
Machine Setters, Operators, and Tenders—Metal and Plastic

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Significant Points

- Manufacturing industries employ more than 90 percent of workers.
- A few weeks of on-the-job training is sufficient for most workers to learn basic machine operations, but a year or more is required to become a highly skilled operator or setter.
- Overall employment of machine setters, operators, and tenders is projected to decline rapidly over the 2006-16 period as a result of productivity improvements and competition for jobs from abroad.
- Those who can operate multiple machines will have the best opportunities for advancement and for gaining jobs with more long-term potential.

Nature of the Work

Consider the parts of a toaster, such as the metal or plastic housing or the lever that lowers the toast. These parts, and many other metal and plastic products, are produced by machine setters, operators, and tenders—metal and plastic. In fact, machine operators in the metalworking and plastics industries play a major role in producing most of the consumer products on which we rely daily.

In general, these workers can be separated into two groups—those who set up machines for operation and those who operate the machines during production. Setup workers prepare the machines *prior* to production, perform initial test runs producing a part, and may adjust and make minor repairs to the machinery *during* its operation. Operators and tenders primarily monitor the machinery during its operation; sometimes they load or unload the machine or make minor adjustments to the controls. Many workers both set up and operate equipment. Because the setup process requires an understanding of the entire production process, setters usually have more training and are more highly skilled than those who simply operate or tend machinery. As new automation simplifies the setup process, however, less skilled workers also are increasingly able to set up machines for operation.

Setters, operators, and tenders usually are identified by the type of machine with which they work. Some examples of specific titles are drilling- and boring-machine toolsetters, milling- and planing-machine tenders, and lathe- and turning-machine tool operators. Job duties usually vary with the size of the firm and the type of machine being operated. Although some workers specialize in one or two types of machinery, many are trained to set up or operate a variety of machines. Increasing automation allows machine setters to operate multiple machines simultaneously. In addition, newer production techniques, such as

team-oriented “lean” manufacturing, require machine operators to rotate between different machines. Rotating assignments results in more varied work, but also requires workers to have a wider range of skills.

Machine setters, operators, and tenders—metal set up and tend machines that cut and form all types of metal parts. Setup workers plan and set up the sequence of operations according to blueprints, layouts, or other instructions. Often this involves loading a computer program with instructions into the machine’s computer controls. On all machines, including those with computer controls, setup workers respond to problems during operation by adjusting the speed, feed and other variables. They also choose the proper coolants and lubricants and select the instruments or tools for each operation. Using micrometers, gauges, and other precision measuring instruments, setup workers compare the completed work within the required tolerances.

Although there are many different types of metalworking machine tools that require specific knowledge and skills, most operators perform similar tasks. Whether tending grinding machines that remove excess material from the surface of solid piece of metal or presses that extrude molten metal through a die to form wire, operators usually perform simple, repetitive operations that can be learned quickly. Typically, these workers place metal stock in a machine on which the operating specifications have already been set. They watch one or more machines and make adjustments to the machines based on either reading from computers and gauges or measuring the resulting product. Regardless of the type of machine they operate, machine operators usually depend on more skilled and experienced setup workers for major adjustments when the machines are not functioning properly.

Machine setters, operators, and tenders—plastic set up and tend machines that transform plastic compounds—chemical-based products that can be produced in powder, pellet, or syrup form—into a wide variety of consumer goods such as toys, tubing, and auto parts. These products are manufactured by various methods, of which injection molding is the most common. 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. Many common kitchen products are produced with this method. To produce long parts, such as pipes or window frames, an extruding machine usually is used. These machines force a plastic



Machine setters, operators, and tenders operate a wide range of machine tools.

compound through a die that contains an opening with the desired shape of the final product. Blow molding is another common plasticsworking 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. The familiar 2-liter soft-drink bottles are produced by this method.

Work environment. Most machine setters, operators, and tenders—metal and plastic work in areas that are clean, well lit, and well ventilated. Nevertheless, many operators require stamina, because they are on their feet much of the day and may do moderately heavy lifting. Also, 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. However, many modern machines are enclosed, minimizing the exposure of workers to noise, dust, and lubricants used during machining. Other required safety equipment varies by work setting and machine. For example, those in the plastics industry who work near materials that emit dangerous fumes or dust must wear face masks or self-contained breathing apparatus.

Overtime is common during periods of increased production for most machine setters, operators, and tenders—metal and plastic, but they usually work a 40-hour week. Because many metalworking and plastics working shops operate more than one shift daily, some operators work nights and weekends.

Training, Other Qualifications, and Advancement

A few weeks of on-the-job training is sufficient for most workers to learn basic machine operations, but a year or more is required to become a highly skilled operator or setter.

Education and training. Employers generally prefer workers who have a high school diploma or equivalent for jobs as machine setters, operators, and tenders. Being able to read, write, and speak English is important. Those interested in this occupation can improve their employment opportunities by completing high school courses in shop and blueprint reading and by gaining a working knowledge of the properties of metals and plastics. A solid math background, including courses in algebra, geometry, trigonometry, and basic statistics, also is useful, along with experience working with computers.

Trainees begin by observing and assisting experienced workers, sometimes in formal training programs or apprenticeships. Under supervision, they may start as tenders, supplying materials, starting and stopping the machine, or removing finished products from it. Then they advance to the more difficult tasks performed by operators, such as adjusting feed speeds, changing cutting tools, or inspecting a finished product for defects. Eventually, they develop the skills and experience to setup machines and assist newer operators.

The complexity of the equipment largely determines the time required to become an operator. Most operators learn the basic machine operations and functions in a few weeks, but a year or more may be needed to become skilled operators or to advance to the more highly skilled job of setter. Although

many operators learn on the job, some community colleges and other educational institutions offer courses and certifications in operating metal and plastics machines. In addition to providing on-the-job training, some employers send promising machine tenders to classes. Other employers prefer to hire workers who have completed, or currently are enrolled in, a training program.

Setters or technicians often plan the sequence of work, make the first production run, and determine which adjustments need to be made. As a result, these workers need a thorough knowledge of the machinery and of the products being manufactured. Strong analytical abilities are particularly important for this job. Some companies have formal training programs for operators and setters, which often combine classroom instruction with on-the-job training. For some positions, such as grinders and rolling or pressing setup workers, formal apprenticeships are available. These programs require 300-600 hours of classroom training, and 2000-4000 hours of on-the-job experience. Workers complete these programs in about 2 to 4 years, depending upon the program.

Other qualifications. As the machinery in manufacturing plants becomes more complex and with changes to shop-floor organization that require more teamwork among employees, employers increasingly look for persons with good communication and interpersonal skills. Mechanical aptitude, manual dexterity, and experience working with machinery also are helpful.

Certification and advancement. Job opportunities and advancement can be enhanced by becoming certified in a particular machining skill. The National Institute for Metalworking Skills has developed standards for machine setters, operators, and tenders—metal. After taking an approved course and passing a written exam and performance requirement, the worker is issued a credential that signifies competence in a specific machining operation. The Society of Plastics Industry, the national trade association representing plastics manufacturers, also certifies workers in that industry. Certifications vary greatly depending upon the skill level involved. Both organizations offer multiple levels of operator and setter certifications. Certifications allow operators and setters to switch jobs more easily because they can prove their skills to a potential employer.

Advancement for operators usually takes the form of higher pay and a wider range of responsibilities, eventually than can advance to be setup workers. With experience and training they can become multiple-machine operators, or trainees for more highly skilled positions, such as, machinists, tool and die makers, or computer-control programmers. (See the statements on machinists, computer control programmers and operators, and tool and die makers elsewhere in the *Handbook*.) Some setup workers may advance to supervisory positions.

Employment

Machine setters, operators, and tenders—metal and plastic held about 1.1 million jobs in 2006. More than 90 percent of jobs were found in manufacturing, primarily in fabricated metal product manufacturing, plastics and rubber products

manufacturing, primary metal manufacturing, machinery manufacturing, and motor vehicle parts manufacturing.

Job Outlook

Overall employment in the various machine setter, operator, and tender occupations is expected to decline rapidly during the projection period. Those who can operate multiple machines will have the best opportunities for advancement and for gaining jobs with more long-term potential.

Employment change. Overall employment in the various machine setter, operator, and tender occupations is expected to decline rapidly by 15 percent from 2006 to 2016. In general, employment growth of these workers will be affected by technological advances, changing demand for the goods they produce, foreign competition, and the reorganization of production processes.

One of the most important factors influencing employment change in this occupation is the implementation of labor-saving machinery. Many firms are adopting new technologies, such as computer-controlled machine tools and robots in order to improve quality, lower production costs, and remain competitive. Computer-controlled equipment allows operators to tend a greater number of machines simultaneously and often makes setup easier, thereby reducing the amount of time setup workers spend on each machine. Robots are being used to load and unload parts from machines. The lower-skilled manual machine tool operators and tenders jobs are more likely to be eliminated by these new technologies, because the functions they perform are more easily automated.

The demand for machine setters, operators, and tenders—metal and plastic largely mirrors the demand for the parts they produce. The consumption of plastic products has grown as they have been substituted for metal goods in many products in recent years. The process is likely to continue and should result in stronger demand for machine operators in plastics than in metal.

Both the plastics and metal industries, however, face stiff foreign competition that is limiting the demand for domestically produced parts. One way in which larger U.S. producers have responded to this competition is by moving production operations to other countries where labor costs are lower. These moves are likely to continue and will further reduce employment growth for machine operators, setters, and tenders—metal and plastic in the United States. Another way domestic manufacturers compete with low-wage foreign competition is by increasing their use of automated systems, which can make manufacturing establishments more competitive by improving their productivity. However, increased automation also limits employment growth.

Job prospects. Despite the overall rapid employment decline, a large number of machine setter, operator, and tender jobs will become available because of an expected surge in retirements, primarily baby boomers, by the end of the decade. Workers with a thorough background in machine operations, certifications from industry associations, exposure to a variety of machines, and a good working knowledge of the properties of metals and plastics will be better able to adjust to the changing environment. In addition, new shop-floor arrangements will

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reward workers with good basic mathematics and reading skills, good communication skills, and the ability and willingness to learn new tasks. As workers adapt to team-oriented production methods, those who can operate multiple machines will have the best opportunities for advancement and for gaining jobs with more long-term potential.

Earnings

Earnings for machine operators can vary by size of the company, union status, industry, and skill level and experience of the operator. Also, temporary employees, who are being hired in greater numbers, usually get paid less than permanently employed workers. The median hourly earnings in May 2006 for a variety of machine setters, operators, and tenders—metal and plastic were:

Model makers, metal and plastic	\$20.22
Patternmakers, metal and plastic.....	17.01
Lay-out workers, metal and plastic	16.15
Metal-refining furnace operators and tenders	15.69
Lathe and turning machine tool setters, operators, and tenders, metal and plastic	15.46
Milling and planing machine setters, operators, and tenders, metal and plastic	15.18
Rolling machine setters, operators, and tenders, metal and plastic	14.93
Heat treating equipment setters, operators, and tenders, metal and plastic	14.83
Tool grinders, filers, and sharpeners	14.73
Multiple machine tool setters, operators, and tenders, metal and plastic	14.68
Drilling and boring machine tool setters, operators, and tenders, metal and plastic	14.36
Pourers and casters, metal.....	14.22
Forging machine setters, operators, and tenders, metal and plastic	13.94
Foundry mold and coremakers.....	13.82
Extruding and drawing machine setters, operators, and tenders, metal and plastic	13.58
Grinding, lapping, polishing, and buffing machine tool setters, operators, and tenders, metal and plastic.....	13.50
Plating and coating machine setters, operators, and tenders, metal and plastic	13.21
Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	12.66
Molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic	12.29
Metal workers and plastic workers, all other	16.69

Related Occupations

Workers in occupations closely related to machine setters, operators, and tenders—metal and plastic include machinists; tool and die makers; assemblers and fabricators; computer control programmers and operators; painting and coating workers, except construction and maintenance; and welding, soldering, and brazing workers. Often, machine operators are responsible for checking the quality of parts being produced, work similar to that of inspectors, testers, sorters, samplers, and weighers.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Machine setters, operators, and tenders—metal and plastic	—	1,141,000	975,000	-166,000	-15
Forming machine setters, operators, and tenders, metal and plastic	51-4020	161,000	140,000	-20,000	-13
Extruding and drawing machine setters, operators, and tenders, metal and plastic	51-4021	94,000	87,000	-6,700	-7
Forging machine setters, operators, and tenders, metal and plastic	51-4022	31,000	22,000	-9,400	-30
Rolling machine setters, operators, and tenders, metal and plastic	51-4023	36,000	32,000	-4,200	-12
Machine tool cutting setters, operators, and tenders, metal and plastic	51-4030	513,000	425,000	-88,000	-17
Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	51-4031	272,000	231,000	-40,000	-15
Drilling and boring machine tool setters, operators, and tenders, metal and plastic	51-4032	43,000	33,000	-9,500	-22
Grinding, lapping, polishing, and buffing machine tool setters, operators, and tenders, metal and plastic	51-4033	101,000	85,000	-16,000	-16
Lathe and turning machine tool setters, operators, and tenders, metal and plastic	51-4034	68,000	52,000	-16,000	-23
Milling and planing machine setters, operators, and tenders, metal and plastic	51-4035	29,000	23,000	-6,100	-21
Metal furnace and kiln operators and tenders	51-4050	33,000	27,000	-6,100	-18
Metal-refining furnace operators and tenders	51-4051	18,000	15,000	-3,500	-19
Pourers and casters, metal	51-4052	15,000	12,000	-2,600	-17
Model makers and patternmakers, metal and plastic	51-4060	16,000	15,000	-1,000	-6
Model makers, metal and plastic	51-4061	8,800	8,200	-600	-6
Patternmakers, metal and plastic	51-4062	7,400	7,000	-400	-5
Molders and molding machine setters, operators, and tenders, metal and plastic	51-4070	171,000	148,000	-23,000	-14
Foundry mold and coremakers	51-4071	15,000	11,000	-3,300	-23
Molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic	51-4072	157,000	137,000	-20,000	-13
Multiple machine tool setters, operators, and tenders, metal and plastic	51-4081	97,000	97,000	300	0
Miscellaneous metalworkers and plastic workers	51-4190	150,000	122,000	-28,000	-18
Heat treating equipment setters, operators, and tenders, metal and plastic	51-4191	27,000	23,000	-4,000	-15
Lay-out workers, metal and plastic	51-4192	10,000	8,100	-2,000	-20
Plating and coating machine setters, operators, and tenders, metal and plastic	51-4193	42,000	37,000	-5,100	-12
Tool grinders, filers, and sharpeners	51-4194	22,000	18,000	-4,200	-19
Metal workers and plastic workers, all other	51-4199	49,000	36,000	-12,000	-25

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

Sources of Additional Information

For general information about careers and companies employing metal machine setters, operators, and tenders, contact:

► National Tooling and Machining Association, 9300 Livingston Rd., Fort Washington, MD 20744.

Internet: <http://www.ntma.org>

► Precision Metalforming Association Educational Foundation, 6363 Oak Tree Blvd., Independence, OH 44131.

Internet: <http://www.pmaef.org>

► Precision Machine Products Association, 6700 West Snowville Rd., Brecksville, OH 44141-3292.

Internet: <http://www.pmpa.org>

For information on schools and employers with training programs in plastics, contact:

► Society of Plastics Industry, 1667 K St.NW., Suite 1000, Washington, DC 20006.

Internet:

<http://www.plasticsindustry.org/outreach/careers.htm>