

Construction Trades and Related Workers

Boilermakers

(O*NET 47-2011.00)

Significant Points

- A formal apprenticeship is the best way to learn this trade.
- Due to the limited number of apprenticeships available and the relatively good wages, prospective boilermakers are likely to face competition.

Nature of the Work

Boilermakers and boilermaker mechanics make, install, and repair boilers, vats, and other large vessels that hold liquids and gases. Boilers supply steam to drive huge turbines in electric power plants and to provide heat and power in buildings, factories, and ships. Tanks and vats are used to process and store chemicals, oil, beer, and hundreds of other products.

Boilers and other high-pressure vessels usually are made in sections, by casting each piece out of molten iron or steel. Manufacturers are increasingly automating this process to increase the quality of these vessels. Boiler sections are then welded together, often using automated orbital welding machines, which make more consistent welds than are possible by hand. Small boilers may be assembled in the manufacturing plant; larger boilers usually are assembled on site.

Following blueprints, boilermakers locate and mark reference points on the boiler foundation, using straightedges, squares, transits, and tape measures. Boilermakers attach rigging and signal crane operators to lift heavy frame and plate sections and other parts into place. They align sections, using plumb bobs, levels, wedges, and turnbuckles. Boilermakers use hammers, files, grinders, and cutting torches to remove irregular edges, so that edges fit properly. They then bolt or weld edges together. Boilermakers align and attach water tubes, stacks, valves, gauges, and other parts and test complete vessels for leaks or other defects. They also install refractory brick and other heat-resistant materials in fireboxes or pressure vessels. Usually, they assemble large vessels temporarily in a

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

Because boilers last a long time—35 years or more—boilermakers regularly maintain them and update components, such as burners and boiler tubes, to increase efficiency. Boilermaker mechanics maintain and repair boilers and similar vessels. They inspect tubes, fittings, valves, controls, and auxiliary machinery and clean or supervise the cleaning of boilers 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.

Working Conditions

Boilermakers often use potentially dangerous equipment, such as acetylene torches and power grinders, handle heavy parts, and work on ladders or on top of large vessels. Work may be done in cramped quarters inside boilers, vats, or tanks that are often damp and poorly ventilated. To reduce the chance of injuries, boilermakers may wear hardhats, harnesses, protective clothing, safety glasses and shoes, and respirators. Boilermakers usually work a 40-hour week, but 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.

Employment

Boilermakers held about 27,000 jobs in 2000. Nearly 6 out of 10 worked in the construction industry, assembling and erecting boilers and other vessels. About one-fifth 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, railroads, or in Navy shipyards and Federal power facilities.

Training, Other Qualifications, and Advancement

Many boilermakers learn this trade through a formal apprenticeship. Others become boilermakers through a combination of trade or technical school training and employer-provided training. Apprenticeship programs usually consist of 4 years of on-the-job training, supplemented by 144 hours of classroom instruction each year in subjects such as set-up and assembly rigging, welding of all types, blueprint reading, and layout. Experienced boilermakers often attend apprenticeship classes to keep their knowledge current. Also, the American Boiler Manufacturers Association, in conjunction with the National Board of Boiler and Pressure Vessel Operators, offers seminars on boiler equipment, operation, maintenance, and safety. When an apprenticeship becomes available, the local union publicizes the opportunity by notifying local vocational schools and high school vocational programs.

When hiring helpers, employers prefer high school or vocational school graduates. Courses in shop, mathematics, drafting, blueprint reading, welding, and machine metalworking are useful. Mechanical aptitude and the manual dexterity needed to handle tools also are important.

Some boilermakers advance to supervisory positions. Because of their broader training, apprentices usually have an advantage in promotion.



Boilermakers maintain and repair boilers and similar vessels.

Job Outlook

Employment of boilermakers is expected to show little or no change through the year 2010. Most job openings will result from the need to replace experienced workers who leave this small occupation. Growth should be limited by the trend toward repairing and retrofitting, rather than replacing, existing boilers; the use of small boilers, which require less on-site assembly; and automation of production technologies.

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

Earnings

In 2000, the median hourly earnings of boilermakers were about \$17.80. The middle 50 percent earned between \$14.06 and \$23.19. The lowest 10 percent earned less than \$9.60 and the highest 10 percent earned more than \$26.81. Apprentices generally start at about 60 percent of journey wages, with wages gradually increasing to the journey wage as progress is made in the apprenticeship.

Almost one-half of all boilermakers belong to labor unions. The principal union is 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 installation, repair, and maintenance workers; pipelayers, plumbers, pipefitters, and steamfitters; sheet metal workers; tool and die makers; and welding, soldering, and brazing workers.

Sources of Additional Information

For further information regarding 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.

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>

Brickmasons, Blockmasons, and Stonemasons

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Significant Points

- Job prospects are expected to be excellent.
- Most entrants learn informally on the job, but apprenticeship programs provide the most thorough training.
- Work is usually outdoors and involves lifting heavy bricks and blocks and working on scaffolds.
- Nearly 3 out of 10 are self-employed.

Nature of the Work

Brickmasons, blockmasons, and stonemasons work in closely related trades creating attractive, durable surfaces and structures. The work varies in complexity, from laying a simple masonry walkway to installing an ornate exterior on a high-rise building. *Brickmasons* and *blockmasons*—who often are referred to simply as bricklayers—build and repair walls, floors, partitions, fireplaces, chimneys, and other structures with brick, precast masonry panels, concrete block, and other masonry materials. Additionally, brickmasons specialize in installing firebrick linings in industrial furnaces. *Stonemasons* build stone walls, as well as set stone exteriors and floors. They work with two types of stone—natural cut, such as marble, granite, and limestone; and artificial stone made from concrete, marble chips, or other masonry materials. Stonemasons usually work on nonresidential structures, such as houses of worship, hotels, and office buildings.

When building a structure, brickmasons use one of two methods, the corner lead or the corner pole. Using the corner lead method, they begin by constructing a pyramid of bricks at each corner—called a lead. After the corner leads are complete, less experienced brickmasons fill in the wall between the corners, using a line from corner to corner to guide each *course*, or layer, of brick. Due to the precision needed, corner leads are time-consuming to erect and require the skills of experienced bricklayers.

Because of the expense associated with building corner leads, most brickmasons use corner poles, also called masonry guides, that enable them to build an entire wall at the same time. They fasten the corner poles (posts) in a plumb position to define the wall line and stretch a line between them. This line serves as a guide for each course of brick. Brickmasons then spread a bed of mortar (a cement, sand, and water mixture) with a trowel (a flat, bladed metal tool with a handle), place the brick on the mortar bed, and press and tap the brick into place. Depending on blueprint specifications, brickmasons either cut bricks with a hammer and chisel or saw them to fit around windows, doors, and other openings. Mortar joints are then finished with jointing tools for a sealed, neat, uniform appearance. Although brickmasons usually use steel supports, or *lintels*, at window and door openings, they sometimes build brick arches instead, which support and enhance the beauty of the brickwork.

Stonemasons often work from a set of drawings, in which each stone has been numbered for identification. Helpers may locate and carry these prenumbered stones to the masons. A derrick operator using a hoist may be needed to lift large stone pieces into place.

When building a stone wall, masons set the first course of stones into a shallow bed of mortar. They then align the stones with wedges, plumb lines, and levels, and adjust them into position with a hard rubber mallet. Masons continue to build the wall by alternating layers of mortar and courses of stone. As the work progresses, masons remove the wedges, fill the joints between stones, and use a pointed metal tool, called a tuck pointer, to smooth the mortar to an attractive finish. To hold large stones in place, stonemasons attach brackets to the stone and weld or bolt these brackets to anchors in the wall. Finally, masons wash the stone with a cleansing solution to remove stains and dry mortar.

When setting stone floors, which often consist of large and heavy pieces of stone, masons first use a trowel to spread a layer of damp mortar over the surface to be covered. Using crowbars and hard rubber mallets for aligning and leveling, they then set the stone in the mortar bed. To finish, workers fill the joints and wash the stone slabs.

Masons use a special hammer and chisel to cut stone. They cut stone along the grain to make various shapes and sizes, and valuable pieces often are cut with a saw that has a diamond blade. Some