
Boilermakers

(O*NET 47-2011.00)

Significant Points

- Boilermakers use potentially dangerous equipment and the work is physically demanding.
- Most boilermakers learn through a formal apprenticeship; people with a welding certification or other welding training get priority in selection to apprenticeship programs.
- Excellent employment opportunities are expected.

Nature of the Work

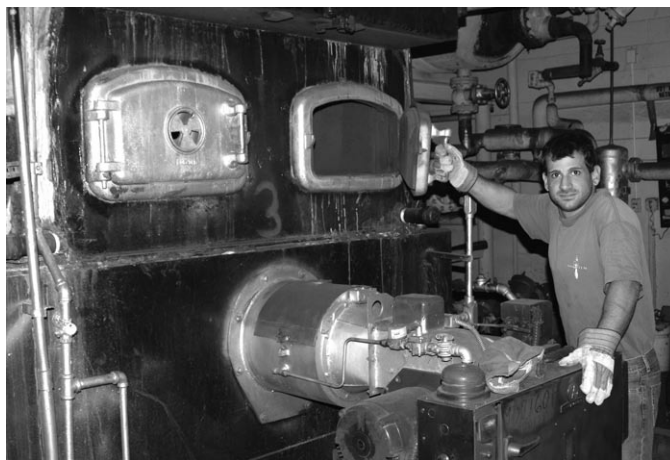
Boilermakers and *boilermaker mechanics* make, install, and repair boilers, closed vats, and other large vessels or containers that hold liquids and gases. Boilers heat water or other fluids under extreme pressure for use in generating electric power and to provide heat and power in buildings, factories, and ships. Chemicals, oil, beer, and hundreds of other products are processed and stored in the tanks and vats made by the Nation's boilermakers.

In addition to installing and maintaining boilers and other vessels, boilermakers also help erect and repair air pollution equipment, blast furnaces, water treatment plants, storage and process tanks, and smoke stacks. Boilermakers also install refractory brick and other heat-resistant materials in fireboxes or pressure vessels. Some install and maintain the huge pipes used in dams to send water to and from hydroelectric power generation turbines.

Electric power plants harness highly pressurized steam in a boiler to spin the blades of a turbine, which is attached to an electric generator. In most plants, coal burned in a firebox is the dominant fuel used to generate steam in the boiler.

Because boilers last a long time—sometimes 50 years or more—boilermakers regularly maintain them and upgrade components, such as boiler tubes, heating elements, and ductwork, to increase efficiency. They regularly inspect fittings, feed pumps, safety and check valves, water and pressure gauges, boiler controls, and auxiliary machinery. For closed vats and other large vessels, boilermakers clean or supervise cleaning using scrapers, wire brushes, and cleaning solvents. They repair or replace defective parts using hand and power tools, gas torches, and welding equipment, and may operate metalworking machinery to repair or make parts. They also dismantle leaky boilers, patch weak spots with metal stock, replace defective sections, and strengthen joints.

Boilers and other high-pressure vessels used to hold liquids and gases usually are made in sections by casting each piece out of steel, iron, copper, or stainless steel. Manufacturers are increasingly automating this process to improve the quality of these vessels. Boiler sections are then welded together, often using robotic welding systems or automated orbital welding machines, which make more consistent welds than are possible by hand and eliminates some of the monotony of the task. Small boilers may be assembled in the manufacturing plant; larger boilers usually are prefabricated in numerous pieces and assembled on site, although they may be temporarily assembled



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in a fabrication shop to ensure a proper fit before final assembly on the permanent site.

Before making or repairing a fabricated metal product, a boilermaker studies design drawings and creates full size patterns or templates, using straightedges, squares, transits, and tape measures. After the various sized shapes and pieces are marked out on metal, boilermakers use hand and power tools or flame cutting torches to make the cuts. The sections of metal are then bent into shape and accurately lined up before they are welded together. If the plate sections are very large, heavy cranes are used to lift the parts into place. Boilermakers align sections using plumb bobs, levels, wedges, and turnbuckles. They use hammers, files, grinders, and cutting torches to remove irregular edges so that metal pieces fit together properly. They then join them by bolting, welding, or riveting. Boilermakers also align and attach water tubes, stacks and liners, safety and check valves, water and pressure gauges, and other parts and test complete vessels for leaks or other defects.

Work environment. Boilermakers often use potentially dangerous equipment, such as acetylene torches and power grinders; handle heavy parts and tools; and work on ladders or on top of large vessels. Dams, boilers, storage tanks, and pressure vessels are usually of substantial size, thus a major portion of boilermaker work is performed at great heights, sometimes hundreds of feet above the ground in the case of dams. The work is physically demanding and may be done in cramped quarters inside boilers, vats, or tanks that are often dark, damp, and poorly ventilated. Field construction work is performed outside so exposure to all types of weather conditions, including extreme heat and cold, is common. To reduce the chance of injuries, boilermakers often wear hardhats, harnesses, protective clothing, ear plugs, safety glasses and shoes, and respirators.

Boilermakers may experience extended periods of overtime when equipment is shut down for maintenance. Overtime work also may be necessary to meet construction or production deadlines. However, since most field construction and repair work is contract work, there may be periods of unemployment when a contract is complete. Many boilermakers must travel to a project and live away from home for long periods of time.

Training, Other Qualifications, and Advancement

Most boilermakers learn this trade through a formal apprenticeship. A few become boilermakers through a combination of

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Boilermakers	47-2011	18,000	20,000	2,500	14

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*.

trade or technical school training and employer-provided training.

Education and training. Most boilermakers train in both boilermaking and structural fabrication. Apprenticeship programs usually consist of 6,000 hours or 4 years of paid on-the-job training, supplemented by a minimum of 144 hours of classroom instruction each year in subjects such as set-up and assembly rigging, plate and pressure welding, blueprint reading, and layout. Those who finish registered apprenticeships are certified as fully qualified journey-workers.

Most apprentices must be high school graduates or have a GED or its equivalent. Those with welding training or a welding certification will have priority in applying for apprenticeship programs. Experienced boilermakers often attend apprenticeship classes or seminars to learn about new equipment, procedures, and technology. When an apprenticeship becomes available, the local union publicizes the opportunity by notifying local vocational schools and high school vocational programs.

Other qualifications. The work of boilermakers requires a high degree of technical skill, knowledge, and dedication. Because the tools and equipment used by boilermakers are typically heavier and more cumbersome than those in other construction trades, having physical strength and stamina is important. Good manual dexterity is also important. Most apprentices must be at least 18 years old.

Advancement. Some boilermakers advance to supervisory positions. Because of their extensive training, those trained through apprenticeships usually have an advantage in getting promoted over those who have not gone through the full program.

Employment

Boilermakers held about 18,000 jobs in 2006. About 63 percent worked in the construction industry, assembling and erecting boilers and other vessels. Around 18 percent worked in manufacturing, primarily in boiler manufacturing shops, iron and steel plants, petroleum refineries, chemical plants, and shipyards. Some also worked for boiler repair firms or railroads.

Job Outlook

Employment of boilermakers is expected to grow faster than average. Excellent employment opportunities are expected.

Employment change. Overall employment of boilermakers is expected to grow by 14 percent between 2006 and 2016, faster than the average for all occupations. Growth will be driven by the need to maintain and upgrade, rather than replace, the many existing boilers that are getting older, and by the need to meet the growing population's demand for electric power. While boilers historically have lasted over 50 years, the need to replace components, such as boiler tubes, heating elements, and

ductwork, is an ongoing process that will continue to spur demand for boilermakers. To meet the requirements of the Clean Air Act, utility companies also will need to upgrade many of their boiler systems in the next few years.

The Energy Policy Act of 2005 is expected to lead to the construction of many new clean-burning coal power plants, spurring demand for boilermakers. The law, designed to promote conservation and use of cleaner technologies in energy production through tax credits and higher efficiency standards, is expected to positively affect the occupation and the energy industry throughout the 2006-16 projection period.

Installation of new boilers and pressure vessels, air pollution equipment, blast furnaces, water treatment plants, storage and process tanks, electric static precipitators, and stacks and liners, will further drive growth of boilermakers, although to a slightly lesser extent than repairs will.

Job prospects. Job prospects should be excellent because of job growth and because the work of a boilermaker remains hazardous and physically demanding, leading some new apprentices to seek other types of work. An even greater number of openings will arise from the numerous boilermakers expected to retire over the projection decade.

People who have welding training or a welding certificate should have the best opportunities for being selected for boilermaker apprenticeship programs.

Most industries that purchase boilers are sensitive to economic conditions. Therefore, during economic downturns, boilermakers in the construction industry may be laid off. However, maintenance and repairs of boilers must continue even during economic downturns so boilermaker mechanics in manufacturing and other industries generally have more stable employment.

Earnings

In May 2006, the median annual earnings of wage and salary boilermakers were about \$46,960. The middle 50 percent earned between \$37,300 and \$59,710. The lowest 10 percent earned less than \$30,410, and the highest 10 percent earned more than \$71,170. Apprentices generally start at about half of journey-level wages, with wages gradually increasing to the journey wage as workers gain skills.

Many boilermakers belong to labor unions, most to the International Brotherhood of Boilermakers. Other boilermakers are members of the International Association of Machinists, the United Automobile Workers, or the United Steelworkers of America.

Related Occupations

Workers in a number of other occupations assemble, install, or repair metal equipment or machines. These occupations include assemblers and fabricators; machinists; industrial machinery

mechanics and maintenance workers; millwrights; pipelayers, plumbers, pipefitters, and steamfitters; sheet metal workers; tool and die makers; and welding, soldering, and brazing workers.

Sources of Additional Information

For more information about boilermaking apprenticeships or other training opportunities, contact local offices of the unions previously mentioned, local construction companies and boiler manufacturers, or the local office of your State employment service. You can also find information on the registered apprenticeships together with links to State apprenticeship programs on the U.S. Department of Labor's Web site: http://www.doleta.gov/atels_bat Apprenticeship information

is also available from the U.S. Department of Labor's toll free helpline: (877) 872-5627.

For information on apprenticeships and the boilermaking occupation, contact:

► International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers, and Helpers, 753 State Ave., Suite 570, Kansas City, KS 66101.

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

For general information on apprenticeships and how to get them, see the *Occupational Outlook Quarterly* article "Apprenticeships: Career training, credentials—and a paycheck in your pocket," online at <http://www.bls.gov/opub/ooq/2002/summer/art01.pdf> and in print at many libraries and career centers.