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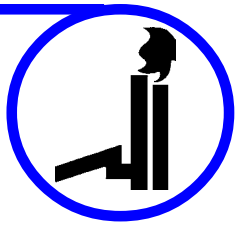
Iron and Steel Industry Workers



Occupational Brief Title Codes:
- D.O.T.: 51
- G.O.E.: 06.02.10
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Occupational Subtitles:
- Blast Furnace Supervisors
- Crane Operators
- Furnace Operators
- Piercing Mill Operators
- Rougher Pulpit Operators
- Shear Operators
- Skip Car Operators
- Speed Operators

Work Classification Based Related D.O.T. Occupations:
- Cupola Tenders
- Foundry Workers
- Kiln Operators
- Mold Workers
- Tin Recovery Workers

Interests Based Related G.O.E. Occupations:
- Firearms Industry Workers
- Industrial Chemicals Workers
- Rubber Goods Production Workers
- Sporting Goods Production Workers
- Toy Industry Workers

Skills Based Related O*NET Occupations:
- Foundry Mold and Coremakers
- Plate Finishers
- Precision Pattern and Die Casters, Nonferrous Metals
- Welders, Production

Noteworthy Quote:

"As an iron and steel industry worker, it is important to understand "teamwork". Workers most often work together as a crew and depend on each other. It is essential for their safety and to achieve a job well-done."

– Member of the National Blacksmiths and Welders Association, Arnold, Nebraska

Iron and steel industry workers (`iron and `steel `in-dus-try `work-ers) combine iron ore with other materials and melt it to make iron and steel products. They operate furnaces and rolling and finishing mills to make steel plates, slabs, bars, ingots, rods, wires, pipes, and hot and cold rolled sheet metal.

Work Performed

Blast Furnaces

Blast furnaces are used to make iron from iron ore, coke, and limestone. This hard but brittle substance is useful for making cast-iron products such as pipes, grates for furnaces and boilers, radiators, and other high-heat, low-stress products. To make these items, foundries pour molten iron into molds.

A blast furnace is a huge water-cooled steel cylinder lined with layers of firebrick. Nearby are stoves which are domed-top cylinders that heat air to high temperatures. Nozzles deliver hot air blasts from the stoves into the furnace.

Stove tenders control the temperature of the air inside the stoves. They open valves that blast the air into the furnace.

Skip car operators use automatic controls to load cars with ore, coke, and limestone, and empty the contents into the furnace in layers. As the mixture burns and melts, it settles and makes room for an almost continuous adding of fresh loads.

Inside the furnace, hot air and burning coke drive the temperature to about 3,000 degrees Fahrenheit and melt and reduce the iron ore to liquid iron. The limestone, acting as a cleansing agent, purifies the molten iron. The pure molten iron collects in a pool at the bottom of the furnace. The limestone and impurities form a glasslike slag that floats on top of the iron.

Blast furnace supervisors, also known as ***blowers***, see that the furnace produces quality iron in quantity. They watch pyrometers that measure temperatures. They order changes in temperature and pressure. Blowers also direct ***blast furnace keepers*** who tap the furnace to remove the liquid iron and slag along with the assistance of ***blast furnace helpers***.

These workers drill out a clay plug to open a taphole above the liquid iron. The slag floating on top of the iron flows down a trough into huge ladles set in place by ***crane operators***.

Keepers and helpers open the lower taphole to draw off the iron and load it into torpedo or bottle cars that keep the iron heated.

Workers tap the furnace every four to five hours. The yield of iron in a twenty-four-hour period may be 8,000 or more tons. Some of the iron becomes molds or pigs, which go to other steel plants or to foundries that use them to make engine blocks or other products. If the blast furnace is in a plant that also makes steel, the iron goes in bottle cars to the steelmaking furnaces.

Steelmaking Furnaces

By varying the amounts of carbon and alloys added to scrap metal, steelmakers produce steel for thousands of products ranging from razor blades to suspension bridge cables. Alloys include chromium, tin, zinc, copper, silicon, tungsten, vanadium, and nickel. Stainless steel, for instance, contains 18 percent chromium and 8 percent nickel.

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CGP

Two kinds of furnaces are used to make steel. They are the basic oxygen furnace (BOF) and the electric arc furnace (EAF). The BOFs produce about 62 percent of the steel made in the United States. The EAFs, which produce specialty steels, account for about 38 percent.

A BOF looks like a huge, pear-shaped upright bottle. It is mounted on trunnions so that it can be tipped to receive raw materials and to pour out steel and slag. The BOF operates with a blast of almost pure oxygen directed through a water-cooled pipe called a lance. The oxygen blows at supersonic speed into the furnace contents to separate impurities and burn out the excess carbon content. The EAF uses an electric current to generate tremendous heat that melts and purifies the steel scrap charge.

Although the processes for these furnaces differ, the workers have similar jobs. ***Melter supervisors*** coordinate the efforts of furnace workers. They take temperatures and tests of molten steel for color and temperature.

Furnace helpers run controls that tilt the furnace to receive a charge or load. ***Scrap crane operators*** position the scrap box at the open tilted furnace and tip the scrap into the furnace. Next, ***charging crane operators***, who control the ladles full of molten iron from the blast furnaces, tip the iron into the BOF.

Furnace operators in a control room overlooking the furnace use automatic controls to lower the oxygen lance into the loaded furnace. They control the heat generated by the oxygen, add the lime and other fluxing agents that take out impurities, and add alloying agents to produce steel with the required properties.

Furnace operators judge from instrument readings when the steel is almost ready to pour. Furnace helpers use a pole to take a sample, which they send to the laboratory for testing. Operators check the test results to decide when and at what temperature to pour the steel.

Furnace helpers then tilt the furnace toward a ladle placed to catch the molten steel. The steel flows out of a taphole. They tilt the vessel the other way and pour the slag over the lip into a slag pot. Vessels of varying size can produce from 75 to 300 tons of molten steel in as little as forty-five minutes.

The next step in the steelmaking process is to pour the molten steel into molds to make ingots. A ***hot metal crane operator*** controls an overhead crane that picks up a ladle of molten steel and positions it above a long row of ingot molds. A ***steel pourer*** operates a plug at the bottom of the ladle, and the steel pours into the molds.

The molds stand on railroad flatcars called ingot buggies. When the ingots cool, ***ingot headers*** operate cranes that loosens the molds or strips the ingots from the molds. The ingots then go on flatcars to soaking pits for further processing into semifinished shapes.

At many plants continuous casters are replacing the ingot method for forming semifinished shapes. Continuous casters convert molten steel directly into solid, semifinished shapes ready for rolling into finished products.

Rolling Mills (Primary Mills)

About 90 percent of all steel is rolled. Since steel is easier to roll when it is hot, the steel ingots are placed in a soaking pit for reheating.

Soaking pit crane operators lift ingots from the railcars and put them in a soaking pit, where they may remain up to fourteen hours at 2150 to 2450 degrees Fahrenheit. When the ingots are uniformly heated and hot enough for rolling, crane operators take the orange-yellow ingots from the pit and put them on ingot buggies that carry them to rolling mills.

In the rolling mills conveyors move the ingots to massive steel rolls. The rolls squeeze the hot ingots to the required size and shape. Some rolling mills reduce the steel in one long, continuous process. Other mills roll out the steel in several passes back and forth between rolls that can reverse direction.

Rollers sit in air-conditioned booths or pulpits above or beside the conveyor bringing in the ingots. They control the size of the opening between the rolls and the speed of the rolls before each pass. ***Manipulators*** work controls that position the ingots on the roller conveyor before each pass.

Shear operators run a heavy hydraulic shear that cuts or rolls the ingots into slabs, blooms, or billets for sale to foundries that make tools, machine gears, road-building equipment, and other products. Most of the semifinished steel from rolling mills goes through further finishing.

Finishing Mills

Sheet steel is the most important product of the iron and steel industry. To make sheets, furnace operators and helpers reheat slabs in furnaces. Rollers then run them through a series of rolls. As the slabs become thinner they also become longer. When the steel reaches the right dimensions after the final pass through the rolls, it winds into huge coils. These coils are then either sold as hot rolled product or sent to a cold rolling mill for further rolling while cold to produce closer dimensional tolerances and desirable surface characteristics.

Speed operators control the speed of the rolls and the conveyor that carries the steel. ***Rougher pulpit operators*** work the controls that position slabs on the conveyor and guide them to the rolls.

To manufacture wire, a rolling process produces long thin rods. Operators run equipment that forces or pulls these rods through a die with a tapered hole. As the rods pass through the die they become thinner until they become wire.

Piercing mill operators control machines that make seamless pipe. They drop hot billets into a trough. Barrel-shaped rolls spin the billets to make them round. Then a tapered shaft called a mandrel pierces the end of each billet and makes the inner diameter of the pipe smooth and uniform.

Most steelmaking mills use continuous casting machines, which produce semifinished molds ready for immediate processing.

Working Conditions

The iron and steel industry spends much effort and money to make iron and steel mills safe places in which to work. Today, the push of a button starts huge machines that pour molten metal and turn the ingots. Workers in pulpits preside over a whole floor of equipment, often in air-conditioned comfort. Electric power, computers, and mechanical devices have reduced manual labor. Companies supply hard hats, safety glasses, safety shoes, and heat-resistant clothing.

Workers who have jobs near coke ovens, furnaces, and in rolling mills must wear protective clothing to reduce exposure to emissions, heat, and noise. Electric arc furnaces and car shakers can be very loud. Heat is intense even in winter.

Hours and Earnings

The normal work week is forty hours: eight hours a day, five days a week. Workers often work rotating shifts: day, afternoon, and night. According to the Bureau of Labor Statistics, in 2004, workers in the primary metal industries averaged 44.5 hours a week. Overtime work during peak production periods is common.

Hourly wages for production workers varied with the products and processes. In the year 2004, according to the Bureau of Labor Statistics, the average weekly earnings for production workers in iron and steel mills was about $1,028. Apprentices earn about half the wages of experienced workers. Earnings vary depending on geographic location, plant size, years of experience, and union membership.

Workers get premium pay for Sundays and holidays and also overtime in certain circumstances. Fringe benefits include one to five weeks of vacation each year. Pension plans, health and life insurance, and supplementary unemployment pay are better than those of most other workers in the United States.

Education and Training

Many jobs in iron and steel manufacturing require only a high school diploma. However, machinery continues to become more complex, and growing numbers of operating and maintenance positions are highly skilled, so employers increasingly prefer to hire graduates from formal postsecondary technical and trade schools. Two-year degrees in mechanical or electrical technology or 2- to 4-year apprenticeships are recommended for persons seeking to advance into the best production jobs.

Still, many iron and steel industry workers learn their skills on the job. Many other workers learn their skills in a four-year or five-year apprenticeship consisting of on-the-job training and class instruction in related subjects.

Some companies pay the fees for employees who take courses in work-related subjects such as chemistry, physics, and metallurgy. Home-study courses or evening classes in high schools, technical schools, or colleges are available and encouraged for these workers.

Licensing, Certification, Unions, and Professional Societies

Unions represent many of the employees working in the United States iron and steel industry. The principal union for production and maintenance workers is the United Steelworkers of America (USW). With more than 1.2 million working and retired members throughout the United States and Canada, the USW strives to improve workers' benefits, working conditions, and the iron and steel industry as a whole. The USW offers various online resources. Most iron and steel companies are closed shops. That is, the workers must belong to a union to work there.

Iron and steel industry workers may also find it useful to belong to professional societies such as the American Iron and Steel Institute (AISI), the Association for Iron and Steel Technology (AIST), and the Steel Manufacturers Association (SMA), among others.

Personal Qualifications

Teamwork is essential in most of the many operating and maintenance jobs in this industry. Workers should be safety-conscious, careful, dependable, and willing to learn. This work is physically demanding, and workers must have the strength and endurance to perform the tasks.

Occupations can be adapted for workers with disabilities. Persons should contact their school or employment counselors, their state office of vocational rehabilitation, or their state department of labor to explore fully their individual needs and requirements as well as the requirements of the occupation.

Where Employed

According to the Bureau of Labor Statistics, employment in the steel industry has declined to about 156,000 salary jobs in the year 2004. The steel industry traditionally has been located in the eastern and Midwestern regions of the country, where iron ore, coal, or one of the other natural resources required for steel are found. Today, about 44 percent of iron and steel industry workers are employed in Pennsylvania, Ohio, and Indiana. There are also steel plants in California, Utah, Alabama, North Carolina, and Florida, among other states.

About half of all workers are employed in production occupations while others are employed in installation, maintenance and repair, and transportation and material moving occupations.

Employment Outlook

Iron and steel industry employment has declined sharply in the past several years. According to the Bureau of Labor Statistics, employment in the steel industry in expected to decline by about 13 percent over the 2004-2014 period. Strong foreign competition and decreased domestic manufacturing have forced a major restructuring of the iron and steel indus-try. To make operations more efficient, companies have installed new technologies, closed plants, or combined operations. These measures made it possible to reduce the workforce.

Despite the projected decline, job openings are expected to be very good for a number of occupations. Demand for all types of engineers, including mechanical, metallurgical, industrial, electrical, and civil, is expected to be favorable. Also, computer scientists and business majors should be in great demand. For skilled production jobs, workers with associate degrees in technology will be highly sought after to operate computer-controlled machines and to repair equipment. The more knowledge and skills a worker has, the better the chances for employment.

Regardless of the declines in employment, many workers will need to be hired to replace those who leave the industry or retire. A large number of workers are expected to retire over the next decade.

Entry Methods

Job seekers should apply at a local union or a state apprenticeship bureau to inquire about an apprenticeship. Newspaper want ads sometimes list jobs for this industry. Local state employment offices may list openings. Professional societies may also have online career centers in which job seekers can post their resumes and view opportunities.

Advancement

Advancement for these workers depends on experience, skills, physical fitness, and length of service. New iron and steel industry workers begin in a labor pool and are on call for departments that need unskilled workers. Able workers with seniority advance from simple jobs to those requiring more skill.

To become a blast furnace blower, for instance, a worker starts as a laborer, then moves from second helper, through first helper, keeper, and finally blower. Workers can learn the work of blowers, process supervisors, and rollers in four or five years, although they may have to wait for a much longer time for an opening.

For Further Research

American Iron and Steel Institute, 1140 Connecticut Avenue, N.W., Suite 705, Washington, DC 20036-4011. Web site: www.steel.org

Association for Iron and Steel Technology, 186 Thorn Hill Road, Warrendale, PA 15086-7528. Web site: www.aist.org

Steel Manufacturers Association, 1150 Connecticut Avenue, N.W., Suite 715, Washington, DC 20036-4131. Web site: www.steelnet.org

United Steelworkers of America, Five Gateway Center, Pittsburgh, PA 15222-1214. Web site: www.steelworkers-usw.org

Acknowledgments

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