precision Machined Products Association (PMPA)  
[www.pmpa.org](http://www.pmpa.org)

The Society of the Plastics Industry  
[www.socplas.org](http://www.socplas.org)

**Table of Contents** *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Electrical and Electronics Repairers maintain, service, and repair a variety of automated assembly line systems as well as production and test equipment. Businesses and other organizations depend on complex electronic equipment for a variety of functions. Some of these units are computer operated, while others may be electromechanical, vacuum, or pneumatic systems that have some electronic controls. Electronics Repairers align, adjust, and calibrate the equipment on a regular basis to keep systems running efficiently. They modify existing, or develop new industrial electronic devices, circuits, and equipment according to company specifications that may not have complete technical data and instructions. When a malfunction does occur, an entire assembly line may stop, and Electronics Repairers must work quickly to locate the problem and repair the system so that production can resume as soon as possible.

Some industrial electronic equipment is self-monitoring and can alert repairers to malfunctions. When equipment breaks down, repairers first check for common causes of trouble, such as loose connections. If routine checks do not locate the trouble, repairers may refer to schematics and manufacturers' specifications to locate problems.

Electronics Repairers sometimes fit older manufacturing equipment with new automated control devices. They replace old electronic control units with programmable logic control (PLC) units. Setting up a new PLC involves connecting it to different sensors and writing a computer program to operate the equipment.

Electronics Repairers calibrate, troubleshoot, maintain, and repair the equipment and instruments that help run tests and locate problems. They use instruments such as oscilloscopes, signal generators, multimeters, pressure gauges and soldering tools to do their work. They keep equipment logs and records of all repairs and services and often keep inventory for spare parts.

### Tasks

- ▶ Perform scheduled preventive maintenance tasks, such as checking, cleaning, and repairing equipment, to detect and prevent problems.
- ▶ Examine work orders and converse with equipment operators to detect equipment problems and to ascertain whether mechanical or human errors contributed to the problems.
- ▶ Set up and test industrial equipment to ensure that it functions properly.
- ▶ Operate equipment to demonstrate proper use and to analyze malfunctions.

## Electrical and Electronics Repairers, Commercial and Industrial Equipment

- ▶ Test faulty equipment to diagnose malfunctions, using test equipment and software, and applying knowledge of the functional operation of electronic units and systems.
- ▶ Repair and adjust equipment, machines, and defective components, replacing worn parts such as gaskets and seals in watertight electrical equipment.
- ▶ Calibrate testing instruments and installed or repaired equipment to prescribed specifications.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Troubleshooting — Determining causes of operating errors and deciding what to do about it.
- ▶ Repairing — Repairing machines or systems using the needed tools.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ Installation — Installing equipment, machines, wiring, or programs to meet specifications.
- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Computers and Electronics — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- ▶ Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).
- ▶ Deductive Reasoning — The ability to apply general rules to specific problems to produce answers that make sense.
- ▶ Oral Comprehension — The ability to listen to and understand information and ideas presented through spoken words and sentences.

### Work Environment

Many Electronics Repairers work on factory floors, where they are subject to noise, dirt, vibration, and heat. Bench technicians work primarily in repair shops, where the surroundings are relatively quiet, and well lit. Electronics Repairers may have to do heavy lifting and require stooping, climbing and maneuvering in hard-to-reach places. They may stand for long periods of time while working on large control panels. Electronics Repairers must follow safety guidelines and often wear protective goggles and hardhats. When working on ladders or elevated equipment, they must wear harnesses to prevent falls. They also must take precautions against electric shock by locking off power to the unit under repair.

Electronics Repairers generally work a 40-hour week. Larger companies may also employ repairers on swing and night shifts. Occasionally, repairers may be on call during their off-duty hours.

## Electrical and Electronics Repairers, Commercial and Industrial Equipment

### What's the California Job Outlook?

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification   | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Electrical and Electronics Repairers, Commercial and Industrial Equipment</b> |                                  |                                  |                         |                            |
| 49-2094  | 6,800                            | 8,000                            | 270                     | \$17.89 to \$28.70         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Overall employment of Electrical and Electronics Repairers is expected to grow at about an average rate for all occupations over the 2004-2014 period. Installation of automated equipment is growing as manufacturers seek new ways to increase production and reduce costs. Companies will install electronic controls, robots, sensors, and other equipment to automate processes such as assembly and testing. Employers will continue to rely on Electrical and Electronics Repairers because any malfunction that idles commercial and industrial equipment is costly.

### Training/Requirements/Apprenticeships

Electrical and Electronics Repairers usually follow one of the following training paths:

- ▶ Community College programs or certificates
- ▶ Regional Occupational Programs
- ▶ Adult Education Programs
- ▶ Vocational school
- ▶ Extensive on-the-job-training

Electrical and Electronics Repairers must understand and apply electronics theory, therefore, formal training in electronics is almost always required. In addition to high school graduation, many employers increasingly expect applicants to have a certificate or associate degree in electronics technology.

Many of California's community colleges offer one-year certificate or two-year degree programs in electronics technology. Training is also available through adult education programs, vocational schools, and regional occupational programs.

Electronics Repairers are certified by trade associations (Refer to Other Sources of Information). Certification is not required but may enhance future employment and promotional opportunities.

### Recommended High School Course Work

High school preparation courses in shop, blue print reading, math, physics, and computer technology are helpful.

## Electrical and Electronics Repairers, Commercial and Industrial Equipment

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ All Other Industrial Machinery
- ▶ Electric Appliance Merchant Wholesalers
- ▶ Electricity and Signal Testing Instruments
- ▶ Electromedical Apparatus
- ▶ Food Product Machinery
- ▶ Industrial Process Variable Instruments
- ▶ Other Electronic Parts Merchant Wholesalers
- ▶ Other Measuring & Controlling Devices
- ▶ Plastics & Rubber Industry Machinery
- ▶ Printing Machinery & Equipment
- ▶ Search, Detection & Navigation
- ▶ Wiring and Equipment Merchant Wholesalers

Search these **yellow page** headings for listings of private firms or local Contractors:

- ▶ Electric Contractors
- ▶ Electric Contractors-Commercial & Industrial
- ▶ Electric Equipment & Supplies-Manufacturers
- ▶ Electric Equipment Service & Repair
- ▶ Electric Motors-Repairing

### Where Can the Job Lead?

Experienced Electronics Repairers with advanced training may become specialists or troubleshooters who help other repairers diagnose difficult problems. Electronics Repairers with leadership ability may advance to supervisory positions. Those with a bachelor's degree may progress to electronic engineering or management positions. Some experienced repairers may enter self-employment by opening their own repair shops.

### Other Sources of Information

Association of Communications & Electronics Schools International (ACES Int'l)  
[www.acesinternational.org](http://www.acesinternational.org)

International Society of Certified Electronics Technicians  
[www.iscet.org](http://www.iscet.org)

Electronics Technicians Association, International (ETA)  
[www.eta-i.org](http://www.eta-i.org)

## Extruding and Drawing Machine Setters, Operators, and Tenders

**Table of Contents** (*scroll or use links below to navigate document*)

**What They Do**

**Tasks**

**Skills, Knowledge, and Abilities**

**Work Environment**

**California's Job Outlook and Wages**

**Trends**

**Training**

**Where Do I Find the Job?**

**Where Can the Job Lead?**

**Other Sources**

### What They Do

Drawing and extruding are one of many machine processes used to turn raw materials into finished manufactured products. Extruding and drawing forces plastics or metal materials through dies into desired shapes by pushing or pulling. Heat may or may not be used depending upon the material. Extruding and Drawing Machine Setters, Operators, and Tenders (Metal and Plastic) set up, operate, or tend machines to push or pull thermoplastic or metal materials into tubes, rods, hoses, wire, bars, or structural shapes. Examples of extruded metal products include copper plumbing pipe; aluminum tracks, frames, and rails; and steel rods and tracks. Plastic products include PVC pipes, medical grade tubing, and window frames.

Other titles used for Extruding and Drawing Machine Setters, Operators, and Tenders include Extrusion Technician, Machine Operator, Core Extruder, Extruder Operator, Extruding Press Adjuster, Extruding Press Operator.

### Tasks

- ▶ Determine setup procedures and select machine dies and parts, according to specifications.
- ▶ Select nozzles, spacers, and wire guides, according to diameters and lengths of rods.
- ▶ Install dies, machine screws, and sizing rings on machines that extrude thermoplastic or metal materials.
- ▶ Change dies on extruding machines according to production line changes.
- ▶ Adjust controls to draw or press metal into specified shapes and diameters.
- ▶ Load machine hoppers with mixed materials, using augers, or stuff rolls of plastic dough into machine cylinders.
- ▶ Start machines and set controls to regulate vacuum, air pressure, sizing rings, and temperature, and to synchronize speed of extrusion.
- ▶ Measure and examine extruded products in order to locate defects, and to check for conformance to specifications; adjust controls as necessary to alter products.
- ▶ Replace worn dies when products vary from specifications.
- ▶ Clean work areas.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

## Extruding and Drawing Machine Setters, Operators, and Tenders

### Important Skills, Knowledge, and Abilities

- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ 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.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Static Strength — The ability to exert maximum muscle force to lift, push, pull, or carry objects.
- ▶ Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.

### Work Environment

Extruding and Drawing Machine Setters, Operators, and Tenders work indoors in machine shops and factories with controlled environment for worker comfort and product quality. They must be alert to the hazards of machinery constantly in motion and observe safety rules. They often wear safety glasses and earplugs and other protective equipment. They stand most of the day and must keep pace with the production line.

Some manufacturing plants operate around the clock, and workers may be required to work evening, night, or weekend shifts, as well as overtime when needed. As workers obtain seniority, they have more choice about shift assignments. Union membership may be available in some industries.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification   | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Extruding and Drawing Machine Setters, Operators, and Tenders (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4021  | 5,300                            | 4,700                            | 180                     | \$8.69 to \$14.95          |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

## Extruding and Drawing Machine Setters, Operators, and Tenders

### Trends

The occupation of Extruding and Drawing Machine Setters, Operators, and Tenders will decline slightly when compared to all California occupations. Most job opportunities will occur from replacing people who retire or permanently leave the field for other reasons. Temporary help services will experience the most growth in hiring Extruding and Drawing Machine Setters, Operators, and Tenders as employers continue the lean manufacturing movement.

### Training/Requirements/Apprenticeships

Extruding and Drawing Machine Setters, Operators, and Tenders often learn the basic skills from experienced workers on the job. They start as a Tender and then advance to Operator and Setter with experience. Community college or vocational school training programs in plastic engineering technology, precision metal working, machine shop, and machine tool technology are available in many areas of California. Use the *Training Information* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to identify training programs available in specific geographic locations.

### Recommended High School Course Work

High school students interested in this kind of work should take mathematics including basic statistics as well as any metal shop courses available.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ All Other Plastics Product
- ▶ Aluminum Foundries (except Die-Casting)
- ▶ Current-Carrying Wiring Device
- ▶ Dental Laboratories
- ▶ Iron and Steel Mills
- ▶ Miscellaneous Electrical Equipment
- ▶ Nonpackaging Plastics Film and Sheet
- ▶ Professional Employer Organizations
- ▶ Steel Foundries (except Investment)
- ▶ Surgical Appliance and Supplies
- ▶ Temporary Help Services
- ▶ Urethane and Other Foam Product

Search these **yellow page** headings for listings of private firms:

- ▶ Employment-Temporary
- ▶ Metal Fabricators
- ▶ Metal Stamping
- ▶ Plastics-Extruders
- ▶ Plastics-Fabricators

# Extruding and Drawing Machine Setters, Operators, and Tenders

## Where Can the Job Lead?

Workers advance from Machine Tender to Operator to Setter. Opportunities for advancement could include supervision, depending on the size of the firm. With further education or training, workers could become Computer Numerical Controlled Machine Operators, Machinists, or Tool and Die Makers.

## Other Sources of Information

Aluminum Extruders Council  
[www.aec.org](http://www.aec.org)

National Tooling & Machining Association  
[www.ntma.org](http://www.ntma.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

The Society of the Plastics Industry  
[www.socplas.org](http://www.socplas.org)

### Table of Contents *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

First-Line Supervisors/Managers of Production and Operating Workers 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. They instruct and train production employees to ensure that employees understand and follow all company policies and safety procedures. First-Line Supervisors/Managers may coordinate work schedules with a materials or purchasing department to make sure that materials are ordered and available for the completion of production orders. They are responsible for scheduling work and setting priorities to meet production deadlines. First-Line Supervisors/Managers may inspect finished products, and monitor gauges, and dials, to make certain that operators meet productivity and quality standards. They may prepare employee performance appraisals and recommend personnel actions such as hirings and promotions.

### Tasks

- ▶ Calculate labor and equipment requirements and production specifications, using standard formulas.
- ▶ Confer with management or subordinates to resolve worker problems, complaints, or grievances.
- ▶ Confer with other supervisors to coordinate operations and activities within or between departments.
- ▶ Demonstrate equipment operations and work and safety procedures to new employees, or assign employees to experienced workers for training.
- ▶ Direct and coordinate the activities of employees engaged in the production or processing of goods, such as inspectors, machine setters, and fabricators.
- ▶ Inspect materials, products, or equipment to detect defects or malfunctions.
- ▶ Interpret specifications, blueprints, job orders, and company policies and procedures for workers.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

### Important Skills, Knowledge, and Abilities

- ▶ Coordination — Adjusting actions in relation to others' actions.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.

## First-Line Supervisors/ Managers of Production and Operating Workers

- ▶ Speaking — Talking to others to convey information effectively.
- ▶ Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- ▶ Production and Processing — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- ▶ 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.
- ▶ Personnel and Human Resources — Knowledge of principles and procedures for personnel recruitment, selection, training, compensation and benefits, labor relations and negotiation, and personnel information systems.
- ▶ Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- ▶ Oral Expression — The ability to communicate information and ideas in speaking so others will understand.
- ▶ Oral Comprehension — The ability to listen to and understand information and ideas presented through spoken words and sentences.
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.
- ▶ Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.

### Work Environment

Most First-Line Supervisors/Managers of Production and Operating Workers work in large manufacturing plants. These firms are concentrated in urban areas. Work spaces are usually clean, well lit, and well ventilated. First-Line Supervisors/Managers work on their feet much of the day near powerful, high-speed machines. The work is generally safe for those who take reasonable care, use protective equipment, and adhere to safety rules. Supervisors/Managers must have the ability to negotiate and compromise with coworkers, which may be stressful at times. First-Line Supervisors/Managers usually work a 40-hour week. However, they may need to work additional hours when production deadlines must be met. Also, some facilities operate around-the-clock. First-Line Supervisors/Managers may need to work late shifts or may be called at irregular hours to resolve emergency problems.

## First-Line Supervisors/ Managers of Production and Operating Workers

### What's the California Job Outlook?

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification                                       | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>First-Line Supervisors/Managers of Production and Operating Workers</b> |                                  |                                  |                         |                            |
| 51-1011  | 69,200                           | 76,700                           | 2,200                   | \$17.12 to \$30.22         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Employment of First-Line Supervisors/Managers of Production and Operating Workers is expected to grow slower than average for all occupations over the 2004-2014 period. However, opportunities will continue to arise from the need to replace the First-Line Supervisors/Managers who retire or leave the labor force for other reasons.

### Training/Requirements/Apprenticeships

First-Line Supervisors/Managers of Production and Operating Workers usually follow one of the following training paths:

- ▶ High school diploma or equivalent
- ▶ Vocational school
- ▶ Community college programs or certificates
- ▶ Bachelor's degree
- ▶ Extensive on-the-job training

Educational requirements vary widely from a high school diploma to a bachelor's degree depending upon the position and the employer's entrance requirements. First-Line Supervisors/Managers of Production and Operating Workers must keep informed of new production technologies and management practices. Many belong to professional organizations and attend trade shows and industry conferences at which new equipment is displayed.

### Recommended High School Course Work

High school preparation courses in language arts, mathematics, science, general business, machine shop, and computer technology are helpful.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ All Other Plastics Product
- ▶ Bare Printed Circuit Board
- ▶ Other Commercial Printing
- ▶ Other Electronic Component

## First-Line Supervisors/ Managers of Production and Operating Workers

- ▶ Commercial Lithographic Printing
- ▶ Commercial Screen Printing
- ▶ Electronic Connector
- ▶ Nonpackaging Plastics Film and Sheet
- ▶ Plastics Plumbing Fixture
- ▶ Quick Printing
- ▶ Semiconductor and Related Devices
- ▶ Urethane and Other Foam Product

Search these **yellow page** headings for listings of private firms:

- ▶ Manufacturer's Agent & Representatives
- ▶ Metal Fabricators
- ▶ Metal Specialties
- ▶ Metal Stamping
- ▶ Pattern Makers
- ▶ Plastics Fabricators
- ▶ Plastics-Molders-Injection
- ▶ Plastics-Raw Materials-Colorants-Compounds

### Where Can the Job Lead?

Advancement opportunities are best for First-Line Supervisors/Managers of Production and Operating Workers with a bachelor's degree in business administration or industrial management. Supervisors/Managers with strong interpersonal skills and proven performance records may advance to plant manager or general manager.

### Other Sources of Information

National Association of Manufacturers  
[www.nam.org](http://www.nam.org)

International Warehouse Logistics Association  
[www.iwla.com](http://www.iwla.com)

## Forging Machine Setters, Operators, and Tenders

**Table of Contents** *(scroll or use links below to navigate document)*

**What They Do**

**Tasks**

**Skills, Knowledge, and Abilities**

**Work Environment**

**California's Job Outlook and Wages**

**Trends**

**Training**

**Where Do I Find the Job?**

**Where Can the Job Lead?**

**Other Sources**

### What They Do

The forging process has come a long way from the days of hammer and anvil. Forging is a technique where metal is heated, and then pressed, pounded, or squeezed under great pressure into strong parts known as “forgings.” The forgings are used in the manufacturing process where reliability and human safety are vital, such as aircraft or auto parts.

Forging Machine Setters, Operators, and Tenders set up, run, and tend forging machines that taper, shape, or form metal or plastic parts. They make products as diverse as steel spindles for trailer axles, drill pipes for oil or gas applications, titanium bulkheads for aircraft, and fishing reels. They are mostly employed in the forging and stamping industry, aerospace, and plastics product manufacturing firms.

### Tasks

- ▶ Read work orders or blueprints to determine specified tolerances and sequences of operations for machine setup.
- ▶ Confer with other workers about machine setups and operational specifications.
- ▶ Operate gas or oil furnaces to heat metal to proper temperature prior to forging.
- ▶ Install, adjust, and remove dies, synchronizing cams, forging hammers, and stop guides, using overhead cranes or other hoisting devices, and hand tools.
- ▶ Start machines to produce sample workpieces, and observe operations to detect machine malfunctions and to verify that machine setups conform to specifications.
- ▶ Set up, operate, or tend presses and forging machines to perform hot or cold forging by flattening, straightening, bending, cutting, piercing, or other operations to taper, shape, or form metal.
- ▶ Select, align, and bolt positioning fixtures, stops, and specified dies to rams and anvils, forging rolls, or presses and hammers.
- ▶ Position and move metal wires or workpieces through a series of dies that compress and shape stock to form die impressions.
- ▶ Turn handles or knobs to set pressures and depths of ram strokes and to synchronize machine operations.
- ▶ Place metal pieces in furnaces, then remove them, using hand tongs or overhead cranes, when metal color indicates proper forging temperatures.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

## Forging Machine Setters, Operators, and Tenders

### Important Skills, Knowledge, and Abilities

- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Installation — Installing equipment, machines, wiring, or programs to meet specifications.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ 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.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Visualization — The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.

### Work Environment

Most Forging Machine Setters, Operators, and Tenders work in areas that are clean, well lit, and well ventilated. Forging areas tend to be hot for workers, and extra precaution against burns is needed when working with metals. Their work requires stamina because they are on their feet much of the day and may do moderately heavy lifting. These workers operate powerful, high-speed machines that can be dangerous if strict safety rules are not observed. Most operators wear protective equipment, such as safety glasses and earplugs, to protect against flying particles of metal or plastic and against noise from the machines.

Most workers in the occupation put in a 40-hour week, and overtime is common during periods of increased production. Large firms may have 24-hour per day operations that require three work shifts. Many forging plants are nonunion, however some workers belong to unions, such as the International Association of Machinists and Aerospace Workers.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification                                       | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Forging Machine Setters, Operators, and Tenders (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4022  | 2,200                            | 2,200                            | 30                      | \$11.86 to \$19.43         |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

## Forging Machine Setters, Operators, and Tenders

### Trends

The number of Forging Machine Setters, Operators, and Tenders is expected to remain stable between 2004 and 2014 compared to all occupations. This is partly due to the increased use of process simulation software and computer-controlled forging machines that reduce the number of forging errors. The need to replace workers who leave because of retirement or other kinds of work will add job opportunities contributing to an estimated 30 openings per year within the state.

### Training/Requirements/Apprenticeships

According to the Forging Industry Educational and Research Foundation, training on forging machines is generally done in the shop and on the job. For the most part, beginning workers are first given tasks away from the forging machine before being trained to set up, run, and tend the equipment. The Bureau of Labor Statistics says, on average, Forging Machine Setters, Operators, and Tenders need between 3 and 12 months of combined on-the-job experience and informal training to do their job competently.

### Recommended High School Course Work

High school students interested in forging machine work should take mathematics, such as geometry and trigonometry, metal shop, and chemistry. Computer skills will be helpful for those who want to work on computer-controlled forging machines.

### Where Do I Find the Job?

Direct application to employers who run forges remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ Aircraft
- ▶ All Other Plastics Product
- ▶ Custom Roll Forming
- ▶ Employment Placement Agencies
- ▶ Guided Missiles and Space Vehicles
- ▶ Iron and Steel Forging
- ▶ Metal Stamping
- ▶ Nonpackaging Plastics Film and Sheet
- ▶ Other Aircraft Parts and Equipment
- ▶ Professional Employer Organizations
- ▶ Temporary Help Services
- ▶ Urethane and Other Foam Product

Search these **yellow page** headings for listings of private firms:

- ▶ Die Makers
- ▶ Metal Cutting
- ▶ Metal Fabricators
- ▶ Metal Rolling and Forming
- ▶ Metal Stamping
- ▶ Plastic Fabricators
- ▶ Sheet Metal Work
- ▶ Tool Designers

# Forging Machine Setters, Operators, and Tenders

## Where Can the Job Lead?

Forging is a small and very specialized segment of the manufacturing production. Advancement for these workers typically comes in the form of higher wages. Some forging machine workers who have years of experience and can demonstrate leadership skills may promote to shift supervisor.

## Other Sources of Information

Forging Industry Association  
[www.forging.org](http://www.forging.org)

Forging Career Center  
[www.forgingcareers.org](http://www.forgingcareers.org)

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

## Grinding and Polishing Workers (Hand)

**Table of Contents** *(scroll or use links below to navigate document)*

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find the Job?](#)

[Where Can the Job Lead?](#)

[Other Sources](#)



[View Career Video](#)

### What They Do

Many manufactured products require the finishing touches that only human hands can provide. Grinding and Polishing Workers use hand tools or hand-held power tools to grind, sand, or polish a variety of metal, wood, stone, clay, plastic, or glass objects. They may also maintain or repair equipment, sharpen abrasive grinding tools, and apply solutions or chemicals.

These workers might be called Grinders, Sanders, or Polishers, depending on their specialities. Theirs is the finishing touch on such diverse products as gun barrels, jewelry, rocking chairs, auto parts, and dentures.

### Tasks

- ▶ Grind, sand, clean, or polish objects or parts, using hand tools or equipment.
- ▶ Select, load, and adjust workpiece or abrasive parts onto equipment or worktable, using hand tools.
- ▶ Measure and mark equipment, objects, or parts, to ensure grinding and polishing standards are met.
- ▶ Remove workpiece from equipment or work table, using hand tools.
- ▶ Record product and processing data on specified forms.
- ▶ Transfer equipment, objects, or parts, to specified work areas, using moving devices.
- ▶ Sharpen abrasive grinding tools, using machines and hand tools.
- ▶ Repair and maintain equipment, objects, or parts, using hand tools.
- ▶ Apply solutions and chemicals to equipment, objects, or parts, using hand tools.
- ▶ Observe and inspect equipment, objects, or parts, to ensure specifications are met.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

### Important Skills, Knowledge, and Abilities

- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Engineering and Technology — Knowledge of the practical application of engineering

## Grinding and Polishing Workers (Hand)

science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Repairing — Repairing machines or systems using the needed tools.
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Wrist-Finger Speed — The ability to make fast, simple, repeated movements of the fingers, hands, and wrists.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.

### Work Environment

Working conditions can be noisy, and Grinding and Polishing Workers must wear safety gear to protect their eyes, hands, ears, and skin from cuts or flying particles. They must have sufficient upper-body strength to hold tools for extended periods while they secure parts. Work schedules are typically 40-hours per week, with many firms offering swing and graveyard shifts. Some workers belong to the International Association of Machinists and Aerospace Workers.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification         | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Grinding and Polishing Workers (Hand)</b> |                                  |                                  |                         |                            |
| 51-9022                                      | 7,000                            | 6,800                            | 180                     | \$8.47 to \$13.06          |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Many products formerly made by hand are now made entirely by machine—right down to the packaging. This is due to the increasing use of computer-controlled machine tools. Employment of these workers is expected to decline slightly between 2004 and 2014; however, there will be a significant number of replacement workers needed in California (1,800) between 2004 and 2014 as workers retire or leave the job for other kinds of work.

### Training/Requirements/Apprenticeships

Grinding and Polishing Workers need anywhere from a few days to a few months of on-the-job training to learn the job. Usually, an experienced worker can teach trainees how to do the job. The best workers are those who demonstrate patience and an attention to detail.

## Grinding and Polishing Workers (Hand)

### Recommended High School Course Work

High school students interested in this kind of work should take wood or metal shop courses. Those who eventually would like to work as Machine Tool Setters, Operators, or Tenders should also take mathematics coursework and blueprint reading.

### Where Do I Find the Job?

Applicants should apply directly to employers who employ Grinding and Polishing Workers. Unions representing these workers also have information concerning apprenticeships and related matters.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ All Other Miscellaneous Manufacturing
- ▶ All Other Motor Vehicle Parts
- ▶ Bolts, Nuts, Screws, Rivets, and Washers
- ▶ Electroplating/Anodizing/Coloring Metal
- ▶ Jewelry (except Costume)
- ▶ Machine Shops
- ▶ Metal Coating and Nonprecious Engraving
- ▶ Nonupholstered Wood Household Furniture
- ▶ Precision Turned Product
- ▶ Sign
- ▶ Sporting and Athletic Goods
- ▶ Wood Kitchen Cabinets and Countertops

Search these **yellow page** headings for listings of private firms:

- ▶ Automobile Body Repairing
- ▶ Automobile Parts, Supplies Manufacturing
- ▶ Furniture Manufacturers
- ▶ Machine Shops
- ▶ Metal Fabricating
- ▶ Woodworking

### Where Can the Job Lead?

Grinding and Polishing Workers with several years experience in one industry or working on one product can promote to a number of positions, such as Machine Tool Setters, Operators, or Tenders. Others enter apprenticeship programs to become Carpenters, Jewelers, or Tool and Die Makers.

### Other Sources of Information

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

United Brotherhood of Carpenters and Joiners of America  
[www.carpenters.org](http://www.carpenters.org)



## Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders

**Table of Contents** (*scroll or use links below to navigate document*)

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders (Metal and Plastic) use a variety of machines to remove excess material or burrs from surfaces, sharpen edges and corners, and buff, hone, and polish metal or plastic workpieces. Workers and machines of this type are found in the automotive, aerospace, semiconductor, technical ceramics, metalworking, optics, and medical device industries.

In many manufactured products, metal and plastic parts must have precise flat and parallel surface finishes; these are the jobs of Grinding, Lapping, Polishing, and Buffing Machine workers. Machine workers operate a number of specialty machines such as honing or lapping machines. Honing is a tool that uses abrasives to give holes a fine surface finish. Lapping is a final finishing process that uses low-speed abrasion methods to remove very small amounts of material. Machine operators must often meet specification requirements to meet high tolerances of thousandths or even ten-thousandths of an inch. Tolerance is the variation allowed when maintaining a specific dimension for a machined part.

Machine operators grind, sharpen, or hone tools and products to required dimensions, using power tools, hand tools, and precision measuring instruments. They inspect or measure workpieces using measuring devices such as gauges or micrometers to conform to product specifications. Products made by these workers include power steering components, turbine engine parts, fuel pumps, engine components, compressors, and a variety of small metal parts, such as nuts, bolts, and screws.

### Tasks

#### *Grinding, Honing, Lapping, and Deburring Machine Set-up Operators*

- ▶ Study blueprints, work order, or machining instructions to determine product dimensions, tooling, and to plan operational sequence.
- ▶ Compute machine indexing and settings for specified dimension and base reference points.
- ▶ Move machine controls to index workpiece and adjust machine for pre-selected operational settings.
- ▶ Select machine tooling to be used in machine operation, utilizing knowledge of machine and production requirements.
- ▶ Activate machine start-up switches to grind, lap, hone, debar, shear, or cut workpiece, according to specifications.
- ▶ Thread and hand feed materials through machine cutters or abraders.

## Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders

- ▶ Mount and position tools in machine chuck, spindle, or other tool holding device to specifications, using hand tools.
- ▶ Observe and adjust machine operation.
- ▶ Repair or replace machine parts, using hand tools, or notify engineering personnel when corrective action is required.
- ▶ Maintain stock of machine parts and machining tools.

### *Buffing and Polishing Set-up Operators*

- ▶ Read work order to determine parts to be buffed or polished.
- ▶ Set and adjust machine controls according to product specifications, utilizing knowledge of machine operation.
- ▶ Start and observe machine operation for conformance to specifications.
- ▶ Select buffing or polishing tools and position and mount tools to machine tool, chuck, or jig, using hand tools.
- ▶ Select and attach workpiece holding fixture to drive mechanism, and position or clamp workpiece to fixture.
- ▶ Hold stick of buffing compound or turn valve and depress pedal to administer coolant to workpiece surface.
- ▶ Remove workpiece and examine finish or luster to ensure surface meets specifications.
- ▶ Repair or replace machine parts to maintain machine in operational condition.

Detailed descriptions of these occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ 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.
- ▶ Visualization — The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Arm-Hand Steadiness — The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.

## Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders

### Work Environment

Most Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders work in areas that are clean, well lit, and well ventilated. They are on their feet much of the day and may do moderately heavy lifting. These workers operate powerful, high-speed machines that can be dangerous. However, risks are minimized if workers wear protective equipment, such as safety glasses and earplugs, to protect against flying particles of metal or plastic and against noise from the machines. Workers in the plastics industry who work near materials that emit dangerous fumes or dust must wear face masks or a breathing apparatus. Most machine operators work a 40-hour week. However, overtime is common during periods of increased production. Many shops operate more than one daily shift. Therefore, some machine operators may work nights and weekends.

Some machine operators may belong to a union, such as the International Association of Machinists and Aerospace Workers, depending on the industry and employer.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification   | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Grinding, Lapping, Polishing Machine Tool Setters, Operators, and Tenders (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4033  | 10,800                           | 10,500                           | 210                     | \$8.98 to \$15.37          |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Employment of Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders is expected to decline slightly compared with all occupations over the 2004–2014 period. However, opportunities will continue to arise from the need to replace the machine operators who retire or leave the labor force for other reasons. Job growth will continue to be influenced by automation. In order to remain competitive with foreign manufacturers, many firms are using new technologies, such as computer-controlled machine tools and robots, to lower production costs. Labor-saving machinery tends to reduce the need for lower skilled machine operators because the tasks they perform are more easily automated. However, opportunities will continue to arise for those with experience on a wide variety of machines, and a good working knowledge of the properties of metals and plastics.

### Training/Requirements/Apprenticeships

Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders usually follow one of the following training paths:

- ▶ Formal, four-year apprenticeship
- ▶ Extensive on-the-job training
- ▶ Vocational school

Some employers may offer formal training programs or apprenticeship opportunities. Also, industry associations offer voluntary certification through an exam process. The Institute for

## Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders

Metalworking Skills and the Society of Plastics Industry offer machine operator certification for their respective industries. Refer to *Other Sources of Information*.

### Recommended High School Course Work

High school preparation courses in machine shop, blueprint reading, drafting, physics, algebra, geometry, language arts, and computer technology are helpful.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Candidates for training or apprenticeship programs should apply directly to employers who employ Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders. Unions representing workers also have information concerning apprenticeships and related matters.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ All Other Motor Vehicle Parts Mfg.
- ▶ Aluminum Foundries (except Die-Casting)
- ▶ Bolts, Nuts, Screws, Rivets, and Washers
- ▶ Electroplating/Anodizing/Coloring Metal
- ▶ Gasoline Engines and Engine Parts
- ▶ Iron and Steel Mills
- ▶ Machine Shops
- ▶ Metal Coating and Nonprecious Engraving
- ▶ Metal Heat Treating
- ▶ Motor Vehicle Power Train Components
- ▶ Precision Turned Product
- ▶ Steel Foundries (except Investment)

Search these **yellow page** headings for listings of private firms:

- ▶ Grinding-Precision and Production
- ▶ Machine Shops
- ▶ Metal Castings
- ▶ Metal Fabricators
- ▶ Metal Rolling and Forming
- ▶ Metal Stamping
- ▶ Plastic Fabricators
- ▶ Plastics Molders, Rotational

### Where Can the Job Lead?

Advancement opportunities for Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders generally takes the form of higher pay. However, there are some limited opportunities for workers to advance to multiple-machine operators or computer-control programmer or operator. Also, skilled Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders may advance to supervisory positions.

### Other Sources of Information

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

## Heat Treating Equipment Setters, Operators, and Tenders

**Table of Contents** *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Heat is as important to manufacturing processes as it is to food preparation. Manufacturers subject metals and plastics to heat, cold, or chemicals to relieve or redistribute stresses and change durability, flexibility, and ductility. Products as diverse as eyeglasses, semiconductor wafers, steel, automobile tires, and plastic bags use heating as a critical step to the finished product. In the steel industry Heat Treating Equipment Setters, Operators, and Tenders heat metal sheets, blooms, billets, bars, plates, and rods to a specified temperature for rolling or processing. In the plastics industry they heat and cure preformed plastic parts.

Heat Treating Equipment Setters, Operators, and Tenders set up, operate, or tend heating equipment, such as heat-treating furnaces, flame-hardening machines, induction machines, soaking pits, baths, electronic induction machines, or vacuum equipment to temper, harden, anneal, or heat-treat metal or plastic objects.

Common titles used for Heat Treating occupations include: Heating Equipment Setter; Heating Regulator; Heat Treat Operator; Heat Treater; Heat Treating Bluer; Heat Treating Furnace Tender; Induction Heat Treater; and Heat Treating Operator.

### Tasks

- ▶ Read production schedule to determine processing sequence and furnace temperature requirements for objects to be heat treated.
- ▶ Visually examine or test objects, using hardness testing equipment, to determine flame temperature and degree of hardness.
- ▶ Estimate flame temperature and heating cycle based on degree of hardness required and metal to be treated.
- ▶ Set automatic controls, observe gauges, and operate gas or electric furnace used to harden temper, or anneal metal parts.
- ▶ Light gas burners and adjust flow of gas and coolant water.
- ▶ Load parts into containers, close furnace door, and insert parts into furnace when specified temperature is reached.
- ▶ Cover parts with charcoal before inserting in furnace to prevent discoloration caused by rapid heating.
- ▶ Clean oxides and scale from parts or fittings, using steam spray or immersing parts in chemical and water baths.

## Heat Treating Equipment Setters, Operators, and Tenders

- ▶ Signal forklift operator to deposit or extract containers of parts into and from furnaces and quenching rinse tanks.
- ▶ Position part in fixture, press buttons to light burners and tend flame hardening machine, according to procedures, to case-harden metal part.
- ▶ Adjust speed and operate continuous furnace through which parts are passed by means of reels and conveyors.
- ▶ Set up and operate die-quenching machine to prevent parts from warping.
- ▶ Activate and tend electric furnace that anneals base sections of hardened parts for subsequent machining.
- ▶ Test parts for hardness, using hardness testing equipment, and stamp heat treatment identification mark on part, using hammer and punch.
- ▶ Examine parts to ensure metal shade and color conform to specifications, utilizing knowledge of metal heat-treating.
- ▶ Reduce heat and allow parts to cool in furnace.
- ▶ Remove parts from furnace after specified time and air dry or cool parts in water or oil brine or other baths.
- ▶ Insert vacuum tube into bag and seal bag around tube with tape.
- ▶ Impregnate fabric with plastic resins and cut fabric into strips.
- ▶ Remove part and cut away plastic bag.
- ▶ Record time and production data.
- ▶ Position plastic sheet and mold in plastic bag, heat material under lamps, and force confrontation of sheet to mold by vacuum pressure.
- ▶ Assist workers in repairing, replacing, cleaning, lubricating, or adjusting furnace equipment using hand tools.
- ▶ Instruct new workers in machine operations.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.

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.

## Heat Treating Equipment Setters, Operators, and Tenders

- ▶ **Control Precision** — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ **Information Ordering** — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ **Arm-Hand Steadiness** — The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.
- ▶ **Near Vision** — The ability to see details at close range (within a few feet of the observer).
- ▶ **Trunk Strength** — The ability to use your abdominal and lower back muscles to support part of the body repeatedly or continuously over time without ‘giving out’ or fatiguing.

### Work Environment

Heat Treating Equipment Setters, Operators, and Tenders work indoors in machine shops and plants where temperatures can become very hot at times due to the nature of their tasks. They must observe safety rules and be alert to the hazards of machinery constantly in motion. They often wear safety glasses, earplugs, and other protective equipment. They are on their feet most of the day using their hands.

Some manufacturing plants operate around the clock, and workers may be required to work evening, night, or weekend shifts as well as overtime when needed. As workers obtain seniority, they have more choice about shift assignments. Union membership may be available in some industries.

### California’s Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification                          | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Heat Treating Equipment Setters, Operators and Tenders</b> |                                  |                                  |                         |                            |
| 51-4191   | 1,500                            | 1,800                            | 80                      | \$11.31 to \$18.83         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

The number of Heat Treating Equipment Setters, Operators, and Tenders is expected to grow faster than average between 2004-2014 compared with all occupations. Job opportunities will continue to occur as workers permanently leave the occupation for retirement and other reasons.

### Training/Requirements/Apprenticeships

Heat Treating Equipment Setters, Operators, and Tenders must have a high school diploma and generally receive on-the-job training from experienced workers.

## Heat Treating Equipment Setters, Operators, and Tenders

### Recommended High School Course Work

High school students interested in this kind of work should take mathematics, physics, and chemistry, as well as metal shop courses when available.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Candidates for training or apprenticeship programs should apply directly to employers who employ Heat Treating Equipment Setters, Operators, and Tenders.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ Aluminum Die-Casting Foundries
- ▶ Aluminum Foundries (except Die-Casting)
- ▶ Electroplating/Anodizing/Coloring Metal
- ▶ Employment Placement Agencies
- ▶ Iron and Steel Mills
- ▶ Iron Foundries
- ▶ Metal Coating and Nonprecious Engraving
- ▶ Metal Heat Treating
- ▶ Nonferrous, ex. Copper/Aluminum, Shaping
- ▶ Professional Employer Organizations
- ▶ Steel Foundries (except Investment)
- ▶ Temporary Help Services

Search these **yellow page** headings for listings of private firms:

- ▶ Employment, Temporary
- ▶ Foundries
- ▶ Heat Treating, Metal
- ▶ Machine Shops
- ▶ Metal Stamping
- ▶ Plating

### Where Can the Job Lead?

Large organizations employ several levels of Heat Treater Operators. Some operators may advance to supervisory positions.

### Other Sources of Information

ASM International - The Materials Information Society  
[www.asm-intl.org](http://www.asm-intl.org)

**Table of Contents** *(scroll or use links below to navigate document)*

**What They Do**

**Tasks**

**Skills, Knowledge, and Abilities**

**Work Environment**

**California's Job Outlook and Wages**

**Trends**

**Training**

**Where Do I Find The Job?**

**Where Can the Job Lead?**

**Other Sources**



**View Career Video**

### What They Do

Industrial Machinery Mechanics adjust, maintain, and repair machinery and mechanical equipment, such as pumps, motors, engines, cranes, escalators, conveyor systems, and production machinery used in factories. They are sometimes called Industrial Machinery Repairers or Machinery Maintenance Mechanics.

Industrial Machinery Mechanics perform “preventive maintenance” routines—a series of prescribed tests and measurements conducted at regular intervals on machinery to ensure continuous operation and to detect possible breakdown conditions before actual equipment failure. They also make adjustments to machinery using precision measuring instruments, and are responsible for cleaning, greasing, and oiling machinery to prevent breakdowns.

### Tasks

- ▶ Confer with operators and observe, test, and evaluate operation of machinery and equipment to diagnose cause of malfunction.
- ▶ Disassemble machinery and equipment to remove parts and make repairs.
- ▶ Repair, replace, adjust, and align components of machinery and equipment.
- ▶ Fabricate replacement parts.
- ▶ Test-run repaired machinery and equipment to verify adequacy of repairs.
- ▶ Clean and lubricate parts, equipment, and machinery.
- ▶ Examine parts for defects, such as breakage or excessive wear.
- ▶ Weld to repair broken metal parts, fabricate new parts, and assemble new equipment.
- ▶ Record repairs and maintenance performed.
- ▶ Enter codes and instructions to program computer-controlled machinery.
- ▶ Repair and replace electrical wiring and components of machinery.
- ▶ Order or requisition parts and materials.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

## Industrial Machinery Mechanics

### Important Skills, Knowledge, and Abilities

- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ 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.
- ▶ Computers and Electronics — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- ▶ Physics — Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes.

### Work Environment

Industrial Machinery Mechanics work in areas that are usually noisy, but well lit and ventilated. The work is sometimes dirty and greasy. Work may be inside or outside. Repair work is relatively safe; however, hazards may include cuts and bruises from sharp tools and metal objects. Safety helmets, goggles, metal-tipped shoes and other protective devices help prevent serious injuries. These workers may work alone or with other workers and trainees. Uniforms are sometimes required. Most mechanics provide their own basic tool kit, which may cost up to \$1,000.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification  | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Industrial Machinery Mechanics</b> |                                  |                                  |                         |                            |
| 49-9041                               | 12,400                           | 13,600                           | 370                     | \$17.10 to \$26.82         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Employment of Industrial Machinery Mechanics is expected to grow slower than average for all occupations through 2014. However, with the trend toward industrial automation, with increasingly complex and more expensive machinery, there will still be a need for additional Industrial Machinery Mechanics to perform essential preventive maintenance routines. Most new machines feature more self-diagnostic capabilities and better reliability, which may reduce the need for some repair work. Because factories and other facilities cannot afford breakdowns of industrial machinery, repairers may be called to the plant at night or on weekends for emergency repairs. Overtime is common among Industrial Machinery Mechanics—more than a third work over 40 hours a week.

### Training/Requirements/Apprenticeships

Many Industrial Machinery Mechanics learn their trade through a four-year apprenticeship program combining classroom instruction with on-the-job training. These programs are usually sponsored by trade unions, and prospective entrants must take examinations in subjects such as basic math. Other workers start as helpers and pick up the skills of the trade informally and by taking courses offered by machinery manufacturers and community colleges.

Mechanics learn from experienced journey-level workers how to operate, disassemble, repair, and assemble machinery. Classroom instruction focuses on subjects such as shop mathematics, blueprint reading, welding, electronics, and computer training.

Most employers prefer to hire those who have completed high school.

### Recommended High School Course Work

High school courses in mechanical drawing, mathematics, physics, computers, and electronics are especially useful.

### Where Do I Find the Job?

Industrial Machinery Mechanics usually register for work with unions. Direct application to employers is another effective job search method. Local government also hires these workers.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ All Other Converted Paper Products
- ▶ All Other Petroleum and Coal Products
- ▶ Asphalt Paving Mixture and Block
- ▶ Asphalt Shingle and Coating Materials
- ▶ Coated and Laminated Paper
- ▶ Corrugated/Solid Fiber Box
- ▶ Dried and Dehydrated Food
- ▶ Frozen Fruit and Vegetable
- ▶ Frozen Specialty Food
- ▶ Fruit and Vegetable Canning
- ▶ Petroleum Refineries
- ▶ Specialty Canning

Search these **yellow page** headings for listings of private firms:

- ▶ Machine Shops, Machinery-Repairing
- ▶ Machinery, Specially Designed

### Where Can the Job Lead?

Advancement for Industrial Machinery Mechanics is usually in the form of salary increases. Large companies may offer promotion into supervisory positions. With advanced training and years of experience, these workers can promote into master mechanic, tool and die maker, or supervisory positions within the industry or firm.

## Industrial Machinery Mechanics

### Other Sources of Information

California Division of Apprenticeship Standards

[www.dir.ca.gov/das](http://www.dir.ca.gov/das)

National Tooling & Machining Association

[www.ntma.org](http://www.ntma.org)

Precision Machined Products Association

[www.pmpa.org](http://www.pmpa.org)

## Lathe and Turning Machine Tool Setters, Operators, and Tenders

**Table of Contents** *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Lathes have been used for thousands of years to shape round objects by turning material on an axis while forcing material against a sharp tool. Lathe and Turning Machine Tool Setters, Operators, and Tenders (Metal and Plastic) set up, operate, or tend lathe and turning machines to turn, bore, thread, form, or face metal or plastic materials, such as wire, rod, or bar stock to form all types of parts. Lathe machined plastic and metal parts can be found in products ranging from motorcycles to guitars to artificial hearts.

Lathe and Turning Machine Tool Setters, Operators, and Tenders can be separated into two groups—those who operate manual lathes and those who operate computer numerical controlled (CNC) lathes. Employers often specify manual or CNC in the job title. Setup workers prepare the machines prior to production and may adjust the machinery during its operation. Operators and tenders primarily monitor the machinery during its operation, sometimes loading or unloading the machine or making minor adjustments to the controls. Many workers both set up and operate equipment. Setup workers plan and set up the sequence of operations according to blueprints, layouts, or other instructions. They adjust the speed, feed, and other controls, choose the proper coolants and lubricants, and select the instruments or tools for each operation.

Lathe and Turning Machine Tool Setters, Operators, and Tenders work in manufacturing under many different job titles including the following apprenticeable specialties:

- ▶ Engine-Lathe Set-Up Operators
- ▶ Screw-Machine Set-Up Operators, Single Spindle
- ▶ Screw-Machine Operators, Single Spindle
- ▶ Screw-Machine Operators, Multiple Spindle
- ▶ Set-Up Operators, Screw-Machine
- ▶ Hand Spinners
- ▶ Engine-Lathe Set-Up Operators, Tool
- ▶ Turret-Lathe Set-Up Operators, Tool

### Tasks

- ▶ Study blueprint, layout, or chart, to visualize work and determine materials needed, sequence of operations, dimensions, and tooling instructions.
- ▶ Compute unspecified dimensions and machine settings, using knowledge of metal properties and shop mathematics.
- ▶ Select cutting tools and tooling instructions, according to knowledge of metal properties and shop mathematics, or written specifications.

## Lathe and Turning Machine Tool Setters, Operators, and Tenders

- ▶ Install holding fixtures, cams, gears, and stops to control stock and tool movement, using hand tools, power tools, and measuring instruments.
- ▶ Mount attachments, such as relieving or tracing attachments, to perform operations, such as duplicating contours of template or trimming workpiece.
- ▶ Move controls to set cutting speeds and depths, and feed rates and to position tool in relation to workplace.
- ▶ Crank machine through cycle, stopping to adjust tool positions and machine controls, to ensure specified timing, clearance, and tolerances.
- ▶ Lift metal stock or workpiece manually or using hoist, and position and secure it in machine, using fasteners and hand tools.
- ▶ Observe operation and stop machine to inspect finished workpiece and verify conformance with specifications of first-run, using measuring instruments.
- ▶ Replace worn tools and sharpen dull cutting tools and dies.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Production and Processing — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- ▶ Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- ▶ Visualization — The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.

### Work Environment

Lathe and Turning Machine Tool Setters, Operators, and Tenders work in areas that are clean, well lit, and well ventilated. They are on their feet most of the day and may do some heavy lifting. These workers operate powerful, high speed machines that can be dangerous. However, risks are minimized if operators wear protective equipment such as safety glasses and earplugs to protect against flying metal or plastic particles and against noise from machinery. Operators working in the plastics industry must wear face masks or a self-contained breathing apparatus to protect themselves from dangerous fumes or dust.

Most Lathe and Turning Machine Tool Setters, Operators, and Tenders work a standard 40-hour week. However, many metalworking and plastics working shops operate more than one shift daily requiring some operators to work nights and weekends. Also, overtime work is common during heavy production periods.

## Lathe and Turning Machine Tool Setters, Operators, and Tenders

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification   | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Lathe and Turning Machine Tool Setter, Operators, and Tenders (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4034  | 6,300                            | 5,900                            | 120                     | \$10.38 to \$19.03         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Employment of Lathe and Turning Machine Tool Setters, Operators, and Tenders is expected to decline slightly compared with all occupations through 2014. However, opportunities will continue to arise from the need to replace the Lathe and Turning Machine Tool Setters, Operators, and Tenders who retire or leave the labor force for other reasons. Job growth will continue to be influenced by automation. In order to remain competitive with foreign manufacturers, many firms are using new technologies, such as computer-controlled machine tools and robots to lower production costs. Labor-saving machinery tends to reduce the need for lower skilled machine operators, because the tasks they perform are more easily automated. However, opportunities will continue to arise for those with experience on a wide variety of machines, and a good working knowledge of the properties of metals and plastics.

### Training/Requirements/Apprenticeships

Lathe and Turning Machine Tool Setters, Operators, and Tenders usually follow one of the following training paths:

- ▶ High school diploma or equivalent
- ▶ Extensive on-the-job training

Some employers may offer formal training programs or apprenticeship opportunities. Also, industry associations offer voluntary certification through an exam process. The Institute for Metalworking Skills and the Society of Plastics Industry offer machine operator certification for their respective industries. Refer to Other Sources of Information.

### Recommended High School Course Work

High school preparation courses in machine shop, blueprint reading, algebra, geometry, language arts, and computer technology are helpful.

## Lathe and Turning Machine Tool Setters, Operators, and Tenders

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Aircraft
- ▶ All Other Motor Vehicle Parts
- ▶ Bolts, Nuts, Screws, Rivets, and Washers
- ▶ Guided Missiles and Space Vehicles
- ▶ Machine Shops
- ▶ Miscellaneous General Purpose Machinery
- ▶ Motor Vehicle Power Train Components
- ▶ Other Aircraft Parts and Equipment
- ▶ Other Motor Vehicle Electrical Equipment
- ▶ Packaging Machinery
- ▶ Precision Turned Product
- ▶ Pump and Pumping Equipment

Search these **yellow page** headings for listings of private firms:

- ▶ Metal Castings
- ▶ Metal Cutting Tools
- ▶ Metal Fabricators
- ▶ Metal Rolling and Forming
- ▶ Plastic Fabricators
- ▶ Plastics Molders, Injection
- ▶ Plastics Molders, Rotational

### Where Can the Job Lead?

Advancement opportunities for Lathe and Turning Machine Tool Setters, Operators, and Tenders generally take the form of higher pay. Although, there are some limited opportunities for Lathe and Turning Machine Tool Setters, Operators, and Tenders to advance to multiple-machine operators, setup operators, or trainees for the more highly skilled position of Machinist, Tool and Die Maker, or Computer-Control Programmer or Operator. Also, skilled set-up workers may advance to supervisory positions.

### Other Sources of Information

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

National Tooling & Machining Association  
[www.ntma.org](http://www.ntma.org)

The Society of the Plastics Industry  
[www.socplas.org](http://www.socplas.org)

## Lay-Out Workers (Metal and Plastic)

**Table of Contents** *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Lay-Out Workers trace patterns and mark specifications on metal or plastic stock for further processing. They use templates, measuring instruments, and hand tools, such as scribes, punches, or hand drills. They plan the layout based on blueprints and templates, applying their knowledge of trigonometry, product design, effects of heat, and allowances for curvature or thickness of material.

Titles used by employers in metal and plastic for Lay-Out Workers include: Composite Parts Worker, Aircraft Lay-Out Worker, Machine Lay-Out Worker, Pattern Lay-Out Worker, Precision Lay-Out Worker, Propeller Lay-Out Worker, Ship Fitter, Lay-Out Person, Hangersmith. They work in architectural and structural metals, aerospace, and industrial machinery industries.

### Tasks

- ▶ Plan and develop layouts from blueprints and templates, applying knowledge of trigonometry, design, effects of heat, and properties of metals.
- ▶ Plan locations and sequences of cutting, drilling, bending, rolling, punching, and welding operations, using compasses, protractors, dividers, and rules.
- ▶ Add dimensional details to blueprints or drawings made by other workers.
- ▶ Compute layout dimensions, and determine and mark reference points on metal stock or workpieces for further processing, such as welding and assembly.
- ▶ Design and prepare templates of wood, paper, or metal.
- ▶ Fit and align fabricated parts to be welded or assembled.
- ▶ Lay out and fabricate metal structural parts such as plates, bulkheads, and frames.
- ▶ Locate center lines and verify template positions, using measuring instruments such as gauge blocks, height gauges, and dial indicators.
- ▶ Mark curves, lines, holes, dimensions, and welding symbols onto workpieces, using scribes, soapstones, punches, and hand drills.
- ▶ Apply pigment to layout surfaces, using paint brushes.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

### Important Skills, Knowledge, and Abilities

- ▶ Mathematics — Using mathematics to solve problems.

## Lay-Out Workers (Metal and Plastic)

- ▶ Production and Processing — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Design — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Visualization — The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.

### Work Environment

Lay-Out Workers must be precise in performing their job to prevent material waste and ensure product quality. They stand most of the day, working indoors in plants with environments controlled for worker comfort and product quality. They must observe safety procedures around hazardous machinery and may wear personal protective equipment.

Some manufacturing plants operate around the clock, and workers may be required to work evening, night, or weekend shifts, as well as overtime when needed. As workers obtain seniority, they have more choice about shift assignments. Union membership may be available in some industries.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification       | Estimated Number of Workers 2005 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Lay-Out Workers (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4192                                    | 850                              | Not Available                    | Not Available           | \$10.53 to \$19.81         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

The occupation of Lay-Out Workers will remain stable with no significant change compared with other occupations in California. Workers who develop Computer Numerical Controlled (CNC) skills will have the best opportunities.

### Training/Requirements/Apprenticeships

Most Lay-Out Workers receive on-the-job training, taking from one to twelve months. Community or vocational college certificate and degree programs in machine shop or machine technology are available in most areas of the state.

## Lay-Out Workers (Metal and Plastic)

### Recommended High School Course Work

High school students interested in this kind of work should take mathematics including trigonometry, drafting, and physics, as well as any type of shop courses available.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Aircraft Engine and Engine Parts
- ▶ Aircraft
- ▶ Fabricated Structural Metal
- ▶ Guided Missiles and Space Vehicles
- ▶ Metal Window and Door
- ▶ Office Machinery
- ▶ Optical Instrument and Lens
- ▶ Ornamental and Architectural Metal Work
- ▶ Other Aircraft Parts and Equipment
- ▶ Other Commercial and Service Machinery
- ▶ Photographic and Photocopying Equipment
- ▶ Sheet Metal Work

Search these **yellow page** headings for listings of private firms:

- ▶ Die Makers
- ▶ Metal Cutting Tools
- ▶ Metal Fabricators
- ▶ Metal Stamping
- ▶ Plastic Fabricators
- ▶ Sheet Metal Work

### Where Can the Job Lead?

Opportunities for Lay-Out Workers' advancement could include supervision, depending on the size of the firm. With further education or training, workers could become Computer Numerical Controlled (CNC) Machine Operators, Machinists, or Tool and Die Makers.

### Other Sources of Information

Aluminum Extruders Council  
[www.aec.org](http://www.aec.org)

National Tooling & Machining Association  
[www.ntma.org](http://www.ntma.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

The Society of the Plastics Industry  
[www.socplas.org](http://www.socplas.org)



**Table of Contents** *(scroll or use links below to navigate document)*

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find the Job?](#)

[Where Can the Job Lead?](#)

[Other Sources](#)



[View Career Video](#)

### What They Do

Almost everything we touch in our daily lives, such as the automobile you drive, contains parts crafted by a Machinist. Even items as books, magazines, and ice cream sundaes depend upon the skills of a Machinist in their production. Ice cream sundaes? Ice cream sundaes begin with a milking machine to milk the cow, a separating machine to separate the cream from the milk, an ice cream making machine to create the ice cream, a freezer to store it, an ice cream scoop to serve it, and a spoon to eat it. A Machinist is the key person in producing the needed equipment and utensils that ultimately result in the ice cream sundae you enjoy. The cow helps a little too!

Machinists use machine tools, such as lathes, drill presses, and milling machines to produce precision metal parts. Some Machinists produce large quantities of a single part. Other precision Machinists produce small batches or one-of-a-kind items. They use their knowledge of the working properties of metals and their skill with machine tools to plan and carry out the operations needed to make machined products that meet precise specifications.

### Tasks

- ▶ Study sample parts, blueprints, drawings, and engineering information in order to determine methods and sequences of operations needed to fabricate products, and determine product dimensions and tolerances.
- ▶ Calculate dimensions and tolerances using knowledge of mathematics and instruments such as micrometers and vernier calipers.
- ▶ Select appropriate tools, machines, and materials to be used in preparation of machinery work.
- ▶ Set up, adjust, and operate all of the basic machine tools and many specialized or advanced variation tools in order to perform precision machining operations.
- ▶ Machine parts to specifications using machine tools such as lathes, milling machines, shapers, or grinders.
- ▶ Align and secure holding fixtures, cutting tools, attachments, accessories, and materials onto machines.
- ▶ Monitor the feed and speed of machines during the machining process.
- ▶ Measure, examine, and test completed units in order to detect defects and ensure conformance to specifications, using precision instruments such as micrometers.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

# Machinists

## Important Skills, Knowledge, and Abilities

- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Troubleshooting — Determining causes of operating errors and deciding what to do about it.
- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ Equipment Maintenance — Performing routine maintenance on equipment and determining when and what kind of maintenance is needed.
- ▶ Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- ▶ Arm-Hand Steadiness — The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).

## Work Environment

Machinists work indoors in machine shops or factories which may or may not be air conditioned or heated. Machinists spend most of the day on their feet and must follow safety rules. They wear safety glasses to protect their eyes from flying metal pieces. Loud noise from machinery requires use of hearing protectors. Machinists often supply their own tools.

Machinists who work for large employers may belong to unions such as International Association of Machinists and Aerospace Workers. Generally, Machinists working for small employers do not belong to unions.

Some manufacturing plants operate around the clock, and Machinists may be required to work evenings, nights, or weekends as well as overtime when needed. As workers obtain seniority, they have more choice about shift assignments.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Machinists</b>                    |                                  |                                  |                         |                            |
| 51-4041                              | 34,200                           | 37,300                           | 1,110                   | \$13.84 to \$22.71         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

The occupation of Machinist will grow slower than average for all California occupations. Most job openings will come from Machinists retiring. Additional growth for Machinists jobs will occur in temporary help firms. Union membership is in decline because of outsourcing to nonunion shops.

### Training/Requirements/Apprenticeships

Machinists can obtain training in several ways:

- ▶ Formal, four-year apprenticeship
- ▶ Vocational school
- ▶ Community college programs or certificates
- ▶ Extensive on-the-job training

Four-year apprenticeship programs combine classroom and on-the-job training. Information about Machinist apprenticeships may be found at [www.dir.ca.gov](http://www.dir.ca.gov), a Web site that hosts an apprenticeship database maintained by the Division of Apprenticeship Standards. Apprenticeships require a high school diploma or GED.

Classroom training is often offered through community colleges and vocational schools. Degree and certificate programs in Machine Shop Technology, Machine Tool Technology, and Precision Systems Maintenance and Repair Technologies are offered in the community colleges.

#### Recommended High School Course Work

Helpful courses for high school students interested in Machinist work include mathematics, especially trigonometry, metalworking, machine shop, and drafting.

### Where Do I Find the Job?

Machine shops are the largest employer of Machinists, although most job growth will be in the temporary help (contract work) industry. Direct application to employers remains one of the most effective job search methods.

## Machinists

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Aircraft Engine and Engine Parts
- ▶ Aircraft
- ▶ Bolts, Nuts, Screws, Rivets, and Washers
- ▶ Employment Placement Agencies
- ▶ Guided Missiles and Space Vehicles
- ▶ Machine Shops
- ▶ Other Aircraft Parts and Equipment
- ▶ Other Guided Missile/Space Vehicle Parts
- ▶ Precision Turned Product
- ▶ Professional Employer Organizations
- ▶ Space Vehicle Propulsion Units and Parts
- ▶ Temporary Help Services

Search these **yellow page** headings for listings of private firms:

- ▶ Automobile Machine Shop Services
- ▶ Employment - Temporary
- ▶ Machine Shops
- ▶ Metal Fabricators
- ▶ Sheet Metal Work
- ▶ Tool Designers

### Where Can the Job Lead?

Experienced Machinists may advance to tool and die maker or numerical tool and process control programmer. They may be promoted to administrative or supervisory positions if the firm is large enough. They may open their own machine shop. With further education they could become tooling engineers or mechanical engineering technicians.

### Other Sources of Information

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

United Automobile Workers  
[www.uaw.org](http://www.uaw.org)

National Tooling & Machining Association  
[www.ntma.org](http://www.ntma.org)

Los Angeles Chapter of the National Tooling & Machining Association  
[www.lantma.org](http://www.lantma.org)

## Meat, Poultry, and Fish Processing Workers

**Table of Contents** *(scroll or use links below to navigate document)*

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find the Job?](#)

[Where Can the Job Lead?](#)

[Other Sources](#)



[View Career Video](#)

### What They Do

*Butchers and Meat, Poultry, and Fish Cutters and Trimmers* are employed at different food-processing stages by which animal carcasses are converted into manageable pieces of meat that are suitable for sale to wholesales and retailers. Butchers and Meat Cutters are usually employed at retail establishments, while Meat, Poultry, and Fish Cutters and Trimmers generally work in animal slaughtering and processing plants.

Butchers and Meat Cutters cut and separate wholesale cuts of meat into retail cuts or individually sized servings. They cut meat into steaks and chops, shape and tie roasts, and grind beef for sale as chopped meat. Butchers and Meat Cutters working in retail stores may weigh, wrap, and label the cuts of meat. They also arrange meat products in refrigerated cases for display. Butchers and Meat Cutters prepare special cuts to fill unique customer orders.

Poultry Cutters and Trimmers slaughter and cut up chickens, turkeys, and other types of poultry. Most Cutters and Trimmers perform routine cuts on poultry as it moves along production lines. The poultry-processing industry is becoming increasingly automated. However, many jobs such as trimming, packing, and deboning are still done manually.

Fish Cutters and Trimmers, also called fish cleaners, scale, cut, and prepare fish by removing the head, scales, and other inedible portions. Then they cut the fish into steaks or fillets. In retail stores, Fish Cutters and Trimmers may also wait on customers and clean fish to order.

Slaughterers and Meat Packers work in slaughtering and processing plants. They slaughter cattle, hogs, goats, and sheep, and cut the carcasses into large wholesale cuts, such as rounds, loins, ribs, and chucks. In some processing plants, Slaughterers and Meat Packers carve large parts into cuts that are ready for the retail market. They usually work on an assembly line with each individual responsible for only a few of the many cuts needed to process a carcass. Slaughterers and Meat Packers regularly use knives, cleavers, meat saws, bandsaws, or other dangerous equipment to convert carcasses into wholesale or retail cuts.

### Tasks

*Butchers and Meat Cutters*

- ▶ Cure, smoke, tenderize, and preserve meat.
- ▶ Cut, trim, bone, tie, and grind meats, such as beef, pork, poultry, and fish, to prepare meat in cooking form.

## Meat, Poultry, and Fish Processing Workers

- ▶ Prepare and place meat cuts and products in display counter, so they will appear attractive and catch the shopper's eye.
- ▶ Prepare special cuts of meat ordered by customers.

### *Meat, Poultry, and Fish, Cutters and Trimmers*

- ▶ Clean, trim, slice, and section carcasses for future processing.
- ▶ Cut and trim meat to prepare for packing.
- ▶ Inspect meat products for defects, bruises, or blemishes, and remove them along with any excess fat.
- ▶ Obtain and distribute specified meat or carcass.

### *Slaughterers and Meat Packers*

- ▶ Cut, trim, skin, sort, and wash viscera of slaughtered animals to separate edible portions from offal.
- ▶ Grind meat into hamburger, and into trimmings used to prepare sausages, luncheon meats, and other meat products.
- ▶ Remove bones and cut meat into standard cuts in preparation for marketing.
- ▶ Saw, split, or scribe carcasses into smaller portions to facilitate handling.

Detailed descriptions of these occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

## Important Skills, Knowledge, and Abilities

- ▶ 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.
- ▶ Biology — Knowledge of plant and animal organisms, their tissues, cells, functions, interdependencies, and interactions with each other and the environment.
- ▶ Food Production — Knowledge of techniques and equipment for planting, growing, and harvesting food products (both plant and animal) for consumption, including storage/handling techniques.
- ▶ 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.
- ▶ Public Safety and Security — Knowledge of relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).

## Meat, Poultry, and Fish Processing Workers

- ▶ **Wrist-Finger Speed** — The ability to make fast, simple, repeated movements of the fingers, hands, and wrists.
- ▶ **Static Strength** — The ability to exert maximum muscle force to lift, push, pull, or carry objects.
- ▶ **Arm-Hand Steadiness** — The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.
- ▶ **Extent Flexibility** — The ability to bend, stretch, twist, or reach with your body, arms, and/or legs.
- ▶ **Trunk Strength** — The ability to use your abdominal and lower back muscles to support part of the body repeatedly or continuously over time without ‘giving out’ or fatiguing.

### Work Environment

Most Butchers and Meat, Poultry, and Fish Cutters and Trimmers frequently work in cold, damp rooms which are refrigerated to prevent meat from spoiling. Work rooms are often damp because meat cutting generates large amounts of blood and condensation. These occupations require physical strength to lift and carry large cuts of meat and the ability to stand for long periods. Butchers, and Meat, Poultry, and Fish Cutters and Trimmers work in clean and sanitary conditions; however, their clothing is often soiled with animal blood and the air may smell unpleasant. They work with powerful cutting equipment and are susceptible to cuts on the fingers or hands. Risks are minimized with the proper use of equipment, hand, and stomach guards. The repetitive nature of the work, such as cutting and slicing may lead to wrist damage (carpal tunnel syndrome).

Butchers, Meat, Poultry, and Fish Processing workers usually work a 40-hour week. Those working in retail establishments may work on the weekends. Some of these workers belong to the United Food and Commercial Workers Union. (Refer to Other Sources of Information.)

### California’s Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification                | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Butchers and Meat Cutters</b>                    |                                  |                                  |                         |                            |
| 51-3021   | 18,600                           | 20,800                           | 630                     | \$10.03 to \$18.96         |
| <b>Meat, Poultry, and Fish Cutters and Trimmers</b> |                                  |                                  |                         |                            |
| 51-3022   | 8,000                            | 9,600                            | 340                     | \$8.09 to \$12.71          |
| <b>Slaughterers and Meat Packers</b>                |                                  |                                  |                         |                            |
| 51-3023   | 3,400                            | 3,700                            | 110                     | \$8.28 to \$11.67          |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

## Meat, Poultry, and Fish Processing Workers

### Trends

Employment of Butchers and Meat Cutters and Slaughterers and Packers is expected to grow at a slower rate than average for all occupations over the 2004–2014 period. Automation and the trend of centralizing the animal slaughtering and processing industries contributes to the employment decline of more highly skilled retail Butchers and Meat Cutters. Centralization enables employers to transfer employment from higher paid butchers to lower wage slaughterers and meatpackers in meatpacking plants. Currently, most red meat arrives at grocery stores partially cut. A growing quantity of meat is delivered prepackaged. This trend results in fewer jobs for retail butchers. However, opportunities will continue to arise from the need to replace employees who retire or leave the labor force for other reasons. Also, there will be a continuing need to meet the consumer demands of a growing population.

Employment of Meat, Poultry, and Fish Cutters and Trimmers is expected to grow faster than average for all occupations over the 2004–2014 period. The demand for poultry workers will remain strong with the growing popularity of labor-intensive, ready-to-heat poultry products. Also, Fish Cutters will remain in demand as the task of preparing ready-to-heat fish products continues to shift from retail stores to processing plants.

### Training/Requirements/Apprenticeships

Butchers, and Meat, Poultry, and Fish Cutters and Trimmers usually follow one of the following training paths:

- ▶ High school diploma preferred
- ▶ Formal two-year apprenticeship
- ▶ Vocational school
- ▶ Regional occupational program
- ▶ Extensive on-the-job training

Most Butchers and Meat Cutters, and Poultry and Fish Cutters and Trimmers learn their skills on the job through both formal and informal training programs. Trainees begin by performing less difficult jobs, such as making simple cuts or removing bones. They work under the guidance of experienced workers to learn the proper use and care of tools and equipment and how to prepare various cuts of meat. The training period for highly skilled Butchers at the retail level may be one or two years.

Butchers and Meat Cutters provide their own hand tools at the beginning of training. These include various knives, a cleaver, stitching needles, and a sharpening steel, that together may cost \$300 or higher.

There are a limited number of apprenticeship openings each year. The usual training path for meat clerks working in grocery stores is to advance into the Butchers and Meat Cutters apprenticeship program. The employer must have a signed agreement with the Joint Apprenticeship Committee. For Butchers and Meat Cutters, approximately 4,000 hours of supervised on-the-job training is required during a two-year apprenticeship program. Apprentices learn to operate powerful cutting tools. In addition to plant work, apprentices receive an average of 144 hours per year of related classroom instruction.

### Recommended High School Course Work

High school preparation courses in business mathematics and shop courses that develop skills in the use of hand and power tools are helpful.

## Meat, Poultry, and Fish Processing Workers

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Butchers and Meat Cutters, and Poultry and Fish Cutters and Trimmers should apply directly to employers for training or apprenticeship programs. Unions representing Butchers and Meat Cutters, and Poultry and Fish Cutters and Trimmers also have information concerning apprenticeships and related matters.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ All Other Specialty Food Stores
- ▶ Animal (except Poultry) Slaughtering
- ▶ Confectionery and Nut Stores
- ▶ Convenience Stores
- ▶ Fish and Seafood Markets
- ▶ Fruit and Vegetable Markets
- ▶ Meat Markets
- ▶ Meat Processed from Carcasses
- ▶ Poultry Processing
- ▶ Rendering and Meat By-Product Processing
- ▶ Supermarket and Other Grocery Stores

Search these **yellow page** headings for listings of private firms:

- ▶ Butchering
- ▶ Fish and Seafood Brokers
- ▶ Fish and Seafood, Retail
- ▶ Fish and Seafood, Wholesale
- ▶ Meat Brokers
- ▶ Meat Cutting Service
- ▶ Meat Packers
- ▶ Meat, Retail
- ▶ Meat, Wholesale
- ▶ Poultry Dealers, Retail
- ▶ Poultry Dealers, Wholesale
- ▶ Poultry Services

### Where Can the Job Lead?

Journey-level Meat Cutters may promote to head Meat Cutter, assistant manager, or manager of a shop. Journey-level Butchers may advance to an inspector or to supervisory positions. Butchers and Meat Cutters sometimes enter self-employment, becoming owners of retail shops.

### Other Sources of Information

American Association of Meat Processors  
[www.aamp.com](http://www.aamp.com)

California Poultry Federation  
[www.cpif.org](http://www.cpif.org)

Food Products Association  
[www.fpa-food.org](http://www.fpa-food.org)



## Milling and Planing Machine Setters, Operators, and Tenders

**Table of Contents** *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Milling and Planing Machine Setters, Operators, and Tenders set up, operate, or tend milling or planing machines to mill, plane, shape, groove, or profile metal or plastic work pieces. Milled pieces are used to manufacture everything from plastic plumbing parts to the bolts, nuts, and screws used to assemble other products. Milled parts could be tiny or large and heavy. As with other manufacturing machine technology occupations, workers usually begin as tenders and advance to operators. The most experienced workers are responsible for setting up horizontal and vertical mills and machining centers. They operate and inspect the first run and then turn the job over to an operator or tender. They maintain and repair the machine. Employers increasingly require computer numerical controlled (CNC) skills and experience. Employers sometime request experience on specific milling machine brands. Milling and Planing Machine Setters, Operators, and Tenders also inspect work to meet precise quality standards.

Employers often use the following job titles for Milling and Planing Machine Setters, Operators, and Tenders: Gear Milling Machine Set-Up Operator; Magnesium Mill Operator; Planer Type Milling Machine Set-Up Operator; Rotary Head Milling Machine Set-Up Operator; and Thread Milling Machine Set-Up Operator.

### Tasks

- ▶ Study blueprint, layout, sketch, or other specifications to determine materials needed, sequence of operations, dimensions, and tooling instructions.
- ▶ Compute dimensions, tolerances, and angles, of workpiece or machine according to specifications and knowledge of metal properties and shop mathematics.
- ▶ Make templates or cutting tools.
- ▶ Select and install cutting tool, stylus, and other accessories according to specifications, using hand tools or power tools.
- ▶ Select cutting speed, feed rate, and depth of cut, applying knowledge of metal properties and shop mathematics.
- ▶ Move controls to set cutting specifications, position cutting tool and workpiece in relation to each other, and start machine.
- ▶ Move cutter or material manually or by turning handwheel, or engage automatic feeding mechanism to mill workpiece to specifications.
- ▶ Turn valve to begin and regulate the flow of coolant on work area.

## Milling and Planing Machine Setters, Operators, and Tenders

- ▶ Observe machine operation and adjust controls to ensure conformance with specified tolerances.
- ▶ Record production output.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ 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.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).

### Work Environment

Milling and Planing Machine Tool Setters, Operators, and Tenders work indoors in machine shops and plants where temperatures are controlled. They are on their feet most of the day using their hands to control machinery. They must observe safety rules and be alert to the hazards of machinery constantly in motion. They often wear safety glasses, earplugs, and other protective equipment. They wear face masks equipped with breathing apparatus when toxic fumes or dust are present.

Some manufacturing plants operate around the clock, and workers may be required to work evening, night, or weekend shifts as well as overtime when needed. As workers obtain seniority, they have more choice about shift assignments. Union membership may be available in some industries.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification   | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Milling and Planing Machine Setters, Operators, and Tenders (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4035  | 3,200                            | 3,100                            | 60                      | \$11.27 to \$19.81         |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

## Milling and Planing Machine Setters, Operators, and Tenders

### Trends

The total number of Milling and Planing Machine Setters, Operators, and Tenders is expected to decline slightly between 2004 and 2014. Openings will occur as workers retire or permanently leave the occupation. Most openings now require computer numerically controlled (CNC) skills.

### Training/Requirements/Apprenticeships

Milling and Planing Machine Setters, Operators, and Tenders often are trained on the job in the basic skills. They start as a tender and then advance to operator and setter with experience. Community college or vocational school training programs in machine shop and machine tool technology are available in many areas of California. Use the *Training Information* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to identify training programs available in specific geographic locations.

### Recommended High School Course Work

High school students interested in this kind of work should take drafting and mathematics courses, especially trigonometry, as well as computer, metal, and machine shop courses when available.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Candidates for training or apprenticeship programs should apply directly to employers who employ Milling and Planing Machine Setters, Operators, and Tenders.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ All Other Motor Vehicle Parts
- ▶ Aluminum Foundries (except Die-Casting)
- ▶ Bolts, Nuts, Screws, Rivets, and Washers
- ▶ Gasoline Engines and Engine Parts
- ▶ Iron and Steel Mills
- ▶ Machine Shops
- ▶ Metal Cutting Machine tool
- ▶ Motor Vehicle Power Train Components
- ▶ Other Engine Equipment
- ▶ Precision Turned Product
- ▶ Special Tools, Dies, Jigs, and Fixtures
- ▶ Turbine Generator and Generator Set Units

Search these **yellow page** headings for listings of private firms:

- ▶ Machine Shops
- ▶ Metal Cutting Tools
- ▶ Metal Fabricators
- ▶ Millwork
- ▶ Plastic Fabricators
- ▶ Sheet Metal Work

### Where Can the Job Lead?

Opportunities for advancement depend on the size of firm. With additional training, Milling and Planing Machine Setters, Operators, and Tenders can pursue Tool and Die Maker or Machinist positions. Workers trained in computer numerically controlled (CNC) skills should find excellent job opportunities.

## Milling and Planing Machine Setters, Operators, and Tenders

### Other Sources of Information

National Tooling & Machining Association

[www.ntma.org](http://www.ntma.org)

National Institute for Metalworking Skills

[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation

[www.pmaef.org](http://www.pmaef.org)

Precision Machined Products Association

[www.pmpa.org](http://www.pmpa.org)

The Society of the Plastics Industry

[www.socplas.org](http://www.socplas.org)

### Table of Contents *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |



[View Career Video](#)

### What They Do

Millwrights install, dismantle, repair, and replace machinery and heavy equipment in manufacturing firms that use assembly lines, as well as at construction sites. They generally work for a contracting company, performing jobs at different factories and locations as contracts come and go. Before the machines even get to the factory or construction site, the Millwright is there to consult with the production managers and others to determine the optimal placement of machines in a plant. When this placement requires building a new foundation, Millwrights either prepare the foundation themselves or supervise its construction.

Millwrights measure angles, material thickness, and small distances, with tools such as squares, calipers, and micrometers. When a high level of precision is required, devices such as lasers and ultrasonic measuring tools may be used. Millwrights also work with hand and power tools, such as cutting torches, welding machines, and soldering guns, and with metalworking equipment, including lathes and grinding machines.

The wide range of facilities and the development of new technology require Millwrights to continually update their skills—from blueprint reading and pouring concrete—to diagnosing and solving mechanical problems.

### Tasks

- ▶ Position steel beams to support bedplates of machines and equipment, using blueprints and schematic drawings, to determine work procedures.
- ▶ Signal crane operator to lower basic assembly units to bedplate, and align unit to centerline.
- ▶ Align machines and equipment, using hoists, jacks, hand tools, squares, rules, micrometers, and plumb bobs.
- ▶ Assemble and install equipment, using hand tools and power tools.
- ▶ Insert shims, adjust tension on nuts and bolts, or position parts, using hand tools and measuring instruments, to set specified clearances between moving and stationary parts.
- ▶ Connect power unit to machines or steam piping to equipment, and test unit to evaluate its mechanical operation.
- ▶ Replace defective parts of machine or adjust clearances and alignment of moving parts.
- ▶ Repair and lubricate machines and equipment.

Detailed descriptions of this occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

## Millwrights

### Important Skills, Knowledge, and Abilities

- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.  
Repairing — Repairing machines or systems using the needed tools.  
Installation — Installing equipment, machines, wiring, or programs to meet specifications.
- ▶ Troubleshooting — Determining causes of operating errors and deciding what to do about it.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Wrist-Finger Speed — The ability to make fast, simple, repeated movements of the fingers, hands, and wrists.
- ▶ Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.

### Work Environment

Most Millwrights work full-time, sometimes in shift work, sometimes outdoors, although working conditions tend to vary from job to job. The work environment can be noisy and there is always a risk of injury involved in working with heavy machinery.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Millwrights</b>                   |                                  |                                  |                         |                            |
| 49-9044                              | 3,500                            | 4,000                            | 130                     | \$20.32 to \$30.24         |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Despite projected slower-than-average employment growth, skilled applicants for Millwright positions should have good job opportunities, especially those with up-to-date skills in laser shaft alignment and vibration analysis. Nationally, about 6 in 10 Millwrights belong to labor unions, one of the highest rates of membership in the economy.

### Training/Requirements/Apprenticeships

Millwrights normally receive training for four years through apprenticeship programs that combine on-the-job training with classroom instruction or through community college coupled with informal on-the-job training. These programs include training in dismantling, moving, erecting, and repairing machinery.

Employers prefer applicants with a high school diploma or equivalency and some vocational training or experience.

#### Recommended High School Course Work

Courses in science, mathematics, mechanical drawing, computers, and machine shop practice are useful.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Candidates for training or apprenticeship programs should apply directly to employers who employ Millwrights. Unions representing Millwrights also have information concerning apprenticeships and related matters.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ Oil and Gas Pipeline Construction
- ▶ Other Heavy Construction
- ▶ Power/Communication System Construction
- ▶ Sawmills
- ▶ Water and Sewer System Construction
- ▶ Wood Preservation

Search these **yellow page** headings for listings of private firms:

- ▶ Millwrights
- ▶ Machinery, Repairing
- ▶ Machinery Movers and Erectors
- ▶ Machine Shops

### Where Can the Job Lead?

Advancement for Millwrights usually takes the form of higher wages. Some advance to the position of supervisor or superintendent, while others may become self-employed contractors.

### Other Sources of Information

California Division of Apprenticeship Standards  
[www.dir.ca.gov/das](http://www.dir.ca.gov/das)

Northern California Millwrights, Local 102  
[www.millwrights102.com](http://www.millwrights102.com)

Union Millwrights' Local 1607, Los Angeles  
[www.unionmillwright.com/1607.html](http://www.unionmillwright.com/1607.html)



**Table of Contents** *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Mixing and Blending Machine Setters, Operators, and Tenders are used to make a vast array of products such as medicines, cleaning products, asphalt, color pigments, and explosives. These workers set up, run, and tend machines that mix or blend dry or wet ingredients before sending them on their way to the next step toward a final product.

### Tasks

- ▶ Add or mix chemicals and ingredients for processing, using hand tools or other devices.
- ▶ Compound and process ingredients or dyes according to formulas.
- ▶ Dislodge and clear jammed materials or other items from machinery and equipment, using hand tools.
- ▶ Dump or pour specified amounts of materials into machinery and equipment.
- ▶ Examine materials, ingredients, or products visually or with hands, in order to ensure conformance to established standards.
- ▶ Observe production and monitor equipment to ensure safe and efficient operation.
- ▶ Open valves to drain slurry from mixers into storage tanks.
- ▶ Read work orders to determine production specifications and information.
- ▶ Start machines to mix or blend ingredients; then allow them to mix for specified times.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

### Important Skills, Knowledge, and Abilities

- ▶ 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.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.

## Mixing and Blending Machine Setters, Operators, and Tenders

- ▶ **Quality Control Analysis** — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ **Problem Sensitivity** — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- ▶ **Control Precision** — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.

### Work Environment

Overall, workers enjoy clean, well lit, and well ventilated work spaces. Some moderately heavy lifting is required when Mixing and Blending Operators place ingredients into mixers; however, modern operations will have assistive devices such as overhead dispensers and hoists. Operators must have stamina to remain on their feet much of the day. Also, these workers operate powerful, high-speed machines that can be dangerous if safety rules are not observed. In medicine and cleaning agent manufacturing, Mixing and Blending Operators often wear hairnets, uniform coats, gloves, and sometimes masks. Some workers must follow strict safety guidelines to avoid coming into contact with toxic or caustic chemicals.

Most workers in the occupation put in a 40-hour week, but overtime is common during periods of increased production. Some operators work nights and weekends.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification                               | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Mixing and Blending Machine Setters, Operators, and Tenders</b> |                                  |                                  |                         |                            |
| 51-9023  | 8,500                            | 9,600                            | 330                     | \$10.65 to \$17.57         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

This occupation is growing slower than average for all occupations in California, due to competition from overseas manufacturers, and due to the increasing automation of machines that requires fewer workers. Most job opportunities will occur as workers retire or leave the job for other kinds of work. The largest increases in worker needs will be seen in pharmaceutical manufacturing and temporary work agencies.

### Training/Requirements/Apprenticeships

Mixing and Blending Machine Setters, Operators, and Tenders almost always are trained on the job, most completing training periods within one year. Graduation from high school is preferred but not always required. In addition, a growing number of workers will receive broader training to set up and tend other types of machines. This is part of a trend to have employees work in teams and rotate tasks and responsibilities.

## Mixing and Blending Machine Setters, Operators, and Tenders

### Recommended High School Course Work

High school students interested in this kind of work should take metal shop courses and mathematics.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ In-Vitro Diagnostic Substance
- ▶ Medicinal and Botanical
- ▶ Pharmaceutical Preparation
- ▶ Polish and Sanitation Goods
- ▶ Soap and Other Detergent
- ▶ Toilet Preparation

Search these **yellow page** headings for listings of private firms:

- ▶ Cleaning Compounds
- ▶ Pharmaceutical Products, Manufacturers

### Where Can the Job Lead?

Advancement may come in the form of higher earnings or more responsibility. Some workers who perform exceptionally well on the production line, learn to operate multiple machines in the production process, and have good communication skills may advance to supervisory positions. Plant size and the existence of formal promotion tracks may influence advancement opportunities.

### Other Sources of Information

Precision Machined Products Association  
[www.pmpa.org](http://www.pmpa.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)



## Molding, Coremaking, and Casting Machine Operators

**Table of Contents** (*scroll or use links below to navigate document*)

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Molding, Coremaking, and Casting Machine Operators (Metal) tend machines that cut and form all types of metal parts. They operate or tend metal molding, casting, or coremaking machines to mold or cast metal products, such as pipes and motor parts. The machines include vacuum casting machines, turnover draw-type coremaking machines, conveyor-screw coremaking machines, and die casting machines.

Operators may tend grinding machines that remove excess material from the surface of machined products or presses that extrude metal through a die to form wire. These workers may place metal stock in a machine on which the operating specifications have already been set. They may watch one or more machines and make minor adjustments according to their instructions.

Molding, Coremaking, and Casting Machine Operators (Plastic) tend machines that transform plastic compounds into a variety of consumer goods such as toys, tubing, and auto parts. Operators produce these products by using plastic molding machines, such as compression or injection molding machines, of which injection molding is the most common. Operators monitor the many gauges on the injection-molding machines, adjusting different inputs, pressures, and speeds to maintain quality. The injection-molding machine heats and liquefies a plastic compound and forces it into a mold. After the part has cooled and hardened, the mold opens and the part is released.

Molding, Coremaking, and Casting Machine Operators (Plastic) usually use an extruding machine to produce long parts such as pipes or window frames. These machines force a plastic compound through a die that contains an opening with the desired shape of the final product. Blow-molding is another common plastics working technique. Blow-molding machines force hot air into a mold, that contains a plastic tube. As the air moves into the mold, the tube is inflated to the shape of the mold, and a plastic container is formed.

### Tasks

*Molding, Coremaking, and Casting Machine Operators (Metal)*

- ▶ Start and operate furnace, oven, diecasting, coremaking, metal molding, or rotating machines to pour metal or create molds and casts.
- ▶ Remove casting from mold, mold from press, or core from core box, using tongs, pliers, hydraulic ram, or by inversion.
- ▶ Pour or load metal or sand into melting pot, furnace, mold, core box or hopper, using shovel, ladle, or machine.
- ▶ Inspect metal casts and molds, for cracks, bubbles, or other defects, and measures castings to ensure specifications are met.

## Molding, Coremaking, and Casting Machine Operators

- ▶ Clean, glue, and rack cores, ingots, or finished products for storage.
- ▶ Cut spouts and pouring holes in molds and sizes hardened cores, using saws.

### *Molding, Coremaking, and Casting Machine Operators (Plastic)*

- ▶ Start machine that automatically liquefies plastic material in heating chamber, injects liquefied material into mold, and ejects molded product.
- ▶ Observe meters and gauges to verify specified temperatures, pressures, and press-cycle times.
- ▶ Turn valves and dials of machines to regulate pressure and temperature, to set press-cycle time, and to close press.
- ▶ Observe continuous operation of automatic machine and width and alignment of plastic sheeting to ensure side flanges.
- ▶ Weigh prescribed amounts of material for molded part and finished product to ensure specifications are maintained.
- ▶ Remove product from mold or conveyor, and clean and reload mold.
- ▶ Position mold frame to correct alignment and tubs containing mixture on top of mold to facilitate loading of molds.

Detailed descriptions of these occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ 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.
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Repairing — Repairing machines or systems using the needed tools.
- ▶ Science — Using scientific rules and methods to solve problems.

## Molding, Coremaking, and Casting Machine Operators

- ▶ Coordination — Adjusting actions in relation to others' actions.
- ▶ Production and Processing — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- ▶ Number Facility — The ability to add, subtract, multiply, or divide quickly and correctly.

### Work Environment

Most Molding, Coremaking, and Casting Machine Operators (Metal and Plastic) work in areas that are clean, well lit, and well ventilated. They are on their feet much of the day and may do moderately heavy lifting. These workers operate powerful, high-speed machines that can be dangerous. However, risks are minimized if workers wear protective equipment, such as safety glasses and earplugs, to protect against flying particles of metal or plastic and against noise from the machines. Workers in the plastics industry who work near materials that emit dangerous fumes or dust must wear face masks or a self-contained breathing apparatus. Most operators work a 40-hour week. However, overtime is common during periods of increased production. Many shops operate more than one daily shift. Therefore, some operators may work nights and weekends.

### What's the California Job Outlook?

The California outlook and wage below represent the occupation across all industries.

| Standard Occupational Classification  | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Molding, Coremaking, and Casting Machine Operators (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4072   | 13,100                           | 12,800                           | 330                     | \$8.48 to \$13.69          |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Employment of Molding, Coremaking, and Casting Machine Operators (Metal and Plastic) is expected to decline slightly through 2014. Job growth will continue to be influenced by automation. In order to remain competitive with foreign manufacturers, many firms are using new technologies, such as computer-controlled machine tools and robots to lower production costs. Labor-saving machinery tends to reduce the need for lower-skilled machine operators, because the tasks they perform are more easily automated. However, opportunities will continue to arise for those with experience on a wide variety of machines, and a good working knowledge of the properties of metals and plastics.

### Training/Requirements/Apprenticeships

Most Molding, Coremaking, and Casting Machine Operators (Metal and Plastic) usually follow one of the following training paths:

- ▶ High school diploma or equivalent
- ▶ Extensive on-the-job training

## Molding, Coremaking, and Casting Machine Operators

Some employers may offer formal training programs or apprenticeship opportunities. Also, industry associations offer voluntary certification through an exam process. The Institute for Metalworking Skills and the Society of Plastics Industry offer machine operator certification for their respective industries. Refer to Other Sources of Information.

### Recommended High School Course Work

High school preparation courses in machine shop, blueprint reading, algebra, geometry, language arts, and computer technology are helpful.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ All Other Miscellaneous Manufacturing
- ▶ All Other Plastics Product
- ▶ Dental Laboratories
- ▶ Employment Placement Agencies
- ▶ Jewelry (except Costume)
- ▶ Nonpackaging Plastics Film and Sheet
- ▶ Professional Employer Organizations
- ▶ Signs
- ▶ Sporting and Athletic Goods
- ▶ Surgical Appliance and Supplies
- ▶ Temporary Help Services
- ▶ Urethane and Other Foam Products

Search these **yellow page** headings for listings of private firms:

- ▶ Metal Castings
- ▶ Metal Cutting Tools
- ▶ Metal Fabricators
- ▶ Metal Rolling and Forming
- ▶ Metal Stamping
- ▶ Plastic Fabricators
- ▶ Plastics Molders, Injection
- ▶ Plastics Molders, Rotational

### Where Can the Job Lead?

Advancement opportunities for operators generally takes the form of higher pay. Although, there are some limited opportunities for operators to advance to Multiple-Machine Operators, Set-Up Operators, or trainees for the more highly skilled position of Machinist, Tool and Die Maker, or Computer-Control Programmer or Operator. Also, skilled set-up workers may advance to supervisory positions.

### Other Sources of Information

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

National Tooling & Machining Association  
[www.ntma.org](http://www.ntma.org)

The Society of the Plastics Industry  
[www.socplas.org](http://www.socplas.org)

## Multiple Machine Tool Setters, Operators, and Tenders

**Table of Contents** *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Almost all products from refrigerators to clock radios are made of metal and/or plastic parts. Multiple Machine Tool Setters, Operators, and Tenders (Metal and Plastic) form part of the manufacturing team that turns out the metal and plastic parts we depend on from morning to night. They often set up, operate, or tend more than one type of cutting or forming machine tool or robot.

Workers often begin as machine tenders, feeding materials into the machine, starting and stopping the machine, and removing finished products. With experience they become Multiple Machine Tool Operators taking on the responsibility of adjusting speeds, changing cutting tools, and inspecting completed product for quality. They operate or tend more than one type of cutting or forming machine tool which has been previously set up, such as band saws, press brakes, slitting machines, drills, lathes, and boring machines.

Machine setters follow blueprints, layouts, and instructions to prepare the machines for production. Setters are the highest skill level for Multiple Machine Tool Setters, Operators, and Tenders. They set up, or set up and operate, more than one type of cutting or forming machine tool, such as gear hobbers, lathes, press brakes, shearing, and boring machines.

### Tasks

- ▶ Set up and operate lathes, cutters, borers, millers, grinders, presses, drills, and auxiliary machines to make metallic and plastic workpieces.
- ▶ Compute data, such as gear dimensions and machine settings, applying knowledge of shop mathematics.
- ▶ Lift, position, and secure workpieces in holding devices, using hoists and hand tools.
- ▶ Measure and mark reference points and cutting lines on workpiece, using traced templates, compasses, and rules.
- ▶ Select, install, and adjust alignment of drills, cutters, dies, guides, and holding devices, using template, measuring instruments, and hand tools.
- ▶ Install machine components, such as chucks, boring bars, or cutting tools, according to specifications, using hand tools.
- ▶ Move controls or mounts gears, cams, or templates in machine to set feed rate and cutting speed, depth, and angle.
- ▶ Activate and tend or operate machines to cut, shape, thread, bore, drill, tap, bend, or mill metal or nonmetallic material.

## Multiple Machine Tool Setters, Operators, and Tenders

- ▶ Position, adjust, and secure workpiece against stops, on arbor, or in chuck, fixture, or automatic feeding mechanism manually or using hoist.
- ▶ Align layout marks with die or blade.
- ▶ Inspect workpiece for defects and measure workpiece, using rule, template, or other measuring instruments to determine accuracy of machine operation.
- ▶ Remove burrs, sharp edges, rust, or scale from workpiece, using file, hand grinder, wire brush, or power tools.
- ▶ Make minor electrical and mechanical repairs and adjustments to machines, and notify supervisor when major service is required.
- ▶ Set machine stops or guides to specified length as indicated by scale, rule, or template.
- ▶ Adjust machine components and change worn accessories, such as cutting tools and brushes, using hand tools.
- ▶ Perform minor machine maintenance, such as oiling or cleaning machines, dies, or workpieces, or adding coolant to machine reservoir.
- ▶ Extract or lift jammed pieces from machine, using fingers, wire hooks, or lift bar.
- ▶ Instruct operators or other workers in machine setup and operation.
- ▶ Record operational data such as pressure readings, length of stroke, feeds, and speeds.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

### Important Skills, Knowledge, and Abilities

- ▶ 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.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ Installation — Installing equipment, machines, wiring, or programs to meet specifications.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).

## Multiple Machine Tool Setters, Operators, and Tenders

### Work Environment

Multiple Machine Tool Setters, Operators, and Tenders work indoors in machine shops and factories with controlled environment for worker comfort and product quality. They must be alert to the hazards of machinery constantly in motion and observe safety rules. They often wear safety glasses and earplugs and other protective equipment. Many operators stand most of the day. Operators must keep pace with the production line.

Some manufacturing plants operate around the clock, and may require evenings, nights, or weekend shift work as well as overtime when needed. As workers obtain seniority, they have more choice about shift assignments. The availability of union membership depends on size of firm and industry.

### California's Job Outlook and Wages

The California Outlook and Wage below represents the occupation across all industries.

| Standard Occupational Classification   | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Multiple Machine Tool Setters, Operators, and Tenders (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4081  | 6,100                            | 6,400                            | 200                     | \$10.28 to \$16.36         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Manufacturers of both metal and plastics products face global competition. Multiple Machine Tool Setters, Operators, and Tenders will grow slower than average through 2014 for all California occupations due to increased automation as well as offshore production. Most openings will occur from replacing retiring baby boom generation workers.

### Training/Requirements/Apprenticeships

Multiple Machine Tool Setters, Operators, and Tenders are often trained on the job, working their way up from tender to operator to setter. Community college and vocational schools offer programs in machine shop technology and machine tool technology. Formal apprenticeship programs may be available at times. The trend toward a team approach to production requires workers who learn quickly and have sound reading, math, and communication skills.

### Recommended High School Course Work

High school students interested in this kind of work should take mathematics, algebra, geometry, computer classes, and metal shop when available.

### Where Do I Find the Job?

Candidates for training or apprenticeship programs should apply directly to employers who employ Multiple Machine Tool Setters, Operators, and Tenders. Community colleges offer assistance in finding jobs to graduates of degree or certificate programs.

## Multiple Machine Tool Setters, Operators, and Tenders

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ All Other Miscellaneous Manufacturing
- ▶ Audio and Visual Equipment
- ▶ Bare Printed Circuit Board
- ▶ Bolts, Nuts, Screws, Rivets, and Washers
- ▶ Dental Laboratories
- ▶ Machine Shops
- ▶ Other Electronic Component
- ▶ Precision Turned Product
- ▶ Semiconductor and Related Devices
- ▶ Sign
- ▶ Surgical and Medical Instrument
- ▶ Surgical Appliance and Supplies

Search these **yellow page** headings for listings of private firms:

- ▶ Die Makers
- ▶ Metal Cutting Tools
- ▶ Metal Fabricators
- ▶ Metal Rolling and Forming
- ▶ Metal Stamping
- ▶ Plastic Fabricators
- ▶ Sheet Metal Work
- ▶ Tool Designers

### Where Can the Job Lead?

Multiple Machine Tool Setters, Operators, and Tenders can pursue skill certification through the National Institute for Metalworking Skills or the Society of Plastics Industry. Certification is based upon a combination of coursework, experience, and passing exams. Operators can advance to supervisory positions or the occupations of Machinist and Tool and Die Maker with further training.

### Other Sources of Information

National Tooling & Machining Association  
[www.ntma.org](http://www.ntma.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

Precision Machined Products Association  
[www.pmpa.org](http://www.pmpa.org)

The Society of the Plastics Industry  
[www.socplas.org](http://www.socplas.org)

## Numerical Tool and Process Control Programmers

**Table of Contents** *(scroll or use links below to navigate document)*

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find the Job?](#)

[Where Can the Job Lead?](#)

[Other Sources](#)



[View Career Video](#)

### What They Do

Many of the functions in machining that were formerly performed by human operators are now more precisely performed by a computer-controlled module. This is true for machines such as lathes, multi-axis spindles, milling machines, and electrical discharge machines.

Before Numerical Tool and Process Control Programmers machine a part, they must carefully plan, prepare, and write computer programs for the operation. First, they review three-dimensional computer aided/automated design (CAD) blueprints of the part. Next, they calculate where to cut or bore into the workpiece, how fast to feed the metal into the machine, and how much metal to remove. They then select tools and materials for the job and plan the sequence of cutting and finishing operations. Finally, they turn the planned machining operations into a set of instructions or program for the machine to follow.

Numerical Tool and Process Control Programmers work on desktop computers in offices that typically are near, but separate from, the shop floor.

### Tasks

- ▶ Prepare geometric layout from graphic displays, using computer-assisted drafting software or drafting instruments and graph paper.
- ▶ Analyze drawings, specifications, printed circuit board pattern film, and design data to calculate dimensions, tool selection, machine speeds, and feed rates.
- ▶ Determine reference points, machine cutting paths, or hole locations, and compute angular and linear dimensions, radii, and curvatures.
- ▶ Write instruction sheets, cutter lists, and machine instruction programs to guide setup and encode numerical control tape.
- ▶ Draw machine tool paths on pattern film, using colored markers and following guidelines for tool speed and efficiency.
- ▶ Enter computer commands to store or retrieve parts patterns, graphic displays, or programs to transfer data to other media.
- ▶ Move reference table to align pattern film over circuit board holes with reference marks on enlarger scope.

## Numerical Tool and Process Control Programmers

- ▶ Align and secure pattern film on reference table of optical programmer and observe enlarger scope view of printed circuit board.
- ▶ Compare encoded tape or computer printout with original program sheet to verify accuracy of instructions.
- ▶ Revise numerical control machine tape programs to eliminate instruction errors and omissions.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge and Abilities

- ▶ 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.
- ▶ Operations Analysis — Analyzing needs and product requirements to create a design.
- ▶ Programming — Writing computer programs for various purposes.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ Technology Design — Generating or adapting equipment and technology to serve user needs.
- ▶ Complex Problem Solving — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- ▶ Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Troubleshooting — Determining causes of operating errors and deciding what to do about them.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).

### Work Environment

Numerical Tool and process Control Programmers work on desktop computers in offices that typically are near, but separate from, the shop floor. These work areas usually are clean, well lit, and free of machine noise. Numerical Tool and Process Control Programmers occasionally need to enter the shop floor to monitor numerically-controlled machining operations. On the shop floor, Programmers encounter the same hazards and exercise the same safety precautions as do the operators. Most Computer Numerical Controlled (CNC) and Process Control Programmers work a 40-hour week; however, overtime is common during peak production periods.

## Numerical Tool and Process Control Programmers

### California's Job Outlook and Wages

The California outlook and wage below represent the occupation across all industries.

| Standard Occupational Classification                  | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Numerical Tool and Process Control Programmers</b> |                                  |                                  |                         |                            |
| 51-4012   | 2,000                            | 2,100                            | 40                      | \$20.29 to \$32.49         |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

As the programming of tools becomes easier, it may eventually be included in machinists' tasks. This could have an adverse effect on the numbers of Numerical Tool and Process Control Programmers required by employers. In California, the occupation is growing slower than average for all occupations; most of the hiring activity expected between 2004 and 2014 will be the replacement of workers who have left for retirement or other types of work. Some growth is expected in the semiconductor component industry, as well as forging and stamping firms.

### Training/Requirements/Apprenticeships

Numerical Tool and Process Control Programmers usually follow one of the following training paths:

- ▶ Formal, four-year apprenticeship
- ▶ Community college programs or certificates
- ▶ Vocational school
- ▶ Extensive on-the-job training

Information about CNC Tool Programmer apprenticeships may be found at [www.dir.ca.gov](http://www.dir.ca.gov), the Department of Industrial Relations' Web site, which maintains an apprenticeship database for California programs. Apprenticeships require a high school diploma or GED. A growing number of Numerical Tool and Process Control Programmers receive most of their formal training from community or technical colleges.

Some community colleges offer tool design technology courses in their Machine Tool Technology programs. Programs accredited by the National Institute for Metalworking Skills (NIMS) are listed at their Web site ([www.nims-skills.org](http://www.nims-skills.org)).

### Recommended High School Course Work

High school students interested in this kind of work should take mathematics, especially trigonometry, as well as metal shop courses.

## Numerical Tool and Process Control Programmers

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Aircraft Engine and Engine Parts
- ▶ Aircraft Manufacturing
- ▶ Bolts, Nuts, Screws, Rivets, and Washers
- ▶ Guided Missiles and Space Vehicles
- ▶ Machine Shops
- ▶ Other Aircraft Parts and Equipment
- ▶ Precision Turned Products Manufacturing

Search these **yellow page** headings for listings of private firms:

- ▶ CAD Systems
- ▶ Machine Tools
- ▶ Tools
- ▶ Tool Designers

### Where Can the Job Lead?

Experienced Numerical Tool and Process Control Programmers can advance to Tool Designers or management positions. A few open their own shops.

### Other Sources of Information

Precision Machined Products Association  
[www.pmpa.org](http://www.pmpa.org)

National Tooling & Machining Association  
[www.ntma.org](http://www.ntma.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

### Table of Contents *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

*Coating, Painting, and Spraying Machine Setters, Operators, and Tenders* control the machinery that applies paints and coatings to a wide range of manufactured products such as food products, glassware, cloth, ceramic, metal, plastic, paper, and wood products. Many paints and coatings have a dual purpose of enhancing product appearance and providing protection from weather or corrosion. Products may be painted or coated with a variety of finishes: lacquer, silver, and copper solution, rubber, paint, varnish, glaze, enamel, oil, or rust-proofing materials.

Spraying Machine Operators use spray guns to coat products. They follow a formula to fill equipment tanks with a mixture of paints or chemicals. They adjust nozzles on the spray guns to obtain the proper dispersion of the spray and hold or position the guns to direct the spray onto the object. Spraying Machine Operators also check the flow of the paint or solution and visually inspect the quality of the coating. These workers regulate the temperature and air circulation in drying ovens while products are drying.

*Painters, Transportation Equipment* refinish old and damaged cars, trucks, and buses in automotive body repair and paint shops. They perform intricate, detailed work and mix paint to match the original vehicle color. Transportation Equipment Painters are considered among the most highly skilled manual spray operators. Painters use power sanders and sandpaper to remove the original paint or rust and then fill small dents and scratches with body filler. They remove parts and trim that are not to be painted. Equipment or Automotive Painters use a spray gun to apply several coats of paint. They apply lacquer, enamel, or water-based primers to vehicles with metal bodies and flexible primer to newer vehicles with plastic body parts. Painters apply successive paint coats with a spray gun until the finish of the repaired sections match that of the undamaged portions of the vehicle. They may place the painted vehicle or parts under heat lamps or in an infrared oven to speed drying. Equipment or Automotive Painters sand the surface after each coat of primer dries to remove any imperfections. Final sanding of the primer coats is done by hand with a fine grade of sandpaper. Then Painters apply a sealer and a final topcoat.

### Tasks

*Coating, Painting, and Spraying Machine Setters, Operators, and Tenders*

- ▶ Observe machine operation and gauges to detect defects or deviations from standards.
- ▶ Fill hopper, reservoir, trough, or pan with material used to coat, paint, or spray, using conveyor or pail.
- ▶ Measure and mix specified quantities of substances to create coatings, paints, or sprays.
- ▶ Thread or feed item or product through or around machine rollers and dryers.

## Painting and Coating Workers (except Const. and Maintenance)

- ▶ Set up and operate machines to paint or coat products with such materials as silver and copper solution, rubber, paint, glaze, oil, or rust proofing materials.
- ▶ Remove materials, parts, or workpieces from painting or coating machines, using hand tools.
- ▶ Record operational data on specified forms.
- ▶ Clean and maintain coating and painting machines, using hand tools.

### *Painters, Transportation Equipment*

- ▶ Adjust controls on infrared ovens, heat lamps, portable ventilators, and exhaust units in order to speed the drying of vehicles between coats.
- ▶ Allow the sprayed product to dry, and then touch up any spots that may have been missed.
- ▶ Apply designs, lettering, or other identifying or decorative items to finished products, using paint brushes or paint sprayers.
- ▶ Apply primer over any repairs made to vehicle surfaces.
- ▶ Apply rust-resistant undercoats, and caulk and seal seams.
- ▶ Buff and wax the finished paintwork.

Detailed descriptions of these occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

## Important Skills, Knowledge, and Abilities

### *Coating, Painting, and Spraying Machine Setters, Operators, and Tenders*

- ▶ **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.
- ▶ **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** — Using mathematics to solve problems.
- ▶ **Operation Monitoring** — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ **Equipment Selection** — Determining the kind of tools and equipment needed to do a job.
- ▶ **Control Precision** — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ **Problem Sensitivity** — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- ▶ **Manual Dexterity** — The ability to move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ **Trunk Strength** — The ability to use your abdominal and lower back muscles to support part of the body repeatedly or continuously over time without 'giving out' or fatiguing.
- ▶ **Near Vision** — The ability to see details at close range (within a few feet of the observer).

## Painting and Coating Workers (except Const. and Maintenance)

### Painters, Transportation Equipment

- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Visual Color Discrimination — The ability to match or detect differences between colors, including shades of color and brightness.
- ▶ Arm-Hand Steadiness — The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.
- ▶ Gross Body Equilibrium — The ability to keep or regain your body balance or stay upright when in an unstable position.
- ▶ Dynamic Flexibility — The ability to quickly and repeatedly bend, stretch, twist, or reach out with your body, arms, and/or legs.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).

### Work Environment

Coating and Painting Workers usually work indoors in special ventilated booths. They may be exposed to dangerous fumes from paint and coating solutions. However, the risk is minimal if Painters wear masks or respirators that cover their noses and mouths and adhere to safety rules. Operators may stand for long periods of time. When using a spray gun, they may have to bend, stoop, or crouch in uncomfortable positions to reach different parts of an object. Most Coating and Painting Workers generally work a 40-hour week. Self-employed automotive painters sometimes work more than 50 hours a week depending on the number of vehicles customers want repainted.

Many Transportation Equipment Painters working for large manufacturers or motor vehicle dealers belong to unions including the International Brotherhood of Painters and Allied Trades, the International Brotherhood of Teamsters, and the Sheet Metal Workers International Association.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupations across all industries.

| Standard Occupational Classification   | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Coating, Painting, and Spraying Machine Setters, Operators, and Tenders</b> |                                  |                                  |                         |                            |
| 51-9121  | 9,500                            | 9,600                            | 260                     | \$9.21 to \$16.11          |
| <b>Painters, Transportation Equipment</b>                                      |                                  |                                  |                         |                            |
| 51-9122  | 6,900                            | 8,400                            | 330                     | \$13.98 to \$24.80         |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

## Painting and Coating Workers (except Const. and Maintenance)

### Trends

Employment of Coating, Painting, and Spraying Machine Setters, Operators, and Tenders is expected to grow slower than average over the 2004–2014 period. However, opportunities will continue to arise from the need to replace workers who retire or leave the labor force for other reasons.

Employment of Transportation Equipment Painters is expected to grow faster than average for all occupations over the 2004–2014 period. The demand for highly skilled transportation painters and auto refinishers will be greater than for lesser-skilled Painting, Coating, and Spraying Machine Operators. The detailed work of refinishing automobiles in repair shops does not lend itself to automation. Automotive painters can expect relatively steady work because automobiles damaged in accidents require repair and refinishing regardless of the state of the economy.

### Training/Requirements/Apprenticeships

Coating, Painting, and Spraying Machine, Operators, and Tenders; and Painters, Transportation Equipment usually follow one of the following training paths:

- ▶ High school diploma preferred
- ▶ Adult education
- ▶ Vocational school
- ▶ Community college programs/certificates
- ▶ Extensive on-the-job training

A high school diploma is not required, but it is helpful. Many community colleges and vocational or technical schools offer instructional programs that enhance employment and advancement opportunities.

Voluntary certification for automotive painters is available through the National Institute for Automotive Service Excellence. To obtain certification, painters must pass a written exam and have at least two years experience in the field. Painters must take the exam every five years to recertify.

#### Recommended High School Course Work

High school preparation courses in art, shop, auto shop, accounting, chemistry, general business, business mathematics, and computer technology are helpful. Accounting and business classes are particularly helpful for those who plan to enter self-employment.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Unions representing Transportation Equipment Painters also have information concerning apprenticeships and related matters.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ Electroplating/Anodizing/Coloring Metal
- ▶ Fabricated Structural Metal
- ▶ Institutional Furniture
- ▶ Metal Coating and Nonprecious Engraving
- ▶ Nonupholstered Wood Household Furniture
- ▶ Ornamental and Architectural Metal Work
- ▶ Plate Work
- ▶ Prefabricated Metal Building & Component

## Painting and Coating Workers (except Const. and Maintenance)

- ▶ Metal Heat Treating
- ▶ Metal Window and Door
- ▶ Sheet Metal Work
- ▶ Wood Kitchen Cabinets and Countertops

Search these **yellow page** headings for listings of private firms:

- ▶ Automobile Body Repairing and Painting
- ▶ Automotive Painting
- ▶ Coating Contractors
- ▶ Coatings, Protective
- ▶ Painting Consultants

### Where Can the Job Lead?

Experienced Painting and Coating workers with leadership ability may become team leaders or supervisors. Those who acquire practical experience, college, or other formal training may become sales or technical representatives for chemical or paint companies.

Most Transportation Equipment Painters start as helpers and learn their skills on the job. It usually takes one to two years of on-the-job training to become skilled in all phases of automotive painting. As helpers gain experience they progress to more complicated tasks such as mixing paint to attain a good match. Some automotive painters may open their own shops.

### Other Sources of Information

National Association of Manufacturers  
[www.nam.org](http://www.nam.org)

National Institute for Automotive Service Excellence  
[www.ase.com](http://www.ase.com)

National Paint & Coatings Association  
[www.paint.org](http://www.paint.org)

International Brotherhood of Teamsters  
[www.teamster.org](http://www.teamster.org)

International Union of Painters and Allied Trades  
[www.iupat.org](http://www.iupat.org)



## Painting, Coating, and Decorating Workers

**Table of Contents** (*scroll or use links below to navigate document*)

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Painting, Coating, and Decorating Workers paint, coat, or decorate various articles such as furniture, glass, plateware, pottery, jewelry, cakes, toys, books, or leather. Many paints and coatings have a dual purpose of enhancing product appearance and providing protection from weather or corrosion. Painting and Coating Workers may assemble fixtures for coating and load and unload fixtures into coating machines. They sometimes use equipment that is controlled by computerized panel boards. Painting, Coating, and Decorating Workers examine finished surfaces of workpieces to verify conformance to specifications and retouch defective areas. They cut out sections of surface material to be inlaid with decorative pieces, using a pattern and knife or scissors. Painting, Coating, and Decorating Workers may place coated workpieces in an oven or dryer for a specified time to dry or harden a finish. They melt or heat coating materials to a specified temperature. Painting, Coating, and Decorating Workers select and mix ingredients to prepare coating substances according to specifications, using a paddle or mechanical mixer. They also perform routine troubleshooting and machine maintenance.

### Tasks

- ▶ Apply coating, such as paint, ink, or lacquer, to protect or decorate workpiece surface, using spray gum, pen, or brush.
- ▶ Immerse workpiece into coating material for specified time.
- ▶ Position and glue decorative pieces in cutout section, following pattern.
- ▶ Read job order and inspect workpiece to determine work procedure and materials required.
- ▶ Conceal blemishes in workpiece, such as nicks and dents, using filler, such as putty.
- ▶ Rinse coated workpiece to remove excess coating material or to facilitate setting of finish coat on workpiece.
- ▶ Drain or wipe workpieces to remove excess coating material or to facilitate setting of finish coat on workpiece.

*Detailed descriptions of these occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

### Important Skills, Knowledge, and Abilities

- ▶ **Monitoring** — Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
- ▶ **Equipment Selection** — Determining the kind of tools and equipment needed to do a job.

## Painting, Coating, and Decorating Workers

- ▶ **Production and Processing** — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- ▶ **Manual Dexterity** — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ **Information Ordering** — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ **Near Vision** — The ability to see details at close range (within a few feet of the observer).
- ▶ **Visual Color Discrimination** — The ability to match or detect differences between colors, including shades of color and brightness.
- ▶ **Arm-Hand Steadiness** — The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.
- ▶ **Finger Dexterity** — The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.

### Work Environment

Painting, Coating, and Decorating Workers usually work indoors in special ventilated booths. They may be exposed to dangerous fumes from paint and coating solutions. However, the risk is minimal if Painters wear masks or respirators that cover their noses and mouths and adhere to safety rules. They may stand for long periods of time. Painting, Coating, and Decorating Workers generally work a 40-hour week.

### California's Job Outlook and Wages

The California outlook and wage below represent the occupation across all industries.

| Standard Occupational Classification             | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Painting, Coating, and Decorating Workers</b> |                                  |                                  |                         |                            |
| 51-9123  | 3,200                            | 3,500                            | 110                     | \$8.38 to \$13.58          |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Employment of Painting, Coating, and Decorating Workers is expected to grow slower than average for all occupations over the 2004-2014 period. However, opportunities will continue to arise from the need to replace the Painting, Coating, and Decorating Workers who retire or leave the labor force for other reasons.

## Painting, Coating, and Decorating Workers

### Training/Requirements/Apprenticeships

Painting, Coating, and Decorating Workers usually follow one of the following training paths:

- ▶ High school diploma preferred
- ▶ Adult Education
- ▶ Vocational school
- ▶ Community College programs or certificates
- ▶ Extensive on-the-job training

A high school diploma is not required, but it is helpful. Many community colleges and vocational or technical schools offer instructional programs that enhance employment and advancement opportunities.

### Recommended High School Course Work

High School preparation courses in art, accounting, chemistry, general business, business mathematics, and computer technology are helpful. Accounting and business classes are particularly helpful for those who plan to enter self-employment.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ All Other Miscellaneous Manufacturing
- ▶ Games, Toys, and Children's Vehicles
- ▶ Gaskets, Packings, and Sealing Devices
- ▶ Institutional Furniture
- ▶ Jewelry (except Costume)
- ▶ Jewelers' Material and Lapidary Work
- ▶ Musical Instrument
- ▶ Nonupholstered Wood Household Furniture
- ▶ Sign Manufacturing
- ▶ Sporting & Athletic Goods
- ▶ Wood Kitchen Cabinets and Countertops

Search these **yellow page** headings for listings of private firms:

- ▶ Coating Contractors
- ▶ Coatings, Protective
- ▶ Decorative Painting
- ▶ Painting Consultants
- ▶ Painting Contractors, Decorative/Faux Finishes

### Where Can the Job Lead?

Experienced Painting, Coating, and Decorating Workers with leadership ability may become team leaders or supervisors. Those who acquire practical experience, college, or other formal training may become sales or technical representatives for chemical or paint companies.

### Other Sources of Information

National Association of Manufacturers  
[www.nam.org](http://www.nam.org)

National Paint & Coatings Association  
[www.paint.org](http://www.paint.org)



**Table of Contents** *(scroll or use links below to navigate document)*

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find the Job?](#)

[Where Can the Job Lead?](#)

[Other Sources](#)



[View Career Video](#)

### What They Do

Printing Machine Operators prepare, operate, and maintain various types of printing machines in a pressroom. Duties of Printing Machine Operators vary according to the type of press they operate. Offset lithography, the most common printing process, transfers an inked impression from a rubber-covered cylinder to paper or other material. With the gravure process, the recesses on an etched plate or cylinder are inked and pressed to paper. Flexography is a form of rotary printing in which ink is applied to a surface by a flexible rubber printing plate with a raised image area. The gravure and flexography printing processes should increase over the next decade. Plateless processes, digital, electrostatic, and ink-jet printing are used for copying, duplicating, and document and specialty printing by commercial printers for short-run jobs.

Printing Machine Operators prepare presses for printing by installing and adjusting the printing plate, adjusting pressure, inking the presses, loading paper and adjusting the press to the paper size. They ensure that paper and ink meet specifications. Operators adjust margins and the flow of ink to the inking rollers. Then, they feed paper through the press cylinders and adjust feed and tension controls. Printing Machine Operators duties differ from shop to shop depending upon the type and size of presses used. Small commercial shops tend to have smaller presses, which print only one or two colors at one time. Large newspaper, magazine, and book printers use giant "in-line web" presses that require a crew of several press operators and press assistants. Paper is fed into these presses in large rolls, called "webs," up to 50 inches or more in width.

Press Operators monitor the operation of printing presses while they are running. They keep the paper feeders well stocked. Operators also make adjustments to correct uneven ink distribution, and speed. If paper jams or tears and causes the press to stop, they fix the problem to reduce downtime and maintain productivity. Operators working with high-speed presses continuously watch for problems and make corrections to prevent expensive losses of paper and ink. In most shops, they perform preventive maintenance by oiling and cleaning the presses and making minor repairs.

### Tasks

- ▶ Push buttons, turn handles or move controls and levers to start printing machine or manually controls equipment operation.
- ▶ Turn, push, or move controls to set and adjust speed, temperature, inkflow, and position and pressure tolerances of press.

## Printing Machine Operators

- ▶ Select and install printing plates, rollers, screens, stencils, type, die, and cylinders in machine according to specifications, using hand tools.
- ▶ Load, position, and adjust unprinted materials on holding fixture or in loading and feeding mechanisms of press.
- ▶ Review work order to determine ink, stock, and equipment needed for production.
- ▶ Accept orders, calculate and quote prices, and receive payments from customers.
- ▶ Discard or correct misprinted materials, using ink eradicators or solvents.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ 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.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Visual Color Discrimination — The ability to match or detect differences between colors, including shades of color and brightness.
- ▶ Oral Comprehension — The ability to listen to and understand information and ideas presented through spoken words and sentences.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).

### Work Environment

Most Printing Machine Operators work in large pressrooms that are usually well-ventilated and climate controlled. Pressrooms contain a wide variety of machinery such as presses, folders, and cutters which create a noisy environment. Printing Machine Operators work on their feet for long periods of time and lift boxes and packages on a daily basis. They often work under the pressure to meet deadlines, which can be stressful. Printing Machine Operators work with high speed press machinery which may be hazardous. However, health risks are minimized when operators follow safe work practices and wear safety gear such as ear protectors. Most Printing Machine Operators work a 35 to 40-hour work week. However, many printing companies operate two or three shifts. Operators may be required to work any shift. Those who work for newspapers may work weekends, nights, and holidays. They may also work overtime to meet deadlines.

Many printing plants are nonunion. However, some Printing Machine Operators at large companies belong to the Graphic Communications International Union.

## Printing Machine Operators

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Printing Machine Operators</b>    |                                  |                                  |                         |                            |
| 51-5023                              | 20,300                           | 21,700                           | 610                     | \$11.31 to \$21.33         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Employment of Printing Machine Operators is expected to grow more slowly than average for all occupations over the 2004–2014 period. However, opportunities will continue to arise from the need to replace the Printing Machine Operators who retire or leave the labor force for other reasons. Also, there will be a continuing need for computer literate operators to work on increasingly computerized printing equipment.

### Training/Requirements/Apprenticeships

Printing Machine Operators usually follow one of the following training paths:

- ▶ High school diploma or equivalent
- ▶ Adult education Program
- ▶ Formal, four-year apprenticeship
- ▶ Vocational school
- ▶ Community college programs or certificates
- ▶ Extensive on-the-job training

Most Printing Machine Operators are trained informally on the job while working as helpers for experienced operators. However, training is also available through formal apprenticeship programs. Apprenticeships for Press Operators in commercial shops last four years. Apprenticeships include on-the-job instruction and related classroom instruction.

Some community colleges and adult education programs offer printing machine technology certificates or degrees.

### Recommended High School Course Work

Due to continuous technical developments, high school preparation courses in chemistry, electronics, color theory, graphic arts, physics, and computer technology are helpful.

## Printing Machine Operators

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ All Other Publishers
- ▶ Book Publishers
- ▶ Commercial Lithographic Printing
- ▶ Commercial Screen Printing
- ▶ Corrugated/Solid Fiber Box
- ▶ Directory and Mailing List Publishers
- ▶ Manifold Business Forms Printing
- ▶ Newspaper Publishers
- ▶ Other Commercial Printing
- ▶ Periodical Publishers
- ▶ Prepress Services
- ▶ Tradebinding and Related Work

Search these **yellow page** headings for listings of private firms:

- ▶ Lithographers
- ▶ Prepress Services
- ▶ Printers Photo Offset
- ▶ Printing Brokers
- ▶ Printing Consultants

### Where Can the Job Lead?

Advancement opportunities for Printing Machine Operators usually involves an increase in pay and responsibility by working on a more complex printing press. For example, a one-color sheet-fed press operator may become a four-color sheet-fed press operator. Some operators may advance to pressroom supervisor assuming the responsibility for an entire crew, while others may advance to become a company salesperson or a plant manager.

### Other Sources of Information

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

Graphic Comm Central  
[www.teched.vt.edu/gcc](http://www.teched.vt.edu/gcc)

Graphic Arts Information Network  
[www.gain.net](http://www.gain.net)

Graphic Communications Conference of the International Brotherhood of Teamsters (GCC/IBT)  
[www.gciu.org](http://www.gciu.org)

## Rolling Machine Setters, Operators, and Tenders

**Table of Contents** *(scroll or use links below to navigate document)*

**What They Do**

**Tasks**

**Skills, Knowledge, and Abilities**

**Work Environment**

**California's Job Outlook and Wages**

**Trends**

**Training**

**Where Do I Find the Job?**

**Where Can the Job Lead?**

**Other Sources**

### What They Do

Rolling Machine Setters, Operators, and Tenders (Metal and Plastic) set up, run, and watch machines that roll steel or plastic raw materials. The machines are used to form bends, beads, and knurls, and to flatten, temper, or reduce the gauge of material. Examples of products made using this type of machine include aluminum cans, steel automobile bodies, and prefabricated metal buildings. These workers are employed in metal manufacturing, aerospace, defense, transportation, shipbuilding, and machine shop industries.

### Tasks

- ▶ Read rolling orders, blueprints, and mill schedules to determine setup specifications, work sequences, product dimensions, and installation procedures.
- ▶ Examine, inspect, and measure raw materials and finished products to verify conformance to specifications.
- ▶ Calculate draft space and roll speed for each mill stand in order to plan rolling sequences and specified dimensions and tempers.
- ▶ Select rolls, dies, roll stands, and chucks from data charts in order to form specified contours and to fabricate products.
- ▶ Install equipment such as guides, guards, gears, cooling equipment, and rolls, using hand tools.
- ▶ Position, align, and secure arbors, spindles, coils, mandrels, dies, and slitting knives.
- ▶ Fill oil cups, adjust valves, and observe gauges to control flow of metal coolants and lubricants onto workpieces.
- ▶ Manipulate controls and observe dial indicators in order to monitor, adjust, and regulate speeds of machine mechanisms.
- ▶ Monitor machine cycles and mill operation to detect jamming and to ensure that products conform to specifications.
- ▶ Adjust and correct machine setups to reduce thicknesses, reshape products, and eliminate product defects.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

### Important Skills, Knowledge and Abilities

- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.

## Rolling Machine Setters, Operators, and Tenders

- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ Installation — Installing equipment, machines, wiring, or programs to meet specifications.
- ▶ 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.
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Arm-Hand Steadiness — The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.

### Work Environment

Most Rolling Machine Setters, Operators, and Tenders (Metal and Plastic) work in clean spaces that are well lit and ventilated. These workers stand much of the day and may do moderately heavy lifting. Operating powerful, high-speed machines can be dangerous if strict safety rules are not followed. Protective equipment such as safety glasses and earplugs are usually required to protect the worker from flying particles and machine noise. Many modern machines are enclosed which minimizes the exposure of workers to noise, dust, and lubricants. Most workers put in a 40-hour week, but overtime is common during periods of peak production. Since many shops have more than one shift, night and weekend work is possible.

Many Rolling Machine Setters, Operators, and Tenders (Metal and Plastic) belong to a union such as the International Association of Machinists and Aerospace Workers; the International Union of Electronic, Electrical, Salaried Machine, and Furniture Workers; the International Brotherhood of Electrical Workers; and the United Steelworkers of America.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification                                       | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Rolling Machine Setters, Operators, and Tenders (Metal and Plastic)</b> |                                  |                                  |                         |                            |
| 51-4023  | 3,400                            | 3,800                            | 120                     | \$10.18 to \$17.90         |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

## Rolling Machine Setters, Operators, and Tenders

### Trends

Employment of Rolling Machine Setters, Operators, and Tenders (Metal and Plastic) is expected to grow at a slower than average rate from 2004 to 2014, although employment trends among these occupations will vary over the next several years. Employment of workers will be affected by the rate of technological implementation, the demand for the goods they produce, the effects of trade, and the reorganization of production processes. Despite these factors, many openings will become available because of an increase in retirements over the next decade. Temporary employees are being hired in greater numbers and usually get paid less than company-employed workers.

### Training/Requirements/Apprenticeships

Rolling Machine Setters, Operators, and Tenders (Metal and Plastic) usually follow one of the following training paths:

- ▶ Community college programs or certificates
- ▶ Extensive on-the-job training

A few weeks of on-the-job training is sufficient for most workers to learn basic machine operations, but several years are required to become a highly skilled operator or setter. Community colleges and other educational institutions offer courses and certifications in operating metal and plastics machines. Programs accredited by the National Institute for Metalworking Skills (NIMS) and the Society of the Plastics Industry are listed at their respective Web sites. Some employers send promising machine tenders to operator classes and others prefer to hire workers who have completed or are currently enrolled in a training program. Many employers require a high school diploma and the ability to read, write, and speak English.

### Recommended High School Course Work

High school students interested in this kind of work should take courses in metal shop, blueprint reading, algebra, geometry, and gain a working knowledge of metal and plastic properties.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ All Other Plastics Product
- ▶ Aluminum Foundries (except Die-Casting)
- ▶ Employment Placement Agencies
- ▶ Fabricated Structural Metal
- ▶ Iron and Steel Mills
- ▶ Nonpackaging Plastics, Film and Sheet
- ▶ Ornamental and Architectural Metal Work
- ▶ Professional Employer Organizations
- ▶ Sheet Metal Work
- ▶ Steel Foundries (except Investment)
- ▶ Temporary Help Services
- ▶ Urethane and Other Foam Product

## Rolling Machine Setters, Operators, and Tenders

Search these **yellow page** headings for listings of private firms:

- ▶ Foundries
- ▶ Metal Fabrication
- ▶ Ornamental Metal Work
- ▶ Plastic Fabricators
- ▶ Sheet Metal
- ▶ Steel Fabricators

### Where Can the Job Lead?

Advancement for Rolling Machine Setters, Operators, and Tenders (Metal and Plastic) usually takes the form of higher pay. There are some limited opportunities to move up to higher level positions which may be increased by becoming certified in a particular machining skill. Some set-up workers may advance to supervisory positions.

### Other Sources of Information

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

National Institute for Metalworking Skills (NIMS)  
[www.nims-skills.org](http://www.nims-skills.org)

National Tooling & Machining Association (NTMA)  
[www.ntma.org](http://www.ntma.org)

Precision Machined Products Association (PMPA)  
[www.pmpa.org](http://www.pmpa.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

The Society of the Plastics Industry  
[www.socplas.org](http://www.socplas.org)

### Table of Contents *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Semiconductor Processors manufacture electronic semiconductors (known as computer chips, microchips, or integrated circuits) in disks of varying sizes, generally eight to twelve inches wide. These disks, called wafers, are thin slices of silicon on which the circuitry of the microchips is layered. Each wafer is eventually cut into dozens or scores of individual chips.

Semiconductor Processors make wafers by means of photolithography, a printing process for creating patterns from photographic images. Operating automated equipment, processors imprint precise microscopic patterns of the circuitry on the wafers, etch out the patterns with acids, and replace the patterns with metals that conduct electricity. Then, the wafers receive a chemical bath to make them smooth, and the imprint process begins again on a new layer with the next pattern. Wafers usually have from 8 to 20 such layers of microscopic, three-dimensional circuitry. Technicians troubleshoot production problems and maintain equipment.

Semiconductors are produced in semiconductor fabricating plants, or “fabs.” Within fabs, the manufacture and cutting of wafers to create semiconductors takes place in “cleanrooms,” production areas that must be kept free of any airborne matter, because the least bit of dust can damage a semiconductor.

### Tasks

- ▶ Align photo mask pattern on photoresist layer, expose pattern to ultraviolet light, and develop pattern, using specialized equipment.
- ▶ Attach ampoule to diffusion pump to remove air from ampoule, and seal ampoule, using blowtorch.
- ▶ Calculate etching time based on thickness of material to be removed from wafers or crystals.
- ▶ Clean semiconductor wafers using cleaning equipment, such as chemical baths, automatic wafer cleaners, or blow-off wands.
- ▶ Etch, lap, polish, or grind wafers or ingots to form circuitry and change conductive properties, using etching, lapping, polishing, or grinding equipment.
- ▶ Load and unload equipment chambers and transport finished product to storage or to area for further processing.
- ▶ Locate crystal axis of ingot, and draw orientation lines on ingot, using x-ray equipment, drill, and sanding machine.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

## Semiconductor Processors

### Important Skills, Knowledge, and Abilities

- ▶ Production and Processing — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Science — Using scientific rules and methods to solve problems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).

### Work Environment

All Semiconductor Processors working in cleanrooms (both Operators and Technicians) must wear special lightweight outer garments known as “bunny suits.” These garments fit over clothing to prevent lint and other particles from contaminating semiconductor-processing worksites. The measures taken to avoid contamination of the wafers create exceptionally clean environments, nearly free of contaminants that could cause occupational illnesses and accidents. The temperature in the cleanrooms must be kept within narrow ranges, usually a comfortable 72 degrees Fahrenheit. Entry and exit of workers in bunny suits from the cleanroom is controlled to minimize contamination, and workers must be re-clothed in a clean suit and decontaminated each time they return to the cleanroom.

The work pace in cleanrooms is deliberately slow to keep the air in cleanrooms as free as possible of dust and other particles. Although workers spend some time alone monitoring equipment, Operators and Technicians spend much of their time working in teams.

Technicians are on their feet most of the day, walking through the cleanroom to oversee production activities. Operators spend a great deal of time sitting or standing at workstations, monitoring computer readouts and gauges. Sometimes they must retrieve wafers from one station and take them to another.

Some semiconductor fabricating plants operate around the clock, so night and weekend work is common. Hours and shifts vary with different employers. Some plants operate eight-hour shifts, five days a week. While other plants operate 12-hour shifts to reduce the disruption of cleanroom operations.

## Semiconductor Processors

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Semiconductor Processors</b>      |                                  |                                  |                         |                            |
| 51-9141                              | 10,800                           | 11,400                           | 300                     | \$13.41 to \$21.62         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Growth of the occupation, Semiconductor Processors, will be slower than average compared to all California occupations. Many companies in the United States are building plants overseas where costs are lower and downsizing their operations in our country. Despite the expected decline in employment of Semiconductor Processors, the demand for semiconductor chips remains very high stemming from the many existing and future applications for semiconductors. Job prospects will be best for people with postsecondary education in electronics or semiconductor technology.

### Training/Requirements/Apprenticeships

A high school diploma or equivalent is the minimum requirement for entry-level operator jobs in semiconductor fabrication plants. However, employers increasingly prefer persons who have completed associate degree programs for semiconductor processor jobs.

Semiconductor technology programs in a growing number of community colleges include an internship at a semiconductor fabricating plant. Many students in these programs already hold full-or part-time jobs in the industry. In their spare time, many work toward degrees in semiconductor technology to update their skills or qualify for promotion to technician jobs. In addition, to ensure that operators and technicians keep their skills current, many employers provide 40 hours of formal training annually. Some employers also provide financial assistance to employees who want to earn associate and bachelor's degrees.

### Recommended High School Course Work

High school students interested in this kind of work should take mathematics and the physical science courses.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Bare Printed Circuit Board
- ▶ Electronic Computer
- ▶ Computer Storage Device
- ▶ Electronic Connector

## Semiconductor Processors

- ▶ Computer Terminal
- ▶ Computer Wholesale
- ▶ Electron Tube
- ▶ Electronic Capacitor
- ▶ Electronic Coils, Transformer and Inductor
- ▶ Electronic Resistor
- ▶ Other Computer Peripheral Equipment
- ▶ Other Electronic Component
- ▶ Semiconductor and Related Devices

Search these **yellow page** headings for listings of private firms:

- ▶ Cellular and PCs Equipment/Supplies
- ▶ Computer Service and Repair
- ▶ Computer Supplies and Parts
- ▶ Computer Wholesale
- ▶ Semiconductor Devices
- ▶ Semiconductor Manufacturers
- ▶ Telecommunications Services
- ▶ Wireless Data Services and Products

### Where Can the Job Lead?

Semiconductor Processors start as operators and advance to technician. Beyond technician, opportunities for advancement are limited. Those that demonstrate ability and skill may advance to a supervisory-level position. Some Semiconductor Processor Technicians transfer to sales engineer jobs with suppliers of the machines that manufacture the semiconductors or become field support personnel.

### Other Sources of Information

Semiconductor Industry Association  
[www.sia-online.org](http://www.sia-online.org)

Maricopa Advanced Technology Education Center  
[www.matec.org](http://www.matec.org)

SEMATECH  
[www.sematech.org](http://www.sematech.org)

### Table of Contents *(scroll or use links below to navigate document)*

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find the Job?](#)

[Where Can the Job Lead?](#)

[Other Sources](#)



[View Career Video](#)

### What They Do

Sheet Metal Workers perform all operations necessary to make, install, and repair a wide variety of products made from metal sheets. They also may work with fiberglass and plastic materials. Sheet Metal Workers first study plans, blueprints, and specifications to determine the kind and quantity of materials they will need. They locate and mark reference points, and using shop mathematics, calculate angles and curves. Next, they cut the flat material and shape it into a three-dimensional form, using hand and power-driven tools and fabricating machines. In an increasing number of shops, Sheet Metal Workers use computerized metal-working equipment. This enables them to experiment with different layouts to find the one that results in the least waste of material. They cut, drill, and form parts with computer-controlled saws, lasers, shears, and presses.

Most Sheet Metal Workers work for contractors who specialize in sheet-metal equipment for residential, industrial, or commercial buildings. They install heating, ventilating and air conditioning systems, as well as roofing, siding and drains. Many sheet metal parts come in standard sizes and shapes, quickly assembled at the job site and need little change for a proper fit. Residential sheet metal parts are inexpensive and easy to mass produce. As a result, residential Sheet Metal Workers may do only on-site installation, often using flexible duct instead of more expensive, custom parts.

### Tasks

- ▶ Determine project requirements, including scope, assembly sequences, and required methods and materials, according to blueprints, drawings, and written or verbal instructions.
- ▶ Select gauges and types of sheet metal or non-metallic material, according to product specifications.
- ▶ Lay out, measure, and mark dimensions and reference lines on material, such as roofing panels, according to drawings or templates, using calculators, scribes, dividers, squares, and rulers.
- ▶ Drill and punch holes in metal, for screws, bolts, and rivets.
- ▶ Fasten seams and joints together with welds, bolts, cement, rivets, solder, caulks, metal drive clips, and bonds in order to assemble components into products or to repair sheet metal items.
- ▶ Finish parts, using hacksaws, and hand, rotary, or squaring shears.
- ▶ Inspect individual parts, assemblies, and installations for conformance to specifications and building codes, using measuring instruments such as calipers, scales and micrometers.

## Sheet Metal Workers

- ▶ Shape metal material over anvils, blocks, or other forms, using hand tools.
- ▶ Trim, file, grind, deburr, buff, and smooth surfaces, seams, and joints of assembled parts, using hand tools and portable power tools.
- ▶ Install assemblies, such as flashing, pipes, tubes, heating and air conditioning ducts, furnace casings, rain gutters, and down spouts, in supportive frameworks.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Installation — Installing equipment, machines, wiring, or programs to meet specifications.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ 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.
- ▶ Computers and Electronics — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- ▶ Design — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- ▶ 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.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Static Strength — The ability to exert maximum muscle force to lift, push, pull, or carry objects.
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.
- ▶ Visualization — The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.

### Work Environment

Sheet Metal Workers may work inside or outside, in a shop or at the job site. Most shops have adequate lighting, ventilation, and machinery safeguards, but may be unheated, oily, greasy, and noisy. At job sites, work may be done from high ladders and scaffolding, or in confined areas. Those who install siding, roofs, and gutters are exposed to all kinds of weather. Sheet Metal Workers are subject to cuts from sharp metal, burns from soldering and welding, falls from ladders and scaffolds, and harmful noise levels. They usually wear safety glasses but must avoid wearing jewelry or loose-fitted clothing that could easily be caught in machinery. They stand for long periods and lift heavy materials and finished pieces. Those performing installation work do considerable bending, lifting, standing, climbing, and squatting, sometimes in close quarters.

## Sheet Metal Workers

Sheet Metal Workers usually work a 40-hour week. Many belong to the Sheet Metal Workers International Association.

### What's the California Job Outlook?

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Sheet Metal Workers</b>           |                                  |                                  |                         |                            |
| 47-2211                              | 20,000                           | 24,200                           | 900                     | \$14.97 to \$28.15         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Job opportunities are expected to grow faster than average compared with all occupations in California. The largest contributors to this growth are the increased demand for new housing in California and the demand for more energy efficient air-conditioning, heating, and ventilation systems in older structures. Since equipment maintenance makes up a large part of the work done by Sheet Metal Workers, the demand for workers in this occupation is less sensitive to the declines in new construction than employment of some other construction trades.

It is important for Sheet Metal Workers to keep up-to-date with technological changes because sheet metal shops are increasingly using new technological developments such as computerized layout and laser-cutting machines.

### Training/Requirements/Apprenticeships

Sheet Metal Workers usually follow one of the following training paths:

- ▶ Formal, four-year apprenticeship
- ▶ Community college programs or certificates
- ▶ Vocational school
- ▶ Extensive on-the-job training

Completion of a four-year apprenticeship is the general requirement to becoming a Sheet Metal Worker. Apprenticeship programs, administered in each area by the local Sheet Metal Joint Apprenticeship Committee, consist of four or five years of on-the-job training and an average of 200 hours per year of classroom instruction. Apprenticeship programs provide comprehensive instruction in both sheet metal fabrication and installation.

Many community colleges offer manufacturing technology and machine shop certificates or degrees. For further information, go to the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov).

### Recommended High School Course Work

High School preparation courses in metal shop, algebra, geometry, trigonometry, mechanical drawing, blueprint reading, drafting, physics, and computer programming are helpful.

## Sheet Metal Workers

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Candidates for training or apprenticeship programs should apply directly to employers who employ Sheet Metal Workers. Community colleges offer assistance in finding jobs to graduates of degree or certificate programs in sheet metal occupations or machine shops. Unions representing Sheet Metal Workers also have information concerning apprenticeships and related matters.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Aircraft Engine and Engine Parts
- ▶ Aircraft Manufacturing
- ▶ Fabricated Structural Metal Mfg
- ▶ Guided Missiles and Space Vehicles
- ▶ Metal Window and Door Manufacturing
- ▶ Ornamental and Architectural Metal Work
- ▶ Other Aircraft Parts and Equipment
- ▶ Plate Work Manufacturing
- ▶ Prefabricated Metal Building and Component
- ▶ Sheet Metal Work Manufacturing

Search these **yellow page** headings for listings of Contractors and private firms:

- ▶ Air Conditioning Contractors & Systems
- ▶ Building, General Contractors
- ▶ Heating Contractors
- ▶ Metal Fabricators
- ▶ Metal Specialties
- ▶ Sheet Metal Work
- ▶ Sheet Metal Working Equipment & Supplies

### Where Can the Job Lead?

Journey-level Sheet Metal Workers may advance to supervisory jobs, while others may become estimators or managers. Some Sheet Metal Workers may go into the contracting business for themselves. Because a sheet metal contractor must have a shop with equipment to fabricate products, this type of business is more expensive to undertake than other types of construction businesses. Self-employed contractors must obtain a sheet metal contractor's license from the California Contractors State License Board. (Refer to *Other Sources of Information*).

### Other Sources of Information

California Department of Consumer Affairs  
[www.dca.ca.gov](http://www.dca.ca.gov)

Contractors State License Board  
[www.cslb.ca.gov](http://www.cslb.ca.gov)

Division of Apprenticeship Standards  
[www.dir.ca.gov/das](http://www.dir.ca.gov/das)

Sheet Metal Workers International Association  
[www.smwia.org](http://www.smwia.org)

International Training Institute for the Sheet Metal and Air Conditioning Industry  
[www.sheetmetal-iti.org](http://www.sheetmetal-iti.org)

**Table of Contents** *(scroll or use links below to navigate document)*

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find The Job?](#)

[Where Does the Job Lead?](#)

[Other Sources](#)



[View Career Video](#)

### What They Do

Without Structural Metal Fabricators and Fitters, there would be no suspension bridges, sports arenas, skyscrapers, or aircraft of any kind. Structural Metal Fabricators, also called Shop Ironworkers, make and assemble structural metal products such as frameworks or shells for machinery, ovens, iron staircases, tanks, stacks, and metal parts for buildings and bridges. They assemble steel columns, beams, reinforcing steel, and other basic metal parts of large structures used at construction sites such as bridges and buildings. They make stairs, ornamental grilles, beams, and girders and also make and assemble units for prefabricated metal buildings. All their work is performed in shops or yards.

Structural Fabricators ordinarily work with large shapes and thick, heavy materials—individual pieces may weigh as much as 20 tons. Both fabricators and fitters use large cranes, hoists, and derricks to lift or move materials and finished products.

Structural Metal Fitters lay out, position, align, and fit together fabricated parts of structural metal products preparatory to welding or riveting. Both fabricators and fitters read and follow job orders and blueprints to guide their work. Fabricators generally work in shops, while fitters usually work at construction sites.

### Tasks

#### *Fabricator*

- ▶ Develop layout and plan sequence of operations for fabricating and assembling structural metal products, applying trigonometry and knowledge of metal.
- ▶ Locate and mark bending and cutting lines onto workpiece, allowing for stock thickness and machine and welding shrinkage.
- ▶ Set up and operate fabricating machines, such as brakes, rolls, shears, flame cutters, and drill presses.
- ▶ Set up and operate machine tools associated with fabricating shops, such as radial drill, end mill, and edge planer.
- ▶ Preheat workpieces to render them malleable, using hand torch or furnace.
- ▶ Hammer, chip, and grind workpiece to cut, bend, and straighten metal.

## Structural Metal Fabricators and Fitters

- ▶ Verify conformance of workpiece to specifications, using square, ruler, and measuring tape.
- ▶ Design and construct templates and fixtures, using hand tools.
- ▶ Position, align, fit, and weld together parts, using jigs, welding torch, and hand tools.

### Tasks

#### Fitter

- ▶ Align parts, using jack, turnbuckles, wedges, drift pins, pry bars, and hammer.
- ▶ Move parts into position, manually or by hoist or crane.
- ▶ Mark reference points onto floor or face block and transpose them to workpiece, using measuring devices, squares, chalk, and soapstone.
- ▶ Give directions to welder to build up low spots or short pieces with weld.
- ▶ Heat-treat parts with acetylene torch.
- ▶ Straighten warped or bent parts, using sledge, hand torch, straightening press, or bulldozer.
- ▶ Locate reference points, using transit, and erect ladders and scaffolding to fit together large assemblies.
- ▶ Remove high spots and cut bevels, using hand files, portable grinders, and cutting torch.
- ▶ Set up face block, jigs, and fixtures.
- ▶ Examine blueprints and plan sequence of operation, applying knowledge of geometry, effects of heat, weld shrinkage, machining, and metal thickness.

Detailed descriptions of these occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Building and Construction — Knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.

### Work Environment

Working conditions vary for Structural Metal Fabricators and Fitters, depending on plant size, industry worked in, and product manufactured. For instance, fitters in the aerospace industry often work in tight, hard-to-reach locations on aircraft, such as fuselages or gear boxes. Most work

## Structural Metal Fabricators and Fitters

stations are temperature controlled and well-lighted. As with any use of power and hand tools, injury is possible, but the work is generally safe for those who take reasonable care, use protective eye and ear equipment, and adhere to safety rules. Tools such as drills, flame cutters, brakes, and edge planers can be loud and emit odors.

Many Structural Metal Fabricators and Fitters are members of labor unions. These include the International Association of Machinists and Aerospace Workers; the United Electrical, Radio and Machine Workers of America; the United Automobile, Aerospace and Agricultural Implement Workers of America; the International Brotherhood of Electrical Workers; and the United Steelworkers of America.

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification            | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Structural Metal Fabricators and Fitters</b> |                                  |                                  |                         |                            |
| 51-2041   | 7,900                            | 8,800                            | 280                     | \$11.06 to \$20.78         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

While the projected employment growth for Structural Metal Fabricators and Fitters is slower than average for all occupations in California between 2004 and 2014, a significant turnover is expected: 1,900 openings will occur during that time as workers leave for other kinds of work or retire. Workers with computer-aided design (CAD) and computer-controlled machine knowledge will have the best job prospects.

### Training/Requirements/Apprenticeships

Structural Metal Fabricators and Fitters usually follow one of the following training paths:

- ▶ Formal, four-year apprenticeship
- ▶ Vocational school
- ▶ Community college programs or certificates
- ▶ Extensive on-the-job training

There are currently four recognized apprenticeable specialties associated with this occupation: Former, Hand; Metal Fabricator; Ship Propeller Finisher; Fabricator-Assembler, and Metal Products.

### Recommended High School Course Work

High school students interested in this type of work should take mathematics, blueprint reading, and metal shop courses.

## Structural Metal Fabricators and Fitters

### Where Do I Find the Job?

Candidates for training or apprenticeship programs should apply directly to employers who employ Structural Metal Fabricators and Fitters. Community colleges offer assistance in finding jobs to completers of certificate programs. Unions representing these workers also have information concerning apprenticeships and related matters.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Fabricated Structural Metal
- ▶ Metal Window and Door
- ▶ Ornamental and Architectural Metal Work
- ▶ Plate Work
- ▶ Prefabricated Metal Building & Component
- ▶ Sheet Metal Work

Search these **yellow page** headings for listings of Contractors and private firms:

- ▶ Metal Fabricators
- ▶ Sheet Metal Work

### Where Can the Job Lead?

Experienced Fabricators and Fitters may become members of research and development teams, working with engineers and other project designers to design, develop, and build prototypes, and test new product models. Those with a background in math, science, and computers may advance to become Numerical Tool and Process Control Programmers or Operators of more highly automated production equipment.

### Other Sources of Information

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Get Tech  
[www.gettech.org](http://www.gettech.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

**Table of Contents** *(scroll or use links below to navigate document)*

[What They Do](#)

[Tasks](#)

[Skills, Knowledge, and Abilities](#)

[Work Environment](#)

[California's Job Outlook and Wages](#)

[Trends](#)

[Training](#)

[Where Do I Find the Job?](#)

[Where Can the Job Lead?](#)

[Other Sources](#)



[View Career Video](#)

### What They Do

Almost everything you touch on a daily basis has been created by metal forming—cars, doorknobs, razor blades, paper clips, shovels, beds, skateboards, and musical instruments are just a few examples. Tool and Die Makers set up and operate the tools, dies, jigs, fixtures, and gauges used in mass production machines to manufacture identical parts made of metal or combinations of metal and other materials. Although Tool and Die Makers use common tools and techniques, the resulting products differ. Tool Makers use machine tools to make jigs and fixtures that hold metal parts being shaved, stamped, or drilled. Die Makers craft metal forms, or dies, that shape metal in stamping and forging operations. Tool and die making is fundamental to the manufacturing process.

Tool and Die Makers commonly use computer-aided design (CAD) to develop products and specifications for tools and dies. The designs are then sent to computer numerically controlled (CNC) machines to produce the die. In shops that use numerically controlled (NC) machine tools, Tool and Die Makers often assist in planning and writing NC programs.

### Tasks

- ▶ Study blueprints or specifications and visualize shape of die, part, or tool.
- ▶ Compute dimensions of assembly and plan sequence of operations.
- ▶ Measure, mark, and scribe metal or plastic stock to lay out machining, using instruments, such as protractors, micrometers, scribes, and rulers.
- ▶ Set up and operate machine tools, such as lathes, milling machines, shapers, and grinders to machine parts.
- ▶ Lift, position, and secure machined parts on surface plate or worktable, using hoist, vises, v-blocks, or angle plates.
- ▶ Smooth and polish flat and contoured surfaces of parts or tools, using scrapers, abrasive stones, files, emery cloth, or power grinder.
- ▶ Design tools, jigs, fixtures, and templates for use as work aids. Cast plastic tools or parts, or tungsten-carbide cutting tips, using pre-made molds.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

## Tool and Die Makers

### Important Skills, Knowledge, and Abilities

- ▶ Reading Comprehension — Understanding written sentences and paragraphs in work-related documents.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Wrist-Finger Speed — The ability to make fast, simple, repeated movements of the fingers, hands, and wrists.
- ▶ Computer — Knowledge of computer hardware and software, including applications and programming.

### Work Environment

Most Tool and Die Makers work either in large manufacturing plants or in contract shops that specialize in making tools and dies. These firms are concentrated in urban areas. Work spaces are relatively pleasant and generally quieter and cleaner than production machine shops. Some moderately heavy lifting is involved. As with any use of hand or power tools, injury is possible, but the work is generally safe for those who take reasonable care, use protective equipment, and adhere to safety rules. Companies employing Tool and Die Makers traditionally operate only one shift per day. Overtime and weekend work are common, especially during peak production periods.

Tool and Die Makers could belong to a variety of unions, such as the International Association of Machinists or the United Auto Workers, depending on the industry and employer.

### California's Job Outlook and Wages

The California Outlook and Wages table below represents the occupation across all industries.

| Standard Occupational Classification | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--------------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Tool and Die Makers</b>           |                                  |                                  |                         |                            |
| 51-4111                              | 4,600                            | 5,000                            | 140                     | \$16.00 to \$26.25         |

*Wages do not reflect self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

In some industries, the number of products that use parts machined by Tool and Die Makers has been reduced because of the use of electronically controlled machine tools. Manufacturers continue to experience a shortage of qualified experienced and inexperienced Tool and Die Makers despite the use of NC machine tools and the increased importation of finished goods and precision metal products.

### Training/Requirements/Apprenticeships

Tool and Die Makers usually follow one of the following training paths:

- ▶ Formal, four-year apprenticeship
- ▶ Vocational school
- ▶ Community College programs or certificates
- ▶ Extensive on-the-job training

Training in the four-year apprenticeship program is spent mostly in the shop and on the job. Information about Tool and Die Maker apprenticeships may be found at [www.dir.ca.gov/das](http://www.dir.ca.gov/das), an apprenticeship database maintained by the Division of Apprenticeship Standards. Apprentices learn to operate hand and power tools, and other mechanical equipment. They also study heat-treating and other metal working processes. In addition to shop work, apprentices receive on an average of 144 hours per year of classroom instruction in mathematics, mechanical drawing, tool designing, CAD, tool programming, and blueprint reading.

Many community colleges offer manufacturing technology and machine shop certificates or degrees. Some community colleges offer tool design technology courses. Programs accredited by the National Institute for Metalworking Skills (NIMS) are listed at their Web site.

#### Recommended High School Course Work

High school students interested in this kind of work should take mathematics, especially trigonometry, as well as metal shop courses.

### Where Do I Find the Job?

Candidates for training or apprenticeship programs should apply directly to employers who employ Tool and Die Makers. Community colleges offer assistance in finding jobs to graduates of degree or certificate programs in tool and die making or machine shop. Unions representing Tool and Die Makers also have information concerning apprenticeships and related matters.

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- |  |   |
|--|---|
| ▶ All Other Plastics Product               | ▶ Metal Stamping                          |
| ▶ Aluminum Foundries (except Die-Casting)  | ▶ Other Aircraft Parts and Equipment      |
| ▶ Bolts, Nuts, Screws, Rivets, and Washers | ▶ Precision Turned Product Manufacturing  |
| ▶ Machine Shops                            | ▶ Special Tools, Dies, Jigs, and Fixtures |
| ▶ Machine Tool Cutters and Accessories     | ▶ Temporary Help Services                 |
| ▶ Metal Cutting Machine Tool               | ▶ Urethane and Other Foam Product         |

## Tool and Die Makers

Search these **yellow page** headings for listings of private firms:

- ▶ Die Makers
- ▶ Metal Cutting Tools
- ▶ Metal Fabricators
- ▶ Metal Rolling and Forming
- ▶ Metal Stamping
- ▶ Plastic Fabricators
- ▶ Sheet Metal Work
- ▶ Tool Designers

### Where Can the Job Lead?

There are several ways for skilled workers to advance. Some move into supervisory and administrative positions in their firms; many obtain their college degree and go into engineering or tool design; and some may start their own shops.

### Other Sources of Information

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

### Table of Contents *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |

### What They Do

Tool Grinders, Filers, and Sharpeners perform precision smoothing, sharpening, polishing, or grinding of metal objects such as dies, parts, and machine tools. It is the job of these workers to help keep production machinery in precise working order. They work in a variety of industries; however, most work in metal manufacturing where metal sheets, strips, bars, rods, drill bits, or wires are made. Some work in private repair shops servicing machinery pieces, while others are self-employed and recondition household scissors or knives.

Other titles for this occupation include Die Polisher, Precision Honer, and Tool Maintenance Worker.

### Tasks

- ▶ Study blueprints or layouts of metal workpieces to determine grinding procedures, and to plan machine setups and operational sequences.
- ▶ Compute numbers, widths, and angles of cutting tools, micrometers, scales, and gauges, and adjust tools to produce specified cuts.
- ▶ Select and mount grinding wheels on machines, according to specifications, using hand tools and applying knowledge of abrasives and grinding procedures.
- ▶ Attach workpieces to grinding machines, then form specified sections and repair cracks, using welding or brazing equipment.
- ▶ Set up and operate grinding or polishing machines to grind metal workpieces such as dies, parts, and tools.
- ▶ Monitor machine operations to determine whether adjustments are necessary; stop machines when problems occur.
- ▶ File or finish surfaces of workpieces, using prescribed hand tools.
- ▶ Straighten workpieces and remove dents, using straightening presses and hammers.
- ▶ Inspect, feel, and measure workpieces to ensure that surfaces and dimensions meet specifications.
- ▶ Fit parts together in preassembly to ensure that dimensions are accurate.

*Detailed descriptions of this occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).*

## Tool Grinders, Filers, and Sharpeners

### Important Skills, Knowledge, and Abilities

- ▶ Design — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ Equipment Maintenance — Performing routine maintenance on equipment and determining when and what kind of maintenance is needed.
- ▶ Mathematics — Using mathematics to solve problems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Troubleshooting — Determining causes of operating errors and deciding what to do about it.
- ▶ Repairing — Repairing machines or systems using the needed tools.
- ▶ Technology Design — Generating or adapting equipment and technology to serve user needs.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Control Precision — The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).

### Work Environment

Tool Grinders, Filers, and Sharpeners generally work indoors in temperature-controlled machine shops and plants. They are on their feet most of the day using their hands to control machinery. They must observe safety rules and be alert to the hazards of machinery constantly in motion. They often wear safety glasses, earplugs, and other protective equipment to avoid burns or cuts. They wear face masks equipped with breathing apparatus when toxic fumes, dust, or minute metal parts are present.

Some manufacturing plants operate around the clock, and workers may be required to work evening, night, or weekend shifts, as well as overtime when needed. Generally, Tool Grinders, Filers, and Sharpeners work a 40-hour week. Union membership may be available in some plants, such as the Electronic, Electrical, Salaried Machine, and Furniture Workers; the International Brotherhood of Electrical Workers; and the United Steelworkers of America.

## Tool Grinders, Filers, and Sharpeners

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification         | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|--|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Tool Grinders, Filers, and Sharpeners</b> |                                  |                                  |                         |                            |
| 51-4194                                      | 1,800                            | 1,900                            | 70                      | \$10.36 to \$17.48         |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

The majority of job opportunities for Tool Grinders, Filers, and Sharpeners will occur from the need to replace people who retire or permanently leave the field for other reasons. This is due to the increased use of numerically controlled machines that require Computer-Controlled Machine Tool Operators to work them. Tool Grinders who update their skills and learn the new machine technology can move into this higher paying job.

In general, employment of workers in this occupation will be affected by the rate of technological implementation, the demand for the goods they produce, the effects of trade, and the reorganization of production processes.

### Training/Requirements/Apprenticeships

Tool Grinders, Filers, and Sharpeners usually require between one and twelve months of combined on-the-job experience and informal training to be considered fully trained. Some take courses in community college or adult education course work leading toward certificates or associate degrees in programs such as agricultural mechanization, machine shop technology, and tool and die technology.

Most employers require newly-hired workers to have a high school or general equivalency diploma (GED). Apprenticeships are sometimes available, according to the California Tool and Die Mold, Machinist, and Metal Working Trades Apprenticeship Committee. Go to the Division of Apprenticeship Standards at [www.dir.ca.gov/das](http://www.dir.ca.gov/das) to find out about current apprenticeships.

#### Recommended High School Course Work

High school students interested in this kind of work should take algebra, geometry, and trigonometry, as well as metal shop, blueprint reading, and computer courses.

### Where Do I Find the Job?

Candidates for training or apprenticeship programs should apply directly to employers who employ Tool Grinders, Filers, and Sharpeners. Unions representing these workers also have information concerning apprenticeships and related matters.

## Tool Grinders, Filers, and Sharpeners

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search using keywords from the following industry names to get a list of private firms and their addresses:

- ▶ Iron and Steel Mills
- ▶ Iron and Steel Pipe
- ▶ Copper Wire
- ▶ Commercial and Industrial Machinery
- ▶ Home and Garden Equipment Repair
- ▶ Machine Tool
- ▶ Cutting Tool

Search these **yellow page** headings for listings of private firms:

- ▶ Die Makers
- ▶ Metal Fabricators
- ▶ Metal Cutting Tools
- ▶ Tools-Electric, Repairing and Parts
- ▶ Metal Stamping
- ▶ Tools-Cutting
- ▶ Sheet Metal Work

### Where Can the Job Lead?

Advancement for Tool Grinders, Filers, and Sharpeners usually takes the form of higher pay for working on more complex equipment. There are opportunities to move to higher-level positions, such as operating computer numerically controlled (CNC) tool grinding machines. Some advance to supervisory positions, while others open their own business. Others take further training and advance to Tool and Die Makers or Machinists.

### Other Sources of Information

International Association of Machinists and Aerospace Workers  
[www.iamaw.org](http://www.iamaw.org)

National Institute for Metalworking Skills  
[www.nims-skills.org](http://www.nims-skills.org)

Precision Metalforming Association Educational Foundation  
[www.pmaef.org](http://www.pmaef.org)

## Welders, Cutters, Solderers, and Brazers

**Table of Contents** *(scroll or use links below to navigate document)*

|  |  |
|--|--|
| <a href="#">What They Do</a>                       | <a href="#">Trends</a>                   |
| <a href="#">Tasks</a>                              | <a href="#">Training</a>                 |
| <a href="#">Skills, Knowledge, and Abilities</a>   | <a href="#">Where Do I Find the Job?</a> |
| <a href="#">Work Environment</a>                   | <a href="#">Where Can the Job Lead?</a>  |
| <a href="#">California's Job Outlook and Wages</a> | <a href="#">Other Sources</a>            |



[View Career Video](#)

### What They Do

Combination Welders perform both arc and gas welding. In arc welding, heat is produced by an electric current. Arc welding is used for large jobs such as fabricated work with heavy plates and large shapes. It is also used in production line and general assembly operations where speed is necessary. Gas welding is done with a flame combining oxygen and acetylene or oxygen and hydrogen gases and is used for small repairs or delicate jobs on light metals or tubing.

Welders use manual, semiautomatic, and automatic arc and gas equipment. They work from blueprints, layouts, and work orders. Their job duties include fabrication and repair of machine parts, motors, trailers, and manufacturing equipment. They repair broken parts, fill holes, cut metal, and increase the size of metal parts.

Welding inspectors interpret and work from procedures, drawings, schematics, and verbal or written instructions. They conduct random visual examinations and test welded joints for defects, correct measurements, joint strength, and weld penetration. Welding inspectors may make minor adjustments as needed.

Solderers and Brazers use molten metal to join two pieces of metal. This differs from welding because the metal added during these processes has a lower melting point than that of the workpiece, so only the added metal is melted, not the workpiece. Soldering is used to join electrical, electronic, and other small metal parts. Brazing uses metals with a higher melting point than soldering. Brazing produces a stronger joint and is used to join metals other than steel. Brazing can be used to apply coatings to parts to reduce wear and protect against corrosion. Skilled welding, soldering, and brazing workers select and set up welding equipment, execute the planned welds, and examine welds to ensure that they meet standards and specifications. Welders are trained to work with a variety of materials in addition to steel, such as titanium, aluminum, or plastics.

The duties of arc Cutters are closely related to that of Welders. But, instead of joining metals, Cutters use the heat from an electric arc, a stream of ionized gas or burning gases to cut and trim metal objects to meet blueprint or work order specifications. Cutters also dismantle large objects, such as ships, railroad cars, automobiles, buildings, or aircraft.

## Welders, Cutters, Solderers, and Brazers

### Tasks

- ▶ Weld metal parts or components together, using brazing, gas or arc welding equipment.
- ▶ Repair broken or cracked parts, fills holes and increases size of metal parts, using welding equipment.
- ▶ Weld in flat, horizontal, vertical, or overhead positions.
- ▶ Clean or degrease parts, using wire brush, portable grinder, or chemical bath.
- ▶ Inspect finished workpiece for conformance to specifications.
- ▶ Melt and apply solder along adjoining edges of workpieces to solder joints, using soldering iron, gas torch, or electric-ultrasonic equipment.
- ▶ Guide torch and rod along joint workpieces to heat to brazing temperature, melt braze alloy, and bond workpieces together.

Detailed descriptions of these occupations may be found in the Occupational Information Network (O\*NET) at [online.onetcenter.org](http://online.onetcenter.org).

### Important Skills, Knowledge, and Abilities

- ▶ 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.
- ▶ Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Arm-Hand Steadiness — The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.
- ▶ Manual Dexterity — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).

### Work Environment

Welders, Cutters, Solderers, and Brazers are exposed to a number of hazards including the intense light created by the arc, poisonous fumes, and very hot materials. They are exposed to hot flying flecks that can cause skin burns and set fire to clothing. These workers wear protective gear such as goggles, welding hoods, heavy gloves, and safety shoes to guard against injuries.

Welders and Cutters may work outdoors, exposed to the weather, or indoors in a confined area designed to contain sparks. Outdoors, they may work on a scaffold or platform high off the ground. Physical activities depend upon the type of job and may include lifting heavy objects and equipment, reaching, walking, climbing, stooping, kneeling, and crawling.

Most Welders, Cutters, Solderers, and Brazers work a 40-hour week. However, overtime is common. Some Welders, Cutters, Solderers, and Brazers work in factories that operate around the clock, requiring shift work. At times, they may work in shifts as long as 12 hours.

Some workers may belong to one of the following unions: the International Association of Machinists and Aerospace Workers; the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers, and Helpers; the United Automobile, Aerospace, and Agriculture Implement Workers of America; or the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada.

## Welders, Cutters, Solderers, and Brazers

### California's Job Outlook and Wages

The California Outlook and Wage table below represents the occupation across all industries.

| Standard Occupational Classification            | Estimated Number of Workers 2004 | Estimated Number of Workers 2014 | Average Annual Openings | 2006 Wage Range (per hour) |
|---|----------------------------------|----------------------------------|-------------------------|----------------------------|
| <b>Welders, Cutters, Solderers, and Brazers</b> |                                  |                                  |                         |                            |
| 51-4121   | 29,800                           | 33,100                           | 1,170                   | \$11.37 to \$19.53         |

*Wages do not include self-employment.*

*Average annual openings include new jobs plus net replacements.*

*Source: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov), Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.*

### Trends

Welders, Cutters, Solderers, and Brazers occupations are expected to grow slower than average for all occupations over the 2004-2014 projections period. Many companies are investing more in automation to cut labor costs. This will reduce the demand for some low-skilled Welders, Cutters, Solderers, and Brazers because the simple, repetitive jobs are being automated. However, opportunities will continue to exist because technology is helping to improve welding, creating more uses for welding in the workplace.

### Training/Requirements/Apprenticeships

Welders, Cutters, Solderers, and Brazers usually follow one of the following training paths:

- ▶ Formal, four-year apprenticeship
- ▶ Vocational school
- ▶ Community college programs or certificates
- ▶ Extensive on-the-job training

Training for Welding, Cutting, Soldering, and Brazing workers can range from a few weeks of school or on-the-job training for low-skilled positions to several years of combined school and on-the-job training for highly skilled jobs. Formal training is available in high schools, vocational schools, and postsecondary institutions, such as vocational-technical institutes, community colleges, apprenticeship programs, and private welding schools. Welders must be licensed through the Contractor's State License Board for jobs in which failure of welds can be dangerous.

Voluntary certification for Welders is available through the American Welding Society (AWS). The AWS also offers a written examination process to certify welding inspectors. Inspectors recertify every nine years by taking a written examination.

## Welders, Cutters, Solderers, and Brazers

### Recommended High School Course Work

High school preparation courses in blueprint reading, shop mathematics, mechanical drawing, physics, chemistry, and computer programming are helpful.

### Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Candidates for training or apprenticeship programs should apply directly to employers who employ Welders, Cutters, Solderers, and Brazers. Community colleges offer assistance in finding jobs to graduates of degree or certificate programs in tool and die making or machine shop. Unions representing Welders also have information concerning apprenticeships and related matters.

Use the *Search for Employers by Industry* feature on the *Career Center* page at [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov) to locate employers in your area. Search under the following industry names to get a list of private firms and their addresses:

- ▶ Employment Placement Agencies
- ▶ Fabricated Structural Metal
- ▶ Metal Window and Door
- ▶ Motor Vehicle Body
- ▶ Ornamental and Architectural Metal Work
- ▶ Plate Work
- ▶ Professional Employer Organizations
- ▶ Sheet metal Work
- ▶ Temporary Help Services
- ▶ Travel Trailer and Camper
- ▶ Truck Trailer

Search these **yellow page** headings for listings of private firms:

- ▶ Welding
- ▶ Welding Certification
- ▶ Welding Inspection and Consulting

### Where Can the Job Lead?

With additional training and experience Welders may advance to welding supervisors, instructors, or inspectors. Many employers prefer to hire certified welding inspectors. Some experienced Welders may open their own repair shops.

### Other Sources of Information

Contractors State License Board  
[www.cslb.ca.gov](http://www.cslb.ca.gov)

American Welding Society  
[www.aws.org](http://www.aws.org)