

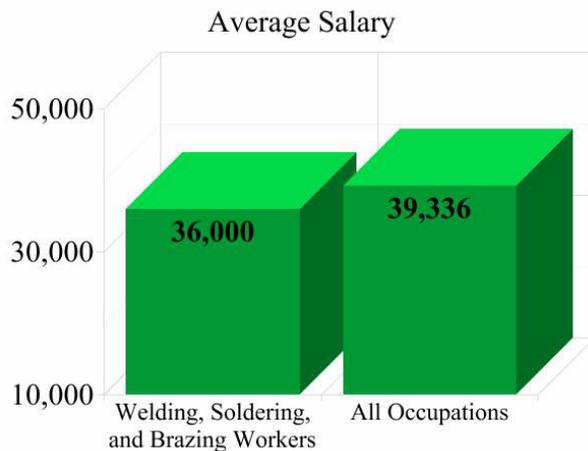
Welding, Soldering, and Brazing Workers

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WHAT THEY DO

Welding is the most common way of permanently joining metal parts. In this process, heat is applied to metal pieces, melting and fusing them to form a permanent bond. Because of its strength, welding is used in shipbuilding, automobile manufacturing and repair, aerospace applications, and thousands of other manufacturing activities. Welding also is used to join beams in the construction of buildings, bridges, and other structures and to join pipes in pipelines, powerplants, and refineries.

Welders may work in a wide variety of industries, from car racing to manufacturing. The work done in the different industries and the equipment used may vary greatly. The most common and simplest type of welding today is arc welding, which uses electrical currents to create heat and bond metals together, but there are over 100 different processes that a welder can employ. The type of weld used is normally determined by the types of metals being joined and the conditions under which the welding is to take place. Steel, for instance, can be welded more easily than titanium. Some of these processes involve manually using a rod and heat to join metals, while others are semiautomatic, with a welding machine feeding wire to bond materials. Automated welding, done completely by robots, is increasingly being used in the manufacturing industry.



Like welders, soldering and brazing workers use molten metal to join two pieces of metal. However, the metal added during the soldering and brazing process has a melting point lower than that of the piece, so only the added metal is melted, not the piece. Soldering uses metals with a melting point below 840 degrees Fahrenheit; brazing uses metals with a higher melting point. Because soldering and brazing do not melt the pieces being joined, these processes normally do not create the distortions or weaknesses in the pieces that can occur with welding.

Soldering commonly is used to make electrical and electronic circuit boards, such as computer chips. Soldering workers tend to work with small pieces that must be precisely positioned. Brazing often is used to connect copper plumbing pipes and thinner metals that the higher temperatures of welding would warp. Brazing also can be used to apply coatings to parts to reduce wear and protect against corrosion.

Skilled welding, soldering, and brazing workers generally plan work from drawings, called blueprints, or specifications and use their knowledge of welding processes and base metals to determine how best to join the parts. The difficulty of the weld is determined by its position—horizontal, vertical, overhead, or 6G (circular, as in large pipes)—and by the type of metals to be fused. Highly skilled welders often are trained to work with a wide variety of materials, such as titanium, aluminum, or plastics, in addition to steel. Welders then select and set up welding equipment, execute the planned welds, and examine the welds to ensure that they meet standards or specifications.

Automated welding is being used in an increasing number of production processes. In these instances, a machine or robot performs the welding tasks while being monitored by a welding machine operator. Welding, soldering, and brazing machine setters, operators, and tenders follow specified layouts, work orders, or blueprints. Operators must load parts correctly and monitor the machine constantly to ensure that it produces the desired bond. About 12 percent of all welding, soldering, and brazing workers operate automated machinery.

The work of arc, plasma, and oxy-gas cutters is closely related to that of welders. However, instead of joining metals, cutters use the heat from an electric arc, a stream of ionized gas called plasma, or burning gases to cut and trim metal objects to specific dimensions. Cutters also dismantle large objects, such as ships, railroad cars, automobiles, buildings, or aircraft.

EDUCATION REQUIRED

Formal training is available in high schools and postsecondary institutions, such as vocational-technical institutes, community colleges, and private welding, soldering, and brazing schools.

The U.S. Armed Forces operate welding and soldering schools as well. Some employers are willing to hire inexperienced entry-level workers and train them on the job, but many prefer to hire workers who have been through formal training programs. Courses in blueprint reading, shop mathematics, mechanical drawing, physics, chemistry, and metallurgy are helpful.

An understanding of electricity also is very helpful, and knowledge of computers is gaining importance, especially for welding, soldering, and brazing machine operators, who are becoming more responsible for programming robots and other computer-controlled machines. Because understanding the welding process and inspecting welds is important for both welders and welding machine operators, companies hiring machine operators prefer workers with a background in welding.

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OTHER USEFUL SKILLS

Some welding positions require general certifications in welding or certifications in specific skills such as inspection or robotic welding. The American Welding Society certification courses are offered at many welding schools. Some employers have developed their own internal certification tests. Some employers are willing to pay training and testing costs for employees, while others require workers to pay for classes and certification themselves.

The Institute for Printed Circuits offers certifications and training in soldering. In industries such as aerospace and defense, where highly accurate and skilled work is required, many employers require these certifications. In addition, the increasing use of lead-free soldering techniques, which require more skill than traditional lead-based soldering techniques, has increased the importance of certification to employers. Welding, soldering, and brazing workers need good eyesight, hand-eye coordination, and manual dexterity, along with good math, problem-solving, and communication skills.

HOW TO ADVANCE

Welders can advance to more skilled welding jobs with additional training and experience. For example, they may become welding technicians, supervisors, inspectors, or instructors. Some experienced welders open their own repair shops. Other welders, especially those who obtain a bachelor's degree or have many years of experience, may become welding engineers.

WORK ENVIRONMENT

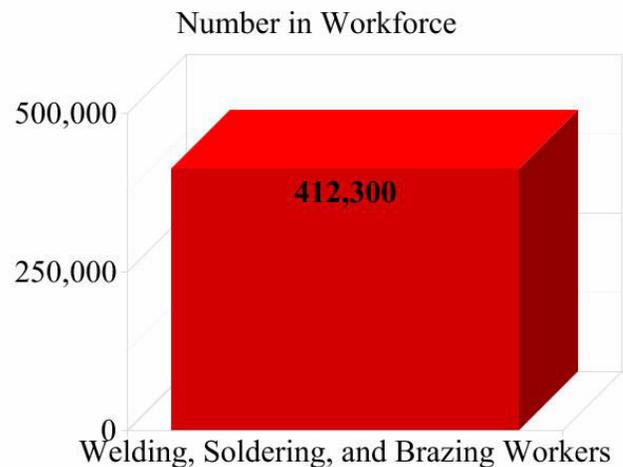
Welding, soldering, and brazing workers often are exposed to a number of hazards, including very hot materials and the intense light created by the arc. They wear safety shoes, goggles, masks with protective lenses, and other devices designed to prevent burns and eye injuries and to protect them from falling objects. The Occupational Safety and Health Administration (OSHA) requires that welders work in safely ventilated areas to avoid the danger from inhalation of gases and particulates that can result from welding processes. Because of these hazards, welding, soldering, and brazing workers suffer more work-related injuries than do workers in most occupations, but injuries can be minimized if proper safety procedures are followed. Automated welding, soldering, and brazing machine operators are not exposed to as many dangers, and a face shield or goggles usually provide adequate protection for these workers.

Although about 50 percent of welders, solderers, and brazers work a 40-hour week, overtime is common, and about 1 out of 5 welder works 50 hours per week or more. Many manufacturing firms offer two or three shifts, ranging from 8 to 12 hours, which allows them to continue production around the clock if needed.

JOB GROWTH

Employment of welders, cutters, solderers, and brazers is expected to experience little or no change, declining by about 2 percent over the 2008–18 decade, while employment of welding, soldering, and brazing machine setters, operators, and tenders is expected to decline moderately by about 7 percent over the same decade. Continued enhancements in productivity and increased automation will reduce the need for welders, although the outlook for welders in manufacturing is stronger than that for other occupations in this industry because of the importance and versatility of welding as a manufacturing process.

The basic skills of welding are the same across industries, so welders can easily shift from one industry to another, depending on where they are needed most. For example, welders laid off in the automotive manufacturing industry may be able to find work in the oil and gas industry, although the shift may require relocating.



Automation will affect welders and welding machine operators differently than other manufacturing occupations. Semiautomated and automated welding machines can be used for many types of welds, but welders still are needed to operate the machines and to inspect the weld and make adjustments. In addition, much of the work in custom applications is difficult or impossible to automate. This type of work includes manufacturing small batches of items, construction work, and making repairs in factories.

Job prospects for welders will vary with the welder's skill level. Prospects should be good for welders trained in the latest technologies. Welding schools report that graduates have little difficulty finding work, and many welding employers report difficulty finding properly skilled welders. However, welders without up-to-date training may face competition for job openings. For all welders, prospects will be better for workers who are willing to relocate to different parts of the country.