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Production Occupations

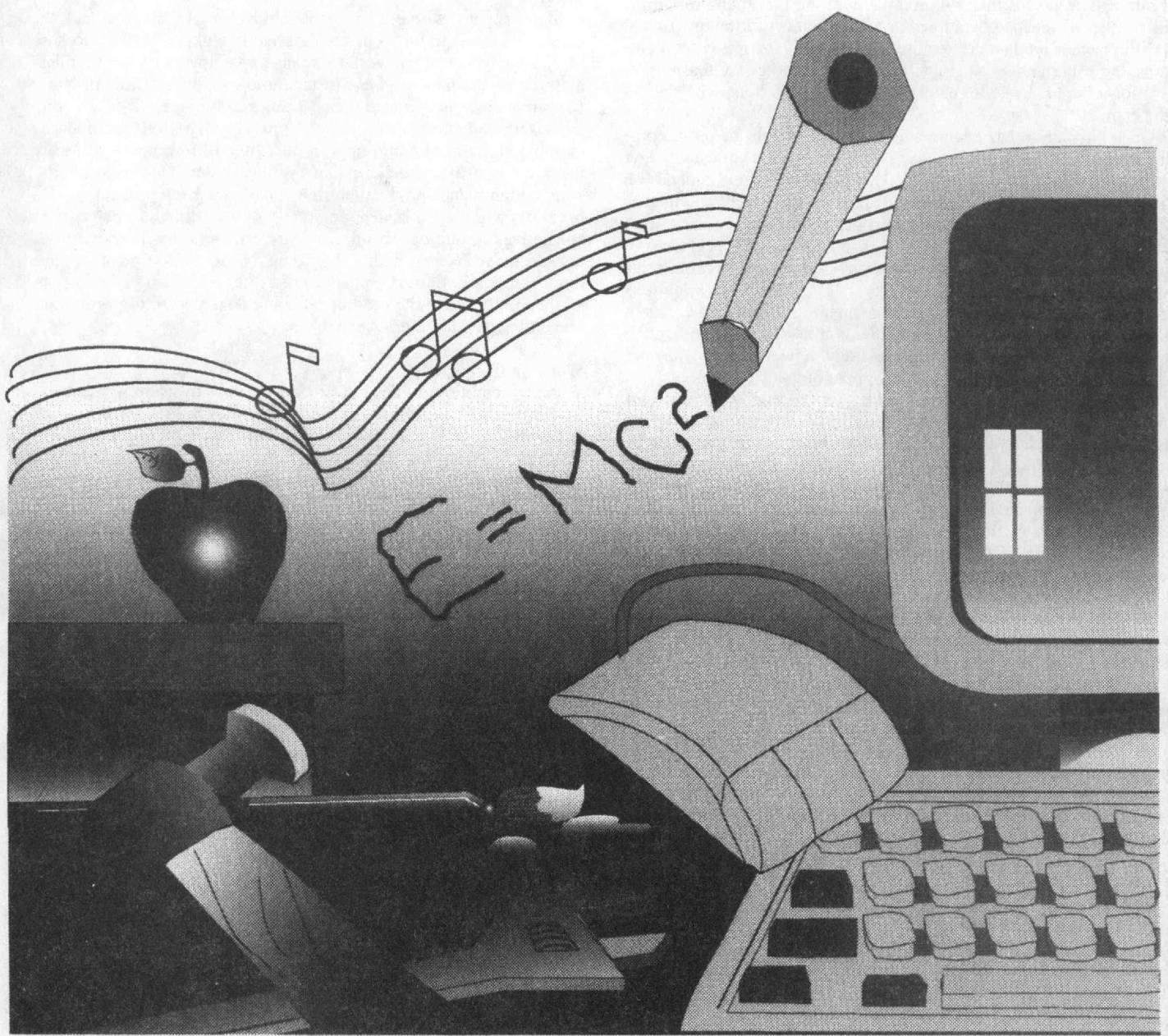


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Apparel Workers

(A list of D.O.T. codes is available on request from the Chief, Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.)

Nature of the Work

Apparel workers transform cloth, as well as leather and fur, into clothing and other consumer products. Many of these workers are also involved in the care and alteration of these products. (Some items that we think of as apparel, such as socks or pantyhose, are produced in knitting mills. Workers who are employed in these factories are classified as textile rather than as apparel workers. A separate statement on textile machinery operators is presented in this section of the *Handbook*.)

Apparel production begins with a design, created by a designer, that has been made into a sample product by a custom tailor or a hand sewer, also known as a sample maker. (A separate statement on designers is presented elsewhere in the *Handbook*.) Because these goods are to be mass produced, a master pattern must be developed. This is the responsibility of *patternmakers*. From the sample, they create pattern pieces that will complement the fabric and minimize the number of sewing operations. In most instances, different sizes of a shirt or other product are required. Instead of creating several patterns, the patternmaker or grader reduces or enlarges the master pattern for different sizes. In many firms, this now is done with the aid of a computer.

Once the pattern has been created, *layout workers* begin the production process. Spreaders, one type of layout worker, spread out layers of material on the cutting table. The number of layers depends on the number of products needed, as well as on the weight and quality of the material. Material must be laid out evenly and to a specified length on the table or problems will arise when cutting begins. Specialized spreading machines enable layout workers to accomplish this with a high degree of precision. Other layout workers known as markers must determine the best arrangement or layout of the pattern pieces to minimize waste. In most plants, this step depends on the judgment of the layout worker. Increasingly, however, computers are used to determine the optimum arrangement of the pattern pieces.

Using an electric knife or other cutting tool, *portable machine cutters* cut out the various pieces of material following the outline of the pattern. On especially delicate or valuable items, this may be done by *hand cutters*. These workers must pay close attention to detail because a mistake in the cutting process can ruin many yards of material. In more automated firms, electronic copies of layouts are sent to computer-controlled cutting machines. Cutters then monitor the running of the machine. Once the material has been cut, it is ready to be sewn together into a shirt, knapsack, dress, or other product.

Most sewing is done by sewing machine operators, who are classified by the type of machine and the type of product on which they work. Because each product requires a variety of sewing operations—and all of these cannot be done on the same machine—companies producing apparel have many types of specialized sewing machines. Sewing machine operators' skills vary by the type of machine on which they work.

Sewing machine operators are also categorized by the specific product they produce. The most basic division, however, is between *garment sewing machine operators* who produce clothing and *nongarment sewing machine operators* who produce such items as towels, sheets, and curtains. Both garment and nongarment machine operators usually specialize in a single operation, such as shoulder seams, cuffs, or hems.

Because of the value and delicate nature of some materials, sewing may be done by hand rather than on a machine. *Hand sewers* are highly skilled workers who may specialize in a particular operation, such as sewing buttonholes or adding lace or other trimming. They also may work with the designer to make a sample of a new product.

When sewing operations have been completed, *hand cutters and trimmers* remove loose threads, basting stitching, and lint from the finished product. Final inspection of the product may be done at this time.

The shape and appearance of certain finished products depend, to a large extent, on the pressing that is done at different stages of production. Pressing may be done by *hand pressers* using a hand iron or on pressing machines that are monitored by *pressing machine operators*. Some pressers specialize in a particular garment part; others are responsible for the final pressing before the product is shipped to the store.

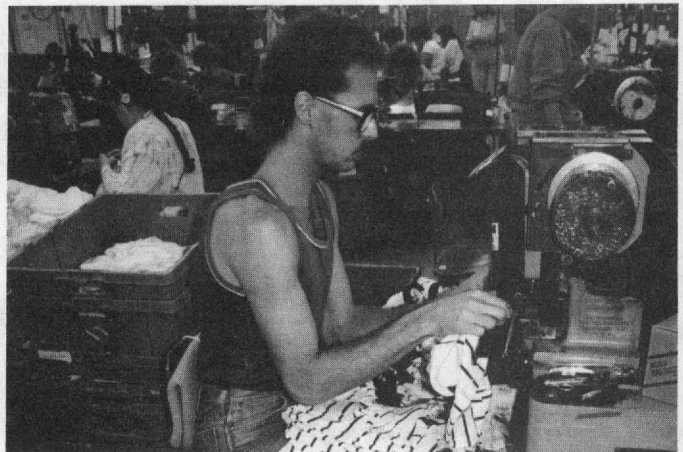
Not all apparel goods are mass produced. Some people prefer or require clothing made especially for them. *Custom tailors and sewers* make garments from start to finish—including taking measurements and helping the customer select the right fabric—and must be knowledgeable in all phases of clothing production. Many work in retail outlets, where they make alterations and adjustments to ready-to-wear clothing.

Inspectors are found in all stages of the production process. (For a more detailed discussion of this occupation, see the statement on inspectors, testers, and graders elsewhere in the *Handbook*.) They may mark defects in uncut fabric so that layout workers can position the pattern to avoid them, or they may mark defects in semifinished garments, which they may repair themselves or send back to be mended.

Many apparel workers are employed by small firms that lack the capital resources to invest in new, more efficient equipment. Because of this, the nature of the work for many apparel workers has been less affected by the increased use of technology. Nevertheless, in larger firms that have modernized their facilities, some operations are computerized, and some of the product-moving operations are done by automated material handling systems. In addition, many firms are increasingly using modular manufacturing systems. In these systems, which often reduce production time while increasing product quality, operators work together in a module or group. Although each worker specializes in one operation, most are cross-trained in the various operations performed within the group. Not only do operators have more communication with other workers, they are also given responsibility for running the module; this includes correcting problems, scheduling, and monitoring standards.

Working Conditions

Working conditions in apparel production vary by establishment and by the type of job being done. Older factories tend to be congested and poorly lit and ventilated, but more modern facilities are usually better planned, have more work space, and are well lighted and ventilated. Some new facilities are even carpeted. In both new and older plants, conditions in the patternmaking and cutting areas tend to be better than those in the sewing and pressing areas. Due to the nature of the work and the machinery being used, sewing and pressing areas



Apparel manufacturing will remain very labor intensive.

are usually noisy, whereas patternmaking and spreading areas are quieter. Laundries and drycleaning establishments are often hot and noisy; retail stores, on the other hand, generally are relatively quiet and comfortable.

Most persons in apparel occupations work a standard 5-day, 40-hour week, although overtime is sometimes necessary to meet production deadlines. However, some apparel manufacturers are adding a second shift to justify the expense of the new machinery. For the convenience of customers, evening and weekend hours may be necessary for those employed in retail stores and in laundry and drycleaning establishments.

Apparel production work can be physically demanding. Some workers sit for long periods, and others spend long hours on their feet, leaning over tables and operating machinery. However, new machinery and production techniques have decreased the physical demand upon workers. For example, newer pressing machines are now operated by foot pedals or computer controls and don't require much strength to operate. Although there are no serious dangers or health hazards associated with apparel occupations, operators must be attentive while running equipment such as sewing machines, pressers, and automated cutters. A few workers must use protective devices such as gloves.

A major change occurring in some area of apparel production is a shift away from individual performance to teamwork and cooperation among workers. Pay incentive programs are also largely based on a team's performance instead of an individual's. This means that the team or module often has managerial authority over itself, increasing the overall responsibility of each operator and allowing more interpersonal contact. It also means that groups and individual sewing machine operators are under pressure to improve their performance while maintaining quality.

Employment

Apparel workers held 1,037,000 jobs in 1990. Almost 70 percent were sewing machine operators. Table 1 shows the distribution of apparel worker employment by detailed occupation. Production jobs are concentrated in California, New York, North Carolina, Pennsylvania, Georgia, and Tennessee. Most of these jobs are in the apparel and textile industries, except for pressers and custom tailors. Although pressing operations are an integral part of the apparel production process, more than one-half of all pressers are employed in the laundry and drycleaning industry. In addition, more than one-half of all custom tailors and sewers work in retail clothing establishments; many others are self-employed. For both of these occupations, jobs are found in every part of the country.

Table 1. Distribution of apparel workers by detailed occupation, 1990

Occupation	Percent
Total	100
Garment sewing machine operators	56
Nongarment sewing machine operators	13
Custom tailors and sewers	11
Pressing machine operators	8
Hand cutters and trimmers	7
Hand pressers	2
Hand sewers	1
Patternmakers and layout workers	1
Portable machine cutters	1

SOURCE: Bureau of Labor Statistics

Training, Other Qualifications, and Advancement

Training requirements vary by industry. In the apparel industry, for example, few employers require a high school diploma or previous work experience. Nevertheless, entrants with secondary or postsecondary vocational training or previous work experience in apparel production usually have a better chance of getting a job and advancing to a supervisory position.

Retailers prefer to hire custom tailors and sewers with previous experience in apparel manufacture, design, or alterations. Knowledge of fabrics, design, and construction is very important. Although laundries and drycleaners prefer entrants with previous work experience, employers routinely hire inexperienced workers.

Apparel workers need good eye-hand coordination and the ability to perform repetitious tasks for long periods. Knowledge of fabrics and their characteristics is sometimes required.

Regardless of setting, workers usually begin by performing simpler tasks. As they gain experience, they are assigned more difficult operations. Further advancement is limited, however. Some production workers may become first-line supervisors, but the majority remain on the production line. Occasionally, a patternmaker may advance to designer, but usually only after additional training at a design school. Some experienced custom tailors open their own tailoring shop. Custom tailoring is a very competitive field, however, and training in small business operation can mean the difference between success and failure.

Machinery operators are usually trained on the job by more experienced employees or by machinery manufacturers' representatives. However, as machinery in the industry continues to become more complex, apparel workers will need more training, especially in computers and electronics. For example, many markers use computers to determine the best layout and then electronically send the layout to an automated cutting machine. In addition, the trend toward cross-training of operators will increase the time needed to learn different machines as well as increase an operator's skills.

Job Outlook

Employment of apparel workers is expected to decline through the year 2005. The job outlook depends largely on conditions in the apparel industry, where most apparel workers are employed. Increased imports, use of offshore assembly, and greater productivity through the introduction of labor-saving machinery should reduce demand for these workers. Because of the large size of this occupation, however, many thousands of job openings will arise each year from the need to replace persons who transfer to other occupations, retire, or leave the occupation for other reasons.

Employment in the domestic apparel industry has declined in recent years as foreign producers have gained a greater share of the U.S. market. In the face of this growing competition, some domestic producers have had to cut production and lay off workers. If the level of imports continues to rise, as is expected, there will be further cuts in production, and more jobs will be lost.

To avoid losing more of the market, domestic manufacturers are developing the ability to respond more quickly to changes in market demand and to take advantage of their closeness to U.S. markets.

One strategy that domestic manufacturers have adopted to reduce costs is the use of offshore assembly. For example, a manufacturer may cut the pieces of fabric in the United States and ship them to a Caribbean country for assembly. This enables the most labor-intensive step in the production process—sewing—to be done at much lower wage rates. This trend is expected to continue, and should curtail job opportunities for sewing machine operators. Pre-sewing functions will not be adversely affected.

Despite advances in technology, extensive use of automated equipment is difficult due to the soft properties of textile products. In addition, it is time consuming and expensive to adapt existing technology to the wide variety of items produced and the frequent style and seasonal changes. However, some of the larger firms and those that produce a standardized item have automated pre-sewing functions, very simple sewing procedures, and automated material handling. Technological developments such as computer-aided marking and grading, computer-controlled cutters, semiautomatic sewing and pressing machines, and automated material handling systems have increased output while reducing the need for workers.

Opportunities should be best for those interested in a job as a custom tailor or pressing machine operator. Many of these workers are employed by retail establishments and by laundries and drycleaners, employers that are unaffected by imports and are unable to move operations abroad. Employers in some locations are having difficulty

attracting enough of these workers; as a result, those with the appropriate skills and background should find ample opportunities.

Earnings

Earnings of apparel workers vary by industry and by occupation. Average weekly earnings of production workers in the apparel industry were \$240 in 1990, compared to \$320 for textile production workers and \$442 for production workers in all manufacturing industries. However, earnings vary significantly depending on the product being manufactured. Average weekly earnings ranged from a low of \$196 in firms producing women's blouses and shirts to a high of \$452 in establishments making automotive and apparel trimmings.

Sewing machine operators and custom tailors and sewers—accounting for 8 of every 10 apparel workers—had median weekly earnings of \$214 and \$222, respectively, in 1990.

Because many production workers in apparel manufacturing are paid according to the number of acceptable pieces they or their group produce, their total earnings depend on skill, speed, and accuracy.

Benefits also vary. Those offered by large employers usually include paid holidays and vacations, health and life insurance coverage, and increasingly, childcare. Those employed in retail trade also may receive a discount of 10 to 30 percent on their purchases. In addition, some of the larger manufacturers operate company stores, where employees can purchase apparel products at significant discounts. Some small firms, however, may offer only limited benefits. In addition to employer-sponsored benefits, the two principal unions, the Amalgamated Clothing and Textile Workers Union and the International Ladies Garment Workers Union, provide benefits to their members.

Related Occupations

The work of apparel workers varies from that requiring very little skill and training to that which is highly complex, requiring several years of training. Those operating machinery and equipment, such as pressing or sewing machine operators, perform duties similar to metalworking and plastics-working machine operators, textile operatives, and shoe sewing machine operators. Other workers who perform handwork are precision woodworkers, precision assemblers, and shoe and leather workers. Workers who require an in-depth knowledge of the materials with which they work include upholsterers, tool and die makers, and precision welders.

Sources of Additional Information

Information regarding careers in apparel may be obtained from numerous colleges and universities that have specialized textile and apparel programs. A list of these can be found in college guides. In addition, the local office of the State employment service or an apparel manufacturer can provide information on job opportunities in a specific area.

For general information on the apparel industry, write to:

• American Apparel Manufacturers Association, 2500 Wilson Blvd., Suite 301, Arlington, VA. 22201.

Bindery Workers

(D.O.T. 640.682-018, .685-010; 641.682-014; 649.685-066 and -090; 653.360-010, -014, and -018, .380, .382, .562, .585, .662, .680, .682-010, -014, -018, -022, .685-010, -014, -018, -022, -026, and -030; .686-010, -014, -018, -022, and -026, .687-010; 659.686-010; 692.685-146; 794.68-026; 795.684-010 and -022, .687-010; 977.381, .684-010, -018, -022, .687)

Nature of the Work

The process of transforming printed sheets into finished products such as books, magazines, catalogs, folders, or directories is known as "binding." Binding involves operations such as cutting, folding, gathering, gluing, stitching, trimming, sewing, wrapping, and other finishing operations. Bindery workers operate and maintain the machines performing these various tasks.

Depending on the kind of material being bound, job duties may vary. In firms that do *edition binding*, for example, workers bind

books produced in large numbers or "runs," while *job binding* workers bind books produced in smaller quantities. In firms that specialize in *library binding*, workers repair books and provide other specialized binding services to libraries. *Pamphlet binding* workers produce leaflets and folders, while *manifold binding* workers bind business forms such as ledgers and books of sales receipts. *Blankbook binding* workers bind blank pages to produce notebooks, checkbooks, address books, diaries, calendars, and note pads.

Some bindery work consists of only one step. Preparing leaflets or newspaper inserts, for example, requires only folding. Binding of books, on the other hand, requires a number of steps. These are summarized below.

Bookbinders assemble books from large, flat, printed sheets of paper. Skilled bookbinders operate machines that first fold printed sheets into units known as "signatures," which are groups of pages arranged sequentially. Bookbinders sew, stitch, or glue the assembled signatures together. They shape the book bodies with presses and trimming machines and reinforce them with glued fabric strips. Covers, which are created separately, are glued, pasted, or stitched onto the book bodies, and then the books undergo a variety of finishing operations, often including wrapping in paper jackets. Machines are used extensively throughout the process. Many skilled bookbinders also bind magazines.

Some bindery workers specialize in adjusting and preparing equipment, while others operate specific machinery. For example, a bindery worker may fasten sheets or signatures together using a machine stapler and feed the signatures into various machines for stitching, folding, or gluing. In small shops, a worker may perform many binding tasks; in large shops, bookbinding workers are usually assigned to only one or a few operations, most often to the operation of complicated machines, such as a large papercutter or a folding machine. When necessary, bindery workers may also repair and adjust bindery equipment.

A small number of bookbinders work in hand binderies. These highly skilled workers design original or special bindings for limited editions or restore and rebind rare books. The work requires creative ability, knowledge of materials, and a thorough background in the history of binding. Hand bookbinding is perhaps the only kind of binding that gives the individual an opportunity to work at a variety of jobs.

Working Conditions

The job can be fairly strenuous, as bindery workers do considerable lifting, standing, and carrying. Bindery work may also require stooping, kneeling, and crouching. Bindery work often resembles an assembly line; someone seeking a bindery position should not mind performing repetitive tasks. Binderies are often noisy.

Employment

In 1990, bindery workers held about 78,000 jobs, which were distributed as follows:

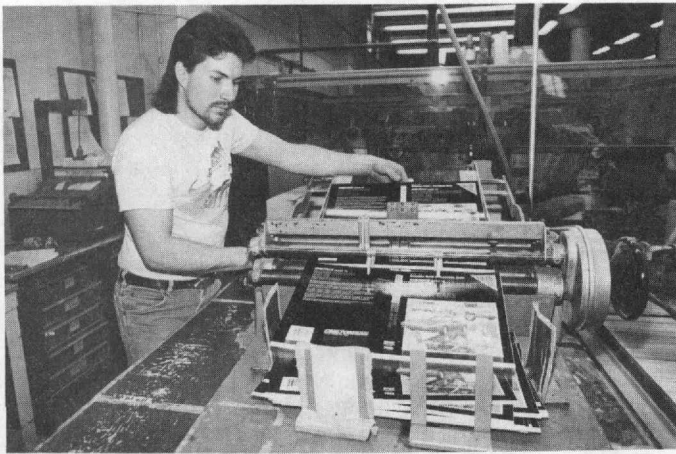
Bindery machine operators, setters, and setup operators	71,000
Bookbinders.....	7,000

Although some bindery workers are employed by large libraries and others work for book publishers, most jobs are in commercial printing plants. Since few publishers maintain their own manufacturing facilities, the printing and assembly of books are often contracted out to commercial printing plants or bindery trade shops. Bindery trade shops, which specialize in binding, are the second largest employer of bindery workers. Firms in this industry sector serve printers without binderies as well as firms whose printing capabilities outstrip their binding capabilities.

Although bindery workers are found in all parts of the country, employment is concentrated near large metropolitan areas such as New York, Chicago, Washington, D.C., Los Angeles, Philadelphia, and Dallas.

Training, Other Qualifications, and Advancement

Most bindery workers learn the craft through on-the-job training. Inexperienced workers usually start by doing simple tasks such as



Bindery workers transform printed sheets into books, magazines, catalogs, and directories.

moving paper from cutting machines to folding machines. At this stage, workers learn the basics, including the characteristics of paper and how to cut large sheets of paper into different sizes with the least amount of waste. As workers gain experience, they advance to more difficult tasks and may learn how to operate one or more pieces of equipment. Generally, it takes 1 to 3 months to train on the simpler machines, but it can take up to 1 year to learn how to operate the more complex equipment, such as a computerized binding machine.

As in most occupations, employers prefer hiring experienced individuals, so those with some knowledge of binding operations are likely to have an advantage in being accepted for employer-provided training. High school students interested in bindery careers can gain some exposure to the industry by taking shop courses or attending a vocational-technical high school. Occupational skill centers, usually operated by a labor union, also provide an introduction to the industry.

Postsecondary programs in the graphic arts are offered by vocational-technical institutes, skill updating or retraining programs, and community and junior colleges. Four-year college programs help prepare people who may eventually move into management positions in the graphic arts industry. Some updating and retraining programs require students to have bindery experience; other programs are available through the union for members. To keep pace with ever-changing technology, retraining will become increasingly important.

Formal apprenticeships, while not as common as they used to be, are still available and enable workers to acquire the high levels of specialization and skill needed for some jobs. A 4-year apprenticeship usually is necessary to teach workers how to restore rare books and to produce valuable collectors' items.

Accuracy, patience, neatness, and good eyesight are among the qualities needed by bindery workers. Careful attention to detail is required since a mistake at this stage in the printing process can be very costly. Finger dexterity is essential for those who count, insert, paste, and fold, while mechanical aptitude is required of individuals operating the newer, more automated equipment. Artistic ability and imagination are required for hand bookbinding. Employers look for individuals with basic mathematics and language skills.

Advancement opportunities are limited. In large binderies, experienced bookbinders may advance to supervisory positions.

Job Outlook

Employment of bindery workers is expected to grow more slowly than the average for all occupations through the year 2005 in response to increasing productivity in bindery operations. While no radical technological changes are on the horizon, the binding process is becoming increasingly mechanized. New "in-line" equipment performs a number of operations in sequence beginning with raw stock at one end and ending with a complete finished product at the other end. As a result, labor requirements have been reduced, and the jobs

of many bindery workers who assisted skilled bookbinders in the past have already been eliminated. Most job openings will result from the need to replace experienced workers who change jobs or leave the labor force.

Anticipated growth in the printing industry will continue to spur demand for these workers. Commercial printers are expected to hire more bindery workers as the volume of printed material grows due to increased reliance on catalogs, newspaper inserts, and direct mail advertising. Continued growth in book publishing is expected as the burgeoning of the middle-aged and older population makes leisure reading more common and as school enrollments grow.

Opportunities for hand bookbinders are limited by the small number of establishments that do this highly specialized work. Opportunities will be best for experienced bindery workers.

Earnings

The basic wage rate for skilled bookbinders varies across the country. Based on limited available data, inexperienced bindery workers generally start at the minimum wage, which was \$4.25 in 1991. Workers beginning in union shops might start at slightly higher levels. According to the Graphic Communications International Union, hourly wage rates for bookbinders in unionized firms in 1990 were \$14.42 for journeyman level I and \$10.02 for level II.

Related Occupations

Other workers who set up and operate production machinery include papermaking machine operators, press operators, and precision machine operators.

Sources of Additional Information

Details about apprenticeships and other training opportunities may be obtained from local printing industry associations, local bookbinding shops, local offices of the Graphic Communications International Union, or local offices of the State employment service.

For general information on bindery occupations, write to:

- Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, PA 15213.
- Graphic Communications International Union, 1900 L St. NW., Washington, DC 20036.
- Binding Industries of America, 70 East Lake St., Chicago, IL 60601.

Blue-Collar Worker Supervisors

(A list of D.O.T. codes is available on request from the Chief, Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.)

Nature of the Work

For the millions of workers who assemble manufactured goods, service motor vehicles, lay bricks, load trucks, or perform thousands of other activities, a blue-collar worker supervisor is the boss. These supervisors ensure that workers, equipment, and materials are used properly and efficiently. They make sure machinery is set up correctly and schedule or perform repairs and maintenance work. Supervisors tell other workers what to do and make sure it is done safely, correctly, and on time. Some supervisors check on their workers more often than others due to the nature of the work and work site. For example, a construction supervisor may spend a good part of the day overseeing blue-collar workers, while an oil drilling supervisor may see workers only a small part of the day because the supervisor must travel between rigs.

Supervisors make work schedules and keep production and employee records. They plan employees' activities and make adjustments for absent workers and machine breakdowns. Supervisors teach employees safe work practices and enforce safety rules and regulations. They also may help workers do their jobs better and train new workers, generally by assigning them to help experienced workers. Blue-collar worker supervisors are often responsible for very expensive and complex systems or equipment.

Many supervisors use computers to schedule workflow in their

unit, monitor the quality of their workers' output, keep track of materials used and update their inventory control system, and perform other supervisory tasks.

Blue-collar worker supervisors tell their subordinates about company plans and policies; recommend good performers for wage increases, awards, or promotions; and deal with poor performers by outlining expectations, counseling them in proper methods, issuing warnings, or recommending that they be disciplined. In companies with labor unions, supervisors follow the provisions of labor-management contracts. Supervisors also meet with managers to discuss goals, company operations, and performance. Blue-collar worker supervisors in manufacturing industries generally report to industrial production managers. (See the statement on industrial production managers elsewhere in the *Handbook*.)

Blue-collar worker supervisors may have other titles, such as first-line supervisors, foremen, or forewomen. In the textile industry, they may be referred to as second hands; on ships, boatswains; in the construction industry, they may be called superintendents or crew chiefs; and in oil drilling, toolpushers or gang pushers.

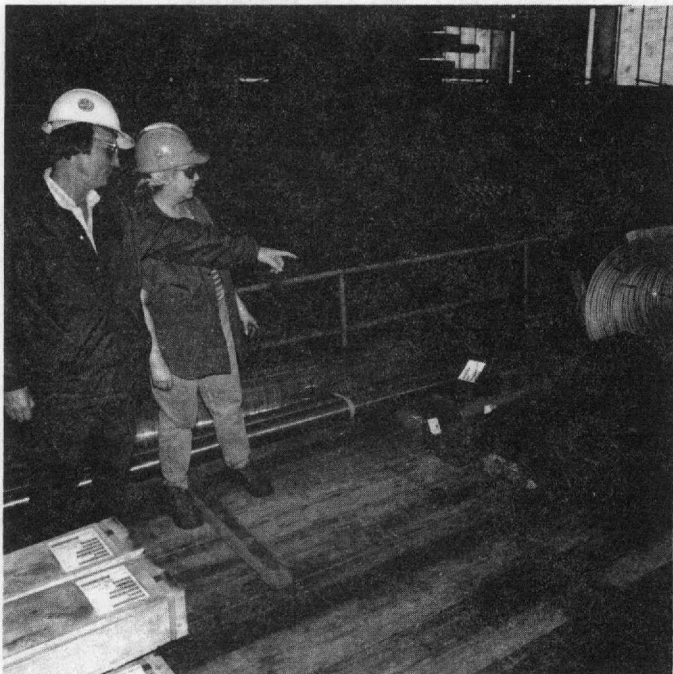
Working Conditions

Many blue-collar worker supervisors work in a shop environment. They may be on their feet much of the time overseeing the work of subordinates and may be subjected to the noise and grime of machinery. Other supervisors, such as those in construction and oil exploration and production, may work outdoors and are subject to all kinds of weather conditions.

Supervisors may be on the job before other workers arrive and stay after they leave. Some supervisors work in plants that operate around the clock and may work any one of three shifts as well as on weekends and holidays. In some cases, supervisors work all three shifts on a rotating basis; in others, shift assignments are made on the basis of seniority.

Employment

Blue-collar worker supervisors held about 1.8 million jobs in 1990. Although salaried supervisors were found in almost all industries, more than 4 in 10 worked in manufacturing—supervising the production of industrial machinery, motor vehicles, appliances, and thousands of other products. About 1 in 7 worked in the construction industry and 1 in 10 in wholesale and retail trade. Others were in pub-



Most blue-collar worker supervisors are promoted from craft, machine operator, or assembly line jobs.

lic utilities, repair shops, transportation, and government agencies. Employment is distributed in much the same way as the population, and jobs are located in all cities and towns.

Training, Other Qualifications, and Advancement

When choosing supervisors, employers generally look for experience, job knowledge, organizational skills, and leadership qualities. Employers emphasize the ability to motivate employees, maintain high morale, command respect, communicate effectively, and get along with people.

Most supervisors rise through the ranks—that is, they are promoted from jobs where they operated or repaired machinery, worked on an assembly line, or worked at a construction craft. This work experience gives them the advantage of knowing how jobs should be done and what problems may arise. Large companies generally offer better opportunities than smaller companies for promotion to blue-collar worker supervisory positions. Newly appointed supervisors may take company-sponsored training to help develop supervisory skills.

Completion of high school is often the minimum educational requirement for supervisors. In high-technology industries, such as aerospace and electronics, employers might require some college or technical school background, or even a bachelor's degree. Employers generally prefer a background in engineering, mathematics, science, business administration, or industrial relations.

A business or engineering degree or in-house training may be needed to advance to jobs such as department head or production manager. Supervisors in the construction industry may use the experience and skills they gain to become contractors, while supervisors in repair shops may open their own shop.

Job Outlook

Employment of blue-collar worker supervisors is expected to grow more slowly than the average for all occupations through the year 2005. However, many openings will arise from the need to replace workers who leave the occupation.

Employment of supervisors depends strongly on industry outlook. Their number is expected to change little in manufacturing, reflecting industry growth and a decline in the number of blue-collar workers they supervise. More advanced production technology that increases the amount that each worker can produce and programs to give workers more autonomy should reduce demand for blue-collar worker supervisors. In construction and most other nonmanufacturing industries, employment of blue-collar worker supervisors, and other blue-collar workers, will increase.

Because of their skill and seniority, blue-collar worker supervisors are often protected from layoffs during a recession. However, some in the highly cyclical construction industry may be laid off when construction activity declines.

Earnings

Median weekly earnings for blue-collar worker supervisors were about \$560 in 1990. The middle 50 percent earned between \$420 and \$760. The lowest 10 percent earned less than \$310, and the highest 10 percent earned over \$970. Most supervisors earn about 20 to 40 percent more than their subordinates. While most blue-collar workers are paid by the hour, most supervisors receive an annual salary. Some supervisors receive extra pay when they work overtime.

Related Occupations

Other workers with supervisory duties include those who supervise professional, technical, sales, clerical, and service workers. Some of these are retail store or department managers, sales managers, clerical supervisors, bank officers, head tellers, hotel managers, postmasters, head cooks, head nurses, and surveyors.

Sources of Additional Information

For information on educational programs for blue-collar worker supervisors, contact:

- American Management Association, 135 West 50th St., New York, NY 10020.
- National Management Association, 2210 Arbor Blvd., Dayton, OH 45439.

Butchers and Meat, Poultry, and Fish Cutters

(D.O.T. 316.681-010, .684-018 and -022; 525.361-010 through .664-010, .684-010 through -058, and .687-010, -030, -066, -070, and -074)

Nature of the Work

Butchers and meat, poultry, and fish cutters reduce animal carcasses into small pieces of meat suitable for sale to consumers. In meatpacking plants, butchers slaughter cattle, hogs, goats, and sheep and cut the carcasses into large wholesale cuts such as rounds, loins, ribs, and chucks to facilitate handling, distribution, and marketing. Meat trimmings are used to prepare sausages, luncheon meats, and other fabricated meat products. Butchers usually work on assembly lines, with each individual responsible for only a few of the many cuts needed to process a carcass. Depending on the type of cut, they may use knives, cleavers, meat saws, bandsaws, and other equipment.

In grocery stores, wholesale establishments that supply meat to restaurants, and institutional food service facilities, butchers—also called meatcutters—separate the wholesale cuts of meat into retail cuts or individual size servings. They cut the meat into steaks and chops using knives and electric saws, shape and tie roasts, and grind beef for sale as hamburger meat. Boneless cuts are prepared using knives, slicers, or power cutters, while bandsaws are required on bone-in pieces. Butchers in retail food stores also may weigh, wrap, and label the cuts and arrange them in refrigerated cases for display to customers. They also may prepare special cuts of meat ordered by customers.

Poultry cutters slaughter and cut up chickens, turkeys, and other types of poultry. However, these tasks are increasingly being performed by machines, and some modern poultry processing plants use hand cutters only for tasks, such as de-boning breast meat, that are difficult for machines to perform with precision.

Fish cleaners cut, scale, and dress fish in fish processing plants and wholesale and retail fish markets. They remove the head, scales, and other inedible portions and cut the fish into steaks or boneless fillets. In markets, they may wait on customers and clean fish to order.

Retail meat and poultry butchers and fish cutters also prepare ready-to-heat foods. This often entails filleting meat or fish or cutting it into bite-sized pieces, preparing and adding vegetables, or applying sauces or breading.

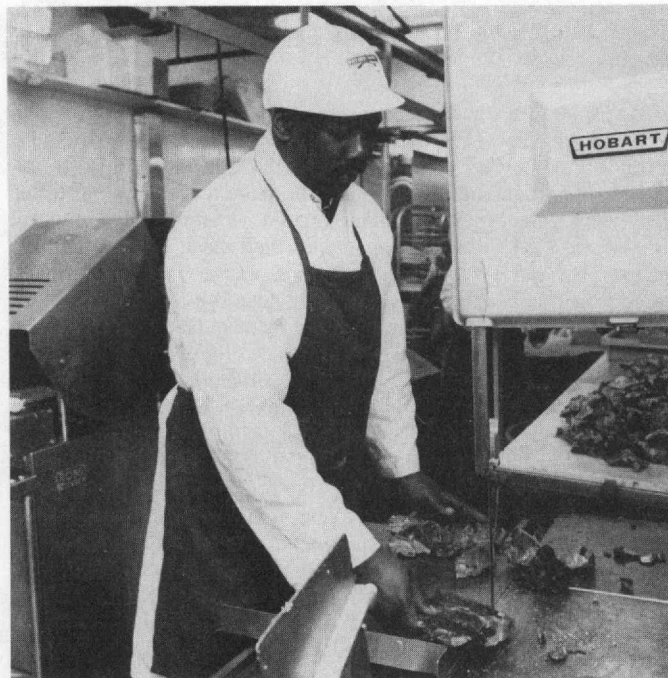
Working Conditions

Working conditions vary by the type and size of establishment. In meatpacking plants and larger retail food establishments, butchers and meatcutters work in large meatcutting rooms equipped with power machines and conveyors. In small retail markets, the meat-cutter or fish cleaner may work in a space behind the meat counter. Health and safety standards require that work areas be clean and sanitary.

Butchers and meat, poultry, and fish cutters often work in refrigerated rooms to help prevent meat from spoiling. The low temperature, combined with the need to stand for long periods of time, makes the work tiring. Butchers and meat, poultry, and fish cutters are more susceptible to injury than most other workers; in 1989, meatpacking plants had the second highest incidence of work-related injury and illness of any industry. Besides injuries that occur when insufficient care is used when working with knives, cleavers, and power tools, the repetitive nature of their work makes them susceptible to cumulative trauma injuries, such as carpal tunnel syndrome. However, the recent introduction of "ergonomic" (user-friendly) meatcutting tools has decreased some of the more strenuous and dangerous aspects of this work.

Employment

Butchers and meat, poultry, and fish cutters held about 355,000 jobs in 1990. Over four-fifths worked in meatpacking and poultry and



The work of butchers and meat, poultry, and fish cutters can be hazardous.

fish processing plants and retail grocery stores, while others were employed by meat and fish markets, restaurants, hotels, and wholesale establishments. The majority of the 234,000 skilled butchers and meatcutters worked in retail grocery stores, while almost 9 out of 10 of the semiskilled meat, poultry, and fish cutters worked in meatpacking and poultry and fish processing plants. Skilled butchers and meatcutters are employed in almost every city and town in the Nation, while semiskilled meat, poultry, and fish cutter jobs are concentrated in communities with food processing plants.

Training, Other Qualifications, and Advancement

Most butchers and meat, poultry, and fish cutters acquire their skills informally on the job or through apprenticeship programs. A few learn their basic skills by attending trade and vocational schools. However, graduates of these schools may need additional on-the-job training and experience to work as butchers and meatcutters.

Generally, on-the-job trainees begin by doing less difficult jobs, such as removing bones. Under the guidance of experienced workers, they learn the proper use of tools and equipment and how to prepare various cuts of meat. After demonstrating skill with tools, they learn to divide quarters into wholesale cuts and wholesale cuts into retail and individual portions. Trainees may learn to roll and tie roasts, prepare sausage, and cure meat. Those in retail food establishments may learn marketing operations such as inventory control, meat buying, and recordkeeping.

Meatcutters who learn the trade through apprenticeship programs generally complete 2 years of supervised on-the-job training supplemented by classroom work. At the end of the training period, apprentices must pass a meatcutting test. In some areas, apprentices may become meatcutters without completing the entire training program if they can pass the test.

Skills important in meat, poultry, and fish cutting are manual dexterity, good depth perception, color discrimination, and good eye-hand coordination. Also, strength is sometimes needed to lift and move heavy pieces of meat. Meatcutters and fish cleaners who wait on customers must have a pleasant personality, a neat appearance, and the ability to communicate clearly. A health certificate may be required for employment.

Butchers and meat, poultry, and fish cutters may progress to supervisory jobs, such as meat or seafood department managers in supermarkets. A few become meat or seafood buyers for wholesalers and supermarket chains. Some become grocery store man-

agers or open their own meat or fish markets. In processing plants, butchers and meat, poultry, and fish cutters can move up to supervisory positions.

Job Outlook

Little or no change is expected in the overall employment of butchers and meat, poultry, and fish cutters through the year 2005. As more meat cutting and processing shifts from the retail store to the plant, employment growth—although slower than the average for all occupations—is expected among semiskilled meat, poultry, and fish cutters, who work primarily in processing plants. On the other hand, a slight decline is expected in the number of skilled butchers and meatcutters, who work primarily in retail stores. Nevertheless, many job opportunities should arise due to the need to replace experienced workers who transfer to other occupations or leave the labor force.

As the Nation's population grows, the demand for meat should continue to increase. Although red meat consumption has been dropping and poultry consumption has been rising in recent years, both of these trends are likely to slow as people consume more low-fat meat products. The consumption of fish is expected to increase slightly in the coming years.

Employment growth of meat, poultry, and fish cutters is expected to be concentrated in meatpacking, poultry, and fish processing plants through the year 2005. Although poultry and fabricated poultry production is primarily performed by machines, the growing popularity of labor-intensive ready-to-heat goods promises to spur demand for poultry workers. Semiskilled meat and fish cutters also will be in demand as the task of preparing ready-to-heat meat and fish goods slowly shifts from the retail store to the processing plant, and as fish is increasingly caught or farmed domestically. Although the supply of edible ocean fish is limited, advances in fish farming, or aquaculture, are expected to reduce the gap between supply and demand.

Employment of skilled meatcutters is expected to decline gradually. Although meat is increasingly cut and processed at the plant, this shift is coming slowly. At present, most red meat arrives at the grocery store partially cut up. The retail meatcutter performs the final processing—cutting wholesale meat cuts into steaks, chops, and roasts and packaging them for sale.

Eventually, as ready-to-heat goods become more popular, both fresh meat and prepared foods will be completely processed and packaged at the plant. However, both consumers and the retail stores are slowly adjusting to this trend. As a result, the demand for retail butchers and poultry and fish cutters should stabilize over the next few years, and eventually decline.

Earnings

Butchers and meatcutters had median hourly earnings of \$7.85 in 1990. The middle 50 percent earned between \$5.70 and \$11.60 an hour. The highest paid 10 percent earned over \$14.30 an hour. Meatcutters employed by retail grocery stores are generally among the highest paid workers.

Butchers and meat, poultry, and fish cutters generally received paid vacation and sick leave, health insurance, and life insurance. Union meatcutters employed by grocery stores also had pension plans.

Many butchers and meat, poultry, and fish cutters are members of the United Food and Commercial Workers International Union.

Related Occupations

Butchers and meat, poultry, and fish cutters must be skilled at both hand and machine work and must have some knowledge of processes and techniques involved in handling and preparing food. Other occupations in food preparation which require similar skills and knowledge include bakers, chefs and cooks, and food preparation workers.

Sources of Additional Information

Information about work opportunities can be obtained from local employers or local offices of the State employment service. For information on training and other aspects of the trade, contact:

• United Food and Commercial Workers International Union, 1775 K St. NW., Washington, DC 20006.

Electric Power Generating Plant Operators and Power Distributors and Dispatchers

(D.O.T. 820.662-010; 952.167-014, .362, .367-014; and .382)

Nature of the Work

Although electricity is vital for most of our everyday activities, it only takes a downed powerline for us to realize how much we take it and the people who help generate it for granted. Powerplant operators control the machinery that generates electricity. Power distributors and dispatchers oversee the flow of electricity through substations and over a network of transmission and distribution lines to users.

Electric power generating plant operators who work in plants fueled by coal, oil, or natural gas regulate and monitor boilers, turbines, generators, auxiliary equipment, such as coal crushers, and switching gear. They operate switches to distribute power demands among generators, combine the current from several generators, and regulate the flow of electricity into powerlines. When power requirements change, they start or stop generators and connect or disconnect them from circuits. Operators monitor instruments to see that electricity is flowing from the plant properly and that voltage is maintained. They also keep records of switching operations and loads on generators, lines, and transformers and prepare reports of unusual incidents or malfunctioning equipment during their shift.

Operators who work in newer plants work mainly in a central control room and usually are called control room operators and control room operator trainees or assistants. In older plants, the controls for the equipment are not centralized, and operators work throughout the plant, operating and monitoring valves, switches, and gauges. Job titles in older plants may be more varied than in newer plants. Auxiliary equipment operators work throughout the plant, while switchboard operators control the flow of electricity from a central point.

Operators of nuclear powerplants are licensed by the Nuclear Regulatory Commission (NRC). NRC-licensed reactor operators are authorized to operate all equipment that affects the power of the reactor in a nuclear powerplant. In addition, an NRC-licensed senior reactor operator acts as the supervisor of the plant for each shift.

Power distributors and dispatchers, also called load dispatchers or systems operators, control the flow of electricity through transmission lines to users. They operate current converters, voltage transformers, and circuit breakers. Dispatchers monitor equipment and record readings at a pilot board, which is a map of the transmission grid system showing the status of transmission circuits and connections with substations and large industrial users. Dispatchers anticipate power needs such as those caused by changes in the weather; they call control room operators to start or stop boilers and generators to bring production into balance with needs. They handle emergencies such as transformer or transmission line failures and route current around affected areas. They also operate and monitor equipment in substations, which step up or step down voltage, and operate switchboard levers to control the flow of electricity in and out of substations.

Working Conditions

Electricity is provided around the clock so operators, distributors, and dispatchers often work nights and weekends, usually on rotating shifts. Shifts are usually 8 hours long, with three shifts per day. Workers usually rotate to a different daily shift schedule periodically so that duty on less desirable shifts is shared by all operators. Work on rotating shifts can be stressful and fatiguing because of the constant change in living and sleeping patterns. Operators, distributors, and dispatchers who work in control rooms generally sit or stand at a control station. This work is not physically strenuous, but requires constant attention. Operators who work outside the control room may be exposed to danger from electric shock, falls, and burns.

Nuclear powerplant operators are subject to random drug tests.



Power dispatchers make adjustments to generator control settings.

Employment

Electric power generating plant operators and power distributors and dispatchers held about 44,000 jobs in 1990. Most worked for electric utility companies and government agencies that produced electricity. Some worked for manufacturing establishments that produce electricity for their own use. Jobs are located throughout the country.

Training, Other Qualifications, and Advancement

Employers generally seek high school graduates for entry level operator, distributor, and dispatcher positions. Those with strong math and science skills are preferred. College level courses or prior experience in a mechanical or technical job may be helpful. Many employers start new workers in helper or laborer jobs in powerplants or in other areas of the utility such as powerline construction. Workers may be assigned to train for any one of many utility positions in operations, maintenance, or other areas. Assignments depend on the results of aptitude tests, worker preferences, and availability of openings.

Workers selected for training as a power distributor or powerplant operator at a conventionally fueled powerplant undergo extensive on-the-job and classroom training provided by the employer. Several years of training and experience are required to become a fully qualified control room operator or power distributor. With further training and experience, workers may advance to shift supervisor. Most advancement opportunities are within a plant or utility; opportunities to advance by moving to another employer are limited.

Entrants to nuclear powerplant operator trainee jobs must have strong math and science skills. Experience in other powerplants or with Navy nuclear propulsion plants also is helpful. Extensive training and experience are necessary to pass the NRC's examinations for licensed reactor operator and senior reactor operator, including on-the-job training, classroom instruction, and individual study. With further training and experience, reactor operators may advance to senior reactor operators, who are qualified to be shift supervisors.

In addition to preliminary training as a powerplant operator or power distributor or dispatcher, most workers are given periodic refresher training. Nuclear powerplant operators are given frequent refresher training on a plant simulator.

Licensed reactor operators must pass an annual requalifying examination administered by their employer to retain their license. Also, licensed reactor operators must pass a NRC administered exam during the term of their license, which is 6 years.

Job Outlook

Employment of electric power generating plant operators, distributors, and dispatchers is expected to grow more slowly than the average for all occupations through the year 2005. The demand for electric power should grow substantially as the economy expands. However, with the increasing use of automatic controls and more efficient equipment, employment needs will not grow as rapidly. Few, if any, new nuclear powerplants are likely to be ordered before the year 2005. However, due to NRC regulations, the number of nuclear powerplant operators needed at all nuclear powerplants may increase.

Most job openings will occur as workers transfer to other occupations or leave the labor force. People hired by electric power companies generally have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Earnings

Earnings in the electric utility industry are relatively high. According to the limited information available, median weekly earnings for conventional powerplant operators were about \$590 in 1990. According to information from union contracts, wages for senior powerplant operators ranged from \$565 to \$910 weekly, and wages for powerplant operators ranged from \$536 to \$773 weekly. Nuclear powerplant operators earned wages of about \$920 in 1990. Senior reactor operators earn 10 to 15 percent higher than licensed reactor operators.

Related Occupations

Other workers who monitor and operate plant and systems equipment include stationary engineers, water and sewage treatment plant operators, waterworks pumpstation operators, chemical operators, and refinery operators.

Sources of Additional Information

For information about employment opportunities, contact local electric utility companies, locals of unions mentioned below, or an office of the State employment service.

For general information about powerplant and nuclear reactor operators and power distributors and dispatchers, contact:

- International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, DC 20005.
- Utility Workers Union of America, 815 16th St. NW., Washington, DC 20006.

Handlers, Equipment Cleaners, Helpers, and Laborers

(A list of D.O.T. codes is available on request from the Chief, Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.)

Nature of the Work

Employers in almost all industries hire individuals at the entry level to assist more skilled production, construction, operating, and maintenance workers, or to perform tasks that do not require significant training. Most are handlers, equipment cleaners, helpers, and laborers. They perform a broad array of jobs, ranging from moving boxes and feeding machines to cleaning equipment and work areas. Many do tasks needed to make the work of more skilled employees flow smoothly. These workers often do routine, physical work under close supervision. They generally follow oral or written instructions from supervisors or more experienced workers, with little opportunity to make decisions. Helpers and laborers must be familiar with the duties of workers they help, as well as with the materials, tools, and machinery they use, in order to perform their jobs effectively.

Freight, stock, and material movers move materials to and from storage areas, loading docks, delivery vehicles, ships' holds, and containers either manually or with forklifts, dollies, handtrucks, or carts. Their specific duties vary by industry and work setting. In factories, they may move raw materials, components, and finished goods between work areas and to and from storage areas and loading docks. They receive and sort materials and supplies and prepare them according to work orders for delivery to work or storage areas. In grocery stores, they stock shelves, bag groceries, carry packages to customers' cars, and return shopping carts to designated areas.

Helpers assist construction trades workers, mechanics and repairers, and workers in production and extractive occupations. (Information on these occupations is given elsewhere in the *Handbook*.) They aid machine operators and tenders by moving materials, supplies, and tools to and from work areas. Some may tend machines during operation if an operator is out. Helpers may sort finished products, keep records of machine processes, report malfunctions to operators, and

clean machinery after use. Mechanics' helpers assist workers who repair motor vehicles, industrial machinery, and electrical, electronic, and other equipment. They furnish tools, materials, and supplies; hold materials or tools; take apart defective equipment; remove rivets; prepare replacement parts; and clean work areas.

Construction trades helpers provide much of the routine physical labor at building sites. They supply tools, materials, and equipment to carpenters, electricians, masons, plumbers, and other construction workers. Workers dig trenches, set braces to support the sides of excavations, and clean up rubble and debris. They may operate jackhammers, earth tampers, cement mixers, buggies, front-end loaders, "walk-behind" ditchdiggers, small mechanical hoists, and laser beam equipment to align and grade ditches and tunnels. In addition to working on building and transportation projects, construction trades helpers may work on other projects, such as hazardous waste cleanup and asbestos abatement. Some laborers have job titles that indicate the work they do. Tenders for bricklayers and plasterers, for example, mix and supply materials, set up and move scaffolding, and provide other services.

Hand packers and packagers manually package or wrap materials. They may inspect items for defects, label cartons and stamp information on products, keep records of items packed, and stack packages on loading docks.

Machine feeders and offbearers feed materials into machines or remove materials from machines or equipment that is automatic or tended by other workers.

Service station attendants fill fuel tanks, wash windshields, change oil, repair tires, and replace belts, lights, windshield wipers, and other accessories on automobiles, buses, trucks, and other vehicles.

Refuse collectors pickup trash and garbage.

Vehicle washers and equipment cleaners clean machinery, vehicles, storage tanks, pipelines, and similar equipment using water and other cleaning agents, vacuums, hoses, brushes, cloths, and other cleaning equipment.

Parking lot attendants assist customers in parking their cars in lots or storage areas and collect fees from customers.

Working Conditions

Most handlers, equipment cleaners, helpers, and laborers do repetitive, physically demanding work. They may lift and carry heavy objects, and stoop, kneel, crouch, and crawl in awkward positions. Some work at great heights, or outdoors in all weather conditions. Some jobs expose workers to harmful chemicals, fumes, odors, loud noise, or dangerous machinery, so these employees may need to wear safety clothing, such as gloves, hats, eye, mouth, and hearing protection, and observe safety procedures.

In factories, handlers, equipment cleaners, helpers, and laborers may work evening or "night-owl" shifts. Their shifts are often 8 hours, but sometimes 12. Handlers may stock shelves at night in grocery stores. Garbage collectors often work early morning shifts, starting at 5:00 or 6:00 A.M.

Employment

Handlers, equipment cleaners, helpers, and laborers held about 4.9 million jobs in 1990. The following tabulation shows the makeup of this occupational group.

Freight, stock, and material movers, hand	881,000
Hand packers and packagers	667,000
Construction trades helpers	549,000
Machine feeders and offbearers	255,000
Service station attendants	245,000
Vehicle washers and equipment cleaners	240,000
Refuse collectors	123,000
Parking lot attendants	50,000
All other helpers, laborers, and material movers, hand	1,909,000

They were employed throughout the country in virtually all industries, with the greatest numbers in manufacturing, construction, and wholesale and retail trade. Almost 1 out of 4 handlers, equipment cleaners, helpers, and laborers worked part time in 1990.



No training or work experience is required for most handler, equipment cleaner, helper, and laborer jobs.

Training, Other Qualifications, and Advancement

For most of these jobs, employers will hire people without work experience or specific training. Some require a high school diploma, others do not. For those jobs requiring physical exertion, employers look for physically fit workers and may require that they pass a physical exam. For all jobs, employers look for people who are reliable and hard working. For those jobs that involve dealing with the public, such as grocery store helpers and garage and parking lot attendants, workers should be pleasant and tactful. Some jobs require literacy and basic mathematics skills to read billing and other records.

Generally, handlers, equipment cleaners, helpers, and laborers learn skills informally from more experienced workers or supervisors. Workers who use dangerous equipment or toxic chemicals often receive training in safety awareness and procedures. In many of these jobs, workers may become trainees or qualify directly for jobs as construction trades workers; machine operators, assemblers, or other production workers; transportation, material moving equipment, or vehicle operators; or mechanics or repairers. Some become supervisors of handlers, equipment cleaners, helpers, and laborers. In fact, many employers do not hire workers for mechanic, construction trade, production, or similar occupations. Rather, they only hire handlers, equipment cleaners, helpers, and laborers, and promote qualified workers as openings arise.

Job Outlook

Overall employment of handlers, equipment cleaners, helpers, and laborers is expected to grow more slowly than the average for all occupations through the year 2005. Employment change for individu-

al occupations will vary, however, ranging from a projected decline in employment of service station attendants to average growth for parking lot attendants and vehicle washers and equipment cleaners. Job openings should be numerous because the occupation is very large and turnover is high.

Demand for handlers, equipment cleaners, helpers, and laborers will depend on growth of the industries that employ these workers, as well as growth of the skilled workers whom they assist. For example, the average employment growth projected for construction trades helpers reflects the average growth expected for the construction industry and for construction trades workers.

Employment growth also is affected by automation. Some of these jobs are repetitive and, therefore, easily replaced by new machines and equipment that can improve productivity and quality control. Automated material handling equipment, such as conveyor belts and computer-controlled lift mechanisms and machines that automatically load, unload, and package materials, will be increasingly used, eliminating some helper, handler, and hand packer and packager jobs. As more skilled jobs become automated or partially automated, such as those of assemblers, demand for these employees will decline, as will demand for workers who assist them. Some workers, however, such as construction trades helpers, are not easily replaced by automation because of the varied nature of their jobs.

In addition to automation, many employers have adopted cost cutting measures such as job combinations, in which one employee performs the work previously done by two different types of workers. This may cause displacement of handlers, equipment cleaners, helpers, and laborers because their jobs may be assumed by more highly skilled workers who perform the skilled labor as well as the helper's work.

Earnings

Median weekly earnings for handlers, equipment cleaners, helpers, and laborers in 1990 were about \$300. The middle 50 percent earned from \$220 to \$420 weekly. The top 10 percent earned over \$550 weekly, and the bottom 10 percent earned less than \$180 weekly. Construction trades helpers have higher weekly earnings than other workers in this group. However, they may be more likely to lose work time because of bad weather and the cyclical nature of construction work. Stock handlers and baggers have the lowest weekly earnings among workers in this group.

Related Occupations

Other entry level workers who perform mostly physical work are roustabouts in the oil industry, certain timber cutting and logging occupations, and groundskeepers. The jobs of handlers, equipment cleaners, helpers, and laborers are often similar to those of the more experienced workers they assist, including machine operators, craft workers, assemblers, mechanics, and repairers.

Sources of Additional Information

For information about jobs as handlers, equipment cleaners, helpers, and laborers, contact local building or construction contractors, manufacturers, and wholesale and retail establishments, or the local office of the State employment service.

For general information about the work of construction laborers, contact:

• Laborers' International Union of North America, 905 16th St. NW., Washington, DC 20006.

Inspectors, Testers, and Graders

(A list of D.O.T. codes is available on request from the Chief, Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.)

Nature of the Work

Inspectors, testers, and graders ensure that products meet quality standards. They may compare products to samples or to specifica-

tions in blueprints or graphs to make sure they are free from defects or other problems. Virtually all manufactured products, including foods, textiles, clothing, glassware, automotive components and completed vehicles, electronic components, computers, and structural steel, are inspected.

Inspectors generally visually check and may also listen to or feel products, or even taste or smell them. They verify dimensions, color, weight, texture, strength, or other physical characteristics of objects and look for imperfections such as cuts, scratches, bubbles, missing pieces, misweaves, or crooked seams. Many inspectors use micrometers, electronic equipment, calipers, alignment gauges, and other instruments to check and compare the dimensions of parts against the parts' specifications. Those testing electrical devices may use voltmeters, ammeters, and oscilloscopes to test the insulation, current flow, and resistance. Machinery testers generally check that parts fit and move correctly and are properly lubricated, check the pressure of gases and the level of liquids, test the flow of electricity, and do a test run to check for proper operation. Some jobs involve only a quick visual inspection; others require a much longer detailed one. Senior inspectors may also set up tests and test equipment.

Some inspectors examine materials received from a supplier before sending them on to the production line. Others inspect components, subassemblies, and assemblies or perform a final check on the finished product.

Inspectors mark, tag, or note problems. They may reject defective items outright, send them for rework, or, in the case of minor problems, fix them themselves. If the product checks out, they may screw on a nameplate, tag it, stamp a serial number, or certify it in some other way. Inspectors also may calibrate precision instruments used in inspection work.

Inspectors, testers, and graders record the results of their inspections, compute the percentage of defects and other statistical parameters, prepare inspection and test reports, notify supervisors of problems, and may help analyze and correct problems.

Increasingly in manufacturing, inspectors are being used in the middle of production lines, rather than at the end. They still test products to ensure that they will meet with specifications, but they may direct the production line to adjust the machinery before the manufacturing line produces unusable parts.

Working Conditions

Working conditions vary from industry to industry. Some inspectors examine similar products for an entire shift; others examine a variety of items. Most remain at one work station, but some travel from place to place to do inspections. Some are on their feet all day; others sit. In some industries, inspectors are exposed to the noise and grime of machinery; in others, they work in a clean, quiet environment. Some may have to lift heavy objects.

Some inspectors work evenings, nights, or weekends. In these cases, shift assignments generally are made on the basis of seniority. Overtime may be required to meet production goals.

Employment

Inspectors, testers, and graders held about 668,000 jobs in 1990. Over 8 of every 10 worked in manufacturing industries, including motor vehicles and equipment; electronic components and accessories; communications equipment; apparel; aircraft and parts; plastic products; and office, computing, and accounting machines. Some worked in wholesale trade, transportation, testing and photofinishing labs, engineering services, and government agencies. Although they are employed throughout the country, most jobs are in large metropolitan areas where many large factories are located.

Training, Other Qualifications, and Advancement

A high school diploma is helpful and may be required for some jobs. Simple jobs are generally filled by beginners with a few days' training. More complex ones are filled by experienced assemblers, machine operators, or mechanics who already have a thorough knowledge of the products and production processes.

In-house training for new inspectors may cover the use of special



Inspectors test electrical components to ensure they work properly.

meters, gauges, computers, or other instruments; quality control techniques, blueprint reading, and reporting requirements. There are some postsecondary training programs in testing, but most employers prefer to train inspectors themselves.

Inspectors, testers, and graders need mechanical aptitude, good hand-eye coordination, and good vision.

Advancement for these workers frequently takes the form of higher pay. However, they also may advance to inspector of more complex products, supervisor, or quality control technician.

Job Outlook

Employment of inspectors, testers, and graders is expected to remain about the same through the year 2005. Because the occupation is large, however, many job openings will arise each year from the need to replace workers who transfer to other occupations or leave the labor force.

Even though the volume of manufactured goods will grow, employment will not grow for several reasons. For one thing, manufacturers are taking steps to improve production methods—relying on computers and statistical analysis to control the production process. This should result in fewer defects and reduced requirements for inspectors. In some cases, machines will alert workers when items approach limits so that problems can be corrected before defects occur. In addition, more firms are holding assemblers, machine operators, and other production workers responsible for quality, and having them correct problems as they occur. Also, better inspecting machinery will improve inspectors' speed and accuracy, so fewer of them will be needed, and, in some cases, completely automated equipment will eliminate the need for inspectors.

Earnings

Inspectors, testers, and graders had median weekly earnings of about \$380 in 1990. The middle 50 percent earned from about \$285 to \$526 a week. The lowest 10 percent earned less than \$209 a week; the highest 10 percent earned more than \$679.

Related Occupations

Other workers who inspect products or services are construction and building inspectors and inspectors and compliance officers, except construction, which includes consumer safety, environmental health, agricultural commodity, immigration, customs, postal, motor vehicle, safety, and other inspectors.

Sources of Additional Information

For general information about this occupation, contact:

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

• The American Society for Quality Control, Membership Department, 310 West Wisconsin Ave., Milwaukee, WI 53203.

Painting and Coating Machine Operators

(A list of D.O.T. codes is available on request from the Chief, Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.)

Nature of the Work

Paints and coatings are an important part of most products. In manufacturing, everything from cars to candy is covered by either paint, plastic, varnish, chocolate, or some special coating solution. Often the paints and coatings are merely intended to enhance the products' appeal to consumers, as with the chocolate coating on candy. More often, however, the protection provided by the paint or coating is essential to the product, as with the coating of insulating material covering wires and other electrical and electronic components. Many paints and coatings have dual purposes, such as the paint finish on an automobile, which heightens the visual impact of the vehicle while providing protection from corrosion. Painting and coating machine operators control the machinery and equipment that applies the many types of paints and coatings to a wide range of manufactured products.

Workers use several basic methods to apply paints and coatings to manufactured articles. For example, dippers immerse racks or baskets of articles in vats of paint, liquid plastic, or other solutions using a power hoist. Tumbling barrel painters deposit articles of porous materials in a barrel of paint, varnish, or other coating, which is then rotated to insure thorough coverage.

The most common method of applying paints and coatings is by spraying the article with the solution. Spray-machine operators use equipment with spray guns to coat metal, wood, ceramic, fabric, paper, and even food products with paint and other coating solutions. Following a formula, operators fill the equipment's tanks with a mixture of paints or chemicals, adding prescribed amounts or proportions. They screw nozzles onto the spray guns and adjust them to obtain the proper dispersion of the spray, and hold or position the guns to direct the spray onto the article. The pressure of the spray is regulated by adjusting valves. Operators check the flow and viscosity of the paint or solution, and visually inspect the quality of the coating. They may also regulate the temperature and air circulation in drying ovens.

In response to concerns about air pollution and worker safety, manufacturers are increasingly using new types of paints and coatings on their products instead of high-solvent paints. Water-based paints and powder coatings are two of the most common. These compounds do not emit as many volatile organic compounds (VOC's) into the air and can be applied to a wide variety of products. Powder coatings are sprayed much like liquid paints and heated to melt and cure the finish.

The switch to new types of paints is often accompanied by a switch to newer, more automated painting equipment that the operator sets and monitors instead of wielding a spray gun. Operators position the automatic spray guns, set the nozzles, and synchronize the action of the guns with the speed of the conveyor carrying articles through the machine and drying ovens. The operator may also add solvents or water to the paint vessel that prepares the paint for application. During operation, the operator attends the painting machine, observes gauges on the control panel and randomly checks articles for evidence of any variation of the coating from specifications. The operator then "touches up" spots where necessary using a spray gun.

Painting and coating machine operators use various types of spray machines to coat a wide range of products. Often their job title reflects the specialized nature of the machine or coating they apply. For example, paper coating machine operators spray "size," on rolls of paper to give it its gloss or finish. Silvering applicators spray silver, tin, and copper solutions on glass in the manufacture of mirrors. Enrobing machine operators coat, or "enrobe," confectionery, bakery, and other food products with melted chocolate, cheese, oils, sugar, or other substances.

Although the majority of painting and coating machine operators are employed in manufacturing, the largest, best known group of them work in automotive body repair and paint shops repainting old

and damaged cars, trucks, and buses. Automotive painters are among the most highly skilled manual spray operators because, when painting only the repaired portions of a vehicle, they often have to mix paint to match the original color, which can be very difficult if the color has faded.

To prepare a vehicle for painting, automotive painters or their helpers use power sanders and sandpaper to remove the original paint or rust, and then fill small dents and scratches with body filler. They also remove or mask parts they do not want painted, such as chrome trim, headlights, windows, and mirrors.

Automotive painters use a spray gun to apply several coats of paint. They apply lacquer or enamel primers to vehicles with metal bodies and flexible primers to newer vehicles with plastic body parts. Aiming the spray gun by hand, they apply successive coats of paint until the finish of the repaired sections of the vehicle matches that of the original undamaged portions. To speed drying between coats, they may place the freshly painted vehicle under heat lamps or in a special infrared oven. After each coat of primer dries, they sand the surface to remove any irregularities and to improve the adhesion of the next coat. Final sanding of the primers may be done by hand with a fine grade of sandpaper. A sealer is then applied and allowed to dry, followed by the final topcoat. When lacquer is used, painters or their helpers usually polish the finished surface after the final coat has dried; enamel dries to a high gloss and usually is not polished.

Working Conditions

Painting and coating machine operators work indoors and may be exposed to dangerous fumes from paint and coating solutions. However, many operators wear masks or respirators that cover their nose and mouth, and painting is usually done in special ventilated booths that protect the operators from these hazards. Provisions of the Clean Air Act of 1990 regulate establishments' emissions of VOC's, including those from paints and other chemicals, thus decreasing the amount of hazardous fumes to which these workers are exposed.

Operators have to stand for long periods of time and, when using a spray gun, they may have to bend, stoop, or crouch in uncomfortable positions to reach all parts of the article.

Most operators work a normal 40-hour week, but self-employed automotive painters sometimes work more than 50 hours a week, depending on the number of vehicles customers bring in to be repainted.



Automotive painters need stamina because they stand for hours.

Employment

Painting and coating machine operators held about 160,000 jobs in 1990. Almost 9 out of 10 worked in manufacturing establishments—in the production of fabricated metal products, motor vehicles and related equipment, industrial machines, household and office furniture, and plastics, wood, and paper products, for example. Others included automotive painters employed by independent automotive repair shops and body repair and paint shops operated by retail automotive dealers. About 1 in 20 painting and coating machine operators was self-employed; most of these were automotive painters.

Training, Other Qualifications, and Advancement

Most painting and coating machine operators acquire their skills on the job, usually by watching and helping experienced operators. For most operators, training lasts from a few days to several months. However, becoming skilled in all aspects of automotive painting usually requires 1 to 2 years of on-the-job training.

Most automotive painters start as helpers and gain their skills informally by working with experienced painters. Beginning helpers usually remove trim, clean and sand surfaces to be painted, mask surfaces that they do not want painted, and polish finished work. As helpers gain experience, they progress to more complicated tasks, such as mixing paint to achieve a good match and using spray guns to apply primer coats or final coats to small areas.

Instructional programs in automotive painting are offered at a growing number of community and junior colleges and vocational and technical schools. Completion of such a program enhances one's employment prospects and can speed promotion to the next level. The quality of formal automotive painting programs varies greatly, however. Better programs provide a thorough background in the latest automotive painting technology, such as the use of acrylic paints, and include substantial practical experience essential to becoming proficient as an automotive painter.

Some employers sponsor training to make their workers more productive by saving time on repainting and learning other efficient methods. This training is available from manufacturers of chemicals, paints, or equipment or from other private sources. It may include safety and quality tips and knowledge of products, equipment, and general business practices.

Painters should have keen eyesight and a good color sense. Courses in automobile-body repair offered by high schools, vocational schools, and community colleges are helpful. Completion of high school generally is not required but usually is an advantage.

Voluntary certification by ASE (the National Institute for Automotive Service Excellence) is recognized as the standard of achievement for automotive painters. For certification, painters must pass a written examination and have at least 2 years of experience in the field. High school, trade or vocational school, or community or junior college training in automotive painting and refinishing may substitute for up to 1 year of experience. To retain certification, painters must retake the examination at least every 5 years.

Experienced painting and coating machine operators with leadership ability may advance to supervisory jobs. Those who acquire practical experience or college or other formal training may become sales or technical representatives to large customers or for chemical or paint companies. Some automotive painters open their own shops.

Job Outlook

Little or no change in the overall employment of painting and coating machine operators is expected through the year 2005 as technological improvements enable these operators to work more productively. Nevertheless, several thousand jobs will become available each year as employers replace experienced operators who transfer to other occupations or retire or stop working for other reasons. Turnover is high, due primarily to wages that are below other machine operative jobs.

Employment of painting and coating machine operators is expected to decline in manufacturing reflecting the increasing automation of paint and coating application. One factor leading to more automation is improvements in the capabilities of industrial robots to move and aim spray guns more like a human operator. As the cost of these machines continues to fall, more should come into use, further expanding the

variety of manufactured articles that can be painted or coated using automatic equipment and reducing the need for operators.

The second factor leading to more automation is the Clean Air Act of 1990, which sets limits on the level of volatile organic compounds that can be released into the air. As firms switch to water-based and powder coatings, for example, in order to meet the requirements of the law, it is likely that many will upgrade their equipment in order to increase the efficiency of the painting process. For example, the powder coating process alone is much more efficient for work on assembly lines than liquid sprays because no drying time is required between coats and because fewer operators are needed for touch-up painting.

Employment of painters is expected to grow faster than average in automotive repair shops and in motor vehicle dealers as the number of cars, trucks, and buses damaged in traffic accidents increases with the motor vehicle population. Automotive painters also will be needed to repaint older vehicles that have rust or faded paint. Also expected to contribute to growth will be the continuing emphasis on building lighter weight cars that achieve high gasoline mileage, but that are prone to greater damage in major collisions. However, job growth will be limited somewhat by the increased use of plastic body panels that reduce minor collision damage. In general, the diversity of vehicles that automotive painters repaint makes their work unsuitable for automation.

The number of job openings for painting and coating machine operators may fluctuate from year to year due to cyclical changes in economic conditions. When demand for manufactured goods slackens, production may be suspended or reduced, and workers may be laid off or face a shortened workweek. However, automotive painters can expect relatively steady work because automobiles damaged in accidents require repair and refinishing regardless of the state of the economy.

Earnings

Painting and coating machine operators who usually worked full time had median weekly earnings of \$385 in 1990. The middle 50 percent had usual weekly earnings between \$282 and \$503, while the highest 10 percent earned more than \$657 weekly. Beginning automotive painter apprentices usually start at about half the hourly rate of fully qualified painters. As they progress, their wages gradually approach those of experienced automotive painters. Helpers start at lower wage rates than beginning apprentices.

Many automotive painters employed by automobile dealers and independent repair shops receive a commission based on the labor cost charged to the customer. Under this method, earnings depend largely on the amount of work a painter does and how fast it is completed. Employers frequently guarantee commissioned painters a minimum weekly salary. Helpers and apprentices usually receive an hourly rate until they become sufficiently skilled to work on a commission basis. Trucking companies, buslines, and other organizations that repair their own vehicles usually pay by the hour.

Many painting and coating machine operators belong to unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters. Most union operators work for manufacturers and the larger automobile dealers.

Related Occupations

Other occupations in which workers apply paints and coatings include construction and maintenance painters, electrolytic metal platers, and hand painting, coating, and decorating occupations.

Sources of Additional Information

For more details about work opportunities, contact local manufacturers, automotive-body repair shops, and automotive dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about training programs.

For general information about a career as an automotive painter, write to:

• Automotive Service Industry Association, 444 North Michigan Ave., Chicago, IL 60611.

• Automotive Service Association, Inc., P.O. Box 929, Bedford, TX 76021-0929.

Information on how to become a certified automotive painter is available from:

• ASE, 13505 Dulles Technology Dr., Herndon, VA 22071-3415.

Photographic Process Workers

(D.O.T. 962.361-010; 970.281-010 and -018, .381-010 and -034; 976.361-010, .380-010, .381-010 and -018, .382-014 and -018, .665-010, .681-010, .682-010 through -018, .684-014, .685-014, -018, -022, -026, and -030)

Nature of the Work

Professional and amateur photographers generally rely on workers in photofinishing laboratories to develop film, make prints and slides, and do related tasks such as enlarging and retouching photographs. Some photographic process workers operate machinery that automatically develops and prints film. Others, called precision photographic process workers, perform delicate tasks by hand.

Developers produce negatives, either by hand or by machine, using a sequence of five steps: Developing, stop bath, fixing bath, washing, and drying. *Printer operators* then make prints from the negatives. First, a negative and light-sensitive paper are placed into an enlarger which consists of an electric lamp and a magnifying lens. When the lamp is turned on, light passes through the negative and lens onto the light-sensitive paper, recording an image. The paper is then put through several chemical baths, one to bring out the image, another to stop the reaction, a third to fix the image, and finally a rinse to wash off excess chemicals.

For custom printing, *precision photographic process workers* may vary the contrast of images, remove unwanted background, and may also mount finished prints in frames or on paper or cardboard backing. Some precision photographic process workers enhance commercial and advertising photographs and special personal photographs such as those of weddings. Workers in this category include *airbrush artists*, who restore damaged and faded photographs; *photographic retouchers*, who alter photographic negatives and prints to accentuate the subject; *colorists*, who apply oil colors to portrait photographs to create natural, lifelike appearances; and *photographic spotters*, who spot out imperfections on photographic prints.

In commercial laboratories and photofinishing minilabs, photographic processing machine operators use automated equipment to develop film. *Film developers* develop still or motion picture film; *color-printer operators* produce color prints from negatives; *automatic print developers* develop strips of exposed photographic paper; *takedown sorters* sort processed film; and *automatic mounters* operate equipment that cuts and mounts slide film into individual transparencies.

Working Conditions

Little photographic processing is done in darkrooms anymore. Work is generally performed in clean, appropriately lighted, well-ventilated, and air-conditioned photofinishing laboratories. Some individuals work at home, airbrushing, spotting, or retouching negatives for professional labs.

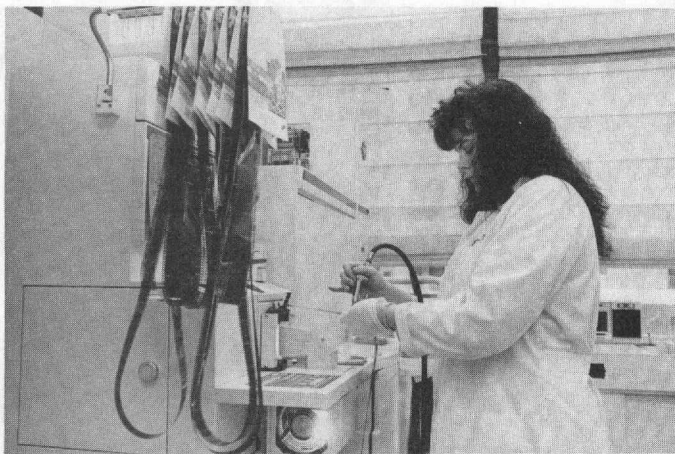
Photographic process workers must do repetitious work at a rapid pace without any loss of accuracy. Detailed tasks, such as airbrushing and spotting, may contribute to eye fatigue.

Some photographic process workers are exposed to the chemicals and fumes associated with developing and printing. These workers wear aprons and rubber gloves and take other precautions against chemical hazards.

Many photo laboratory employees work a 40-hour week, but may work overtime during peak seasons around holidays.

Employment

Photographic process workers held about 76,000 jobs in 1990. Large photofinishing laboratories that serve drug stores and grocery stores



Most photographic process workers learn skills on-the-job.

and 1-hour minilabs employed about half. Many others worked in portrait and commercial art studios and for motion picture producers. Some worked in commercial laboratories that specialize in processing the work of professional photographers.

Employment fluctuates over the course of the year; the peak period is around Christmas time.

Training, Other Qualifications, and Advancement

Most photographic process workers receive on-the-job training. Beginners help experienced workers and gradually learn to develop and print film.

Employers prefer applicants who are high school graduates or those who have some experience or knowledge about the field. Photography courses that include instruction in film processing are valuable. Courses are available through high schools, vocational-technical institutes, private trade schools, adult education programs, and colleges and universities.

On-the-job training in specialized photographic processing occupations can last a few weeks for print developers to several months for airbrush artists, spotters, and negative retouchers. Some workers attend week-long training seminars. Manual dexterity; good vision, including normal color perception; and good hand-eye coordination are important qualifications.

Photographic process workers generally advance from jobs as machine operators to more skilled positions. Others advance to supervisory positions in laboratories.

Job Outlook

Employment of photographic process workers is expected to increase as fast as the average for all occupations through the year 2005 as individuals and businesses take more photographs. Many additional openings will result from replacement needs. Replacement needs are particularly high for machine operators.

The development of simple, completely automated, low-priced pocket cameras should increase interest in amateur photography. Business demand is also expected to increase as the advertising and printing and publishing industries continue to grow.

The increased volume of film to be processed should ensure continued job growth for machine operators, despite labor-saving advances in photographic processing equipment. The growth of minilabs as either stand-alone units or as part of large chainstores should also offset the labor-reducing effect of automation since each location needs a minimum number of workers.

Technological change is unlikely to affect demand for precision photographic process workers too much; the fine adjustments they make to photographs do not lend themselves to mechanization. Despite improvements in camera and film technology, it is unlikely that they will produce business, advertising, or special personal photos that do not need some precision work.

Because photographic processing services are luxuries for consumers, job openings may decrease during recessions.

Earnings

Earnings of photographic process workers vary greatly depending on skill level, experience, and geographic location. Median earnings for full-time photographic process workers in 1990 were about \$315 a week. The middle 50 percent earned between \$229 and \$419 a week. The lowest 10 percent earned less than \$186 a week; the highest 10 percent, more than \$524.

Related Occupations

Precision photographic process workers need a specialized knowledge of the photodeveloping process. Other workers who apply specialized technical knowledge include chemical laboratory technicians, crime laboratory analysts, food testers, medical laboratory assistants, metallurgical technicians, quality control technicians, engravers, and some printing occupations such as photo-lithographer.

Sources of Additional Information

For information about employment opportunities in photographic laboratories and schools that offer degrees in photographic technology, write to:

• Photo Marketing Association International, 3000 Picture Place, Jackson, MI 49201.

Precision Assemblers

(A list of D.O.T. codes is available on request from the Chief, Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.)

Nature of the Work

Workers who put together the parts of manufactured articles are called assemblers. In some instances, such as the building of a car, hundreds of assemblers work on a single product; in others, such as the assembly of a toy doll, a single assembler may be responsible for each product. Assembly work varies from simple, repetitive jobs that are relatively easy to learn to those requiring great precision and many months of experience and training. This statement focuses on the highly experienced and trained group.

The work of precision assemblers requires a high degree of accuracy. Workers must be able to interpret detailed specifications and instructions and apply independent judgment. Some experienced assemblers work with engineers and technicians, assembling prototypes or test products. Precision assemblers involved in product development must know how to read and interpret engineering specifications from text, drawings, and computer-aided drafting systems, and how to use a variety of tools and precision measuring instruments.

Precision assemblers may work on subassemblies or the complete final assembly of finished products or components of products such as electronic equipment, machinery, or aircraft. For example, precision electrical and electronic equipment assemblers put together or modify prototypes or final assemblies of items such as missile control systems, radio or test equipment, computers, machine-tool numerical controls, radar, sonar, telemetering systems, and appliances. Precision electromechanical equipment assemblers prepare and test equipment or devices such as dynamometers, ejection seat mechanisms, magnetic drums, and tape drives. Precision machine builders construct, assemble, or rebuild engines and turbines, and office, agricultural, construction, oil field, rolling mill, textile, woodworking, paper, printing, and food wrapping machinery. Precision aircraft assemblers put together and install parts of airplanes such as wings or landing gear. Precision structural metal fitters align and fit structural metal parts according to detailed specifications prior to welding or riveting.

The manufacturing process is changing. Flexible manufacturing systems, which include the manufacturing applications of robotics, computers, programmable motion control, and various sensing technologies, are changing the way goods are made and affecting the jobs of those who make them. As manufacturing firms strive for greater precision and productivity, jobs that can be performed more economi-

cally or more accurately by automated equipment will be restructured; many of them will be upgraded or disappear. However, until recently, relatively few precision assembly jobs have been eliminated by automation. The need for precision, independent judgment, and knowledge has placed many jobs beyond the capabilities of robots. Because much precision assembly work is done in difficult-to-reach locations unsuited for robots—inside airplane fuselages or inside gear boxes, for example—replacement of these workers by automated processes will be slower and less comprehensive than replacement of welders and painters.

Working Conditions

The conditions under which precision assemblers work depend on the manufacturing plant where they are employed. Electronics assemblers sit at tables in rooms that are clean, well lighted, and free from dust. Assemblers of aircraft and industrial machinery, however, usually come in contact with oil and grease, and their working areas may be quite noisy. They may have to lift and fit heavy objects.

Work schedules of assemblers may vary at plants with more than one shift. In some plants, workers can accept or reject a certain job on a given shift, usually in order of seniority.

Employment

Virtually all of the 352,000 precision assembler jobs in 1990 were in plants that manufacture durable goods. About one-third of all jobs involved assembly of electronic and electrical machinery, equipment, and supplies including electrical switches, welding equipment, electric motors, lighting equipment, household appliances, and radios and television sets. About one-quarter involved assembly of nonelectrical machinery (diesel engines, steam turbine generators, farm tractors, mining and construction machinery, and office machines). Other industries employing many precision assemblers were transportation equipment (aircraft, autos, trucks, and buses) and professional and scientific instruments.

The following tabulation lists the industries that provided most wage and salary jobs for precision assemblers in 1990:

	Percent
Total	100
Electronic and other electrical equipment.....	33
Industrial machinery and equipment.....	25
Transportation equipment	19
Instruments and related products	17
Fabricated metal products	4
Other industries	2

Training, Other Qualifications, and Advancement

Precision assemblers often are promoted from the ranks of workers in less skilled jobs in the same firm. Sometimes, outside applicants may be hired if they possess suitable experience. The ability to do accurate work at a rapid pace is a key job requirement. A high school diploma is helpful but usually is not required.

For some precision assembly jobs, applicants need specialized training. For example, employers may require that applicants for electrical or electronic assembler jobs be technical school graduates or have equivalent military training.

Good eyesight, with or without glasses, is required for assemblers who work with small parts. In plants that make electrical and electronic products, which may contain many different colored wires, applicants often are tested for color vision.

As precision assemblers become more experienced, they may progress to jobs that require more skill and be given more responsibility. Experienced assemblers who have learned many assembly operations and understand the construction of a product may become product repairers. These workers fix assembled articles that operators or inspectors have identified as defective. Assemblers also may advance to quality control jobs or be promoted to supervisor. In some firms, assemblers can become trainees for one of the skilled trades. Those with a background in math, science, and computers may advance to programmers or operators of more highly automated production equipment.



Precision assemblers often check their work for accuracy.

Job Outlook

Employment of precision assemblers is expected to decline through the year 2005 as increasing use of automation and “outsourcing”—the practice of moving assembly operations to countries where labor is cheaper—take their toll of assembly jobs in manufacturing. Despite the expected decline in employment, a moderate number of job openings will occur as workers transfer to another occupation or leave the labor force.

The effect of automation on precision assembler employment will depend on how rapidly and extensively new manufacturing technologies are adopted. Certainly, not all precision assemblers can be replaced efficiently by automated processes. Flexible manufacturing systems are expensive, and a large volume of repetitive work is required to justify their purchase. Also, where the assembly parts involved are irregular in size, new technology is only now beginning to make inroads. For example, robot assembly works best where products are designed specifically to be assembled by robots. In addition, manufacturers are less willing to invest in product and equipment redesign as long as existing operations are profitable.

Although technological change can be expected in a growing number of industries, the impact of automation should be greatest in electronics, communications, and computer equipment manufacturing industries, which produce products best suited for automation. Electrical and electronic assembly jobs are expected to be more adversely affected than other precision assembler jobs.

An alternative to automation for many firms is to send their sub-assembly or component production functions to countries where labor is cheaper. If this trend continues, assembly work sent abroad may well cost more jobs than robots or other automated manufacturing systems.

Earnings

Earnings information is somewhat limited for precision assemblers. Full-time workers who assemble electrical and electronic equipment had median weekly earnings of \$298 in 1990. Most earned between \$232 and \$386; the lowest 10 percent earned less than \$183 a week and the highest 10 percent, over \$480.

In many unionized companies manufacturing autos, aircraft, and electronic equipment, wages of precision assemblers ranged from \$400 to \$600 per week in 1990.

Many precision assemblers are members of labor unions. These unions include the International Association of Machinists and Aerospace Workers; the International Union of Electrical, Radio and

Machine Workers; the United Automobile, Aerospace and Agricultural Implement Workers of America; the International Brotherhood of Electrical Workers; and the United Steelworkers.

Related Occupations

Other occupations that involve operating machines and tools and assembling things are welders, ophthalmic laboratory technicians, and machine operators.

Sources of Additional Information

Information about employment opportunities for assemblers is available from local offices of the State employment service and from locals of the unions mentioned earlier.

Prepress Workers

(D.O.T. 203.362-018, .382-018, -026, .582-042, -046, -062, -074; 208.382-010; 650.582-010, -014, -018, -022, .682-010, .685-010; 652.585-010, .685-106; 652.665-014, .685-022, -086; 970.281-026, .361-014, .381-030; 971.261, .381 except -042, -046, -058, .382, .685; 972.281, .282-010, -014, .381, .382; 973.381-010, -014, -018, -022, -026, -030; 979.381-018, -022, .382-022, .682-014)

Nature of the Work

The printing process can be divided into three stages—prepress, press, and binding or finishing. Prepress workers are responsible for getting the material ready for printing presses. They perform a variety of tasks such as typesetting, designing page layout, photographing text and pictures, and making printing plates.

In recent years, prepress work has undergone major changes due to the application of electronics and computers in the printing process as the industry moves toward complete digitized imaging. Digitized imaging is the technology by which material to be printed is processed directly from computer to plate. Some examples of new prepress technology include digital color scanners with electronic dot generation, electronic color page makeup systems, electronic page layout systems, and off-press color proofing systems.

If electronic imaging becomes more prevalent, the use of film in printing may be eliminated. However, film is still the most economical and efficient data storage and retrieval medium in use. Currently, electronic imaging is limited to larger, more advanced printing shops, but as costs decline and quality improves, the process is likely to increase in use.

Typesetting has been greatly affected by technological changes. In the past, text composition was done by a method called "hot type," in which molten lead was used to create individual letters, paragraphs, and full pages of text. This printing method is well along the road to extinction due to the use of computers.

Today, virtually all composition work is done with computers and "cold type" technology. Cold type, which refers to any method used to create type without molten lead, uses photographic principles to create positive images on paper. The images are assembled into page format and then used to create film negatives from which the actual printing plates are made. This process of readying text for printing is called phototypesetting.

In a common form of phototypesetting, text is entered into a computer that is programmed to hyphenate, space, and create columns of text. Keyboarding of text may be done by typesetters or data entry clerks at the printing establishment or, increasingly, by the author before the job is sent out for composition. The computer stores the text on magnetic tape, floppy disk, or hard disk. The magnetically coded text is then transferred to a typesetting machine which uses photography, a cathode-ray tube, or a laser to create an image on typesetting paper or film. Once it has been developed, the paper or film is sent to a lithographer who makes the actual printing plate.

In another type of composition, a computer produces text on special paper in the desired format. In newspapers, for instance, text is printed in long columns. Workers called *paste-up artists* cut and arrange the columns of text and illustrations onto a special illustration

board called a "mechanical." The special paper adheres easily to the board, yet is designed to allow easy removal and positioning. Once the text is arranged in final form, the board is sent to the camera department where a photographic negative used to create printing plates is produced. In small shops, *job printers* may be responsible for setting type according to copy, reading proof for errors and clarity, and correcting mistakes.

The most advanced method of typesetting, called electronic pagination, is currently in limited commercial use. An *electronic pagination system operator* works at a keyboard to select the size and style of type, the column width, and appropriate spacing, as well as to enter and store each character in the computer. The computer then displays and arranges columns of type on a screen that is similar to a TV screen. An entire newspaper page—complete with artwork and graphics—can be made up on the screen exactly as it will appear in print. Operators check the text and make any required corrections. The information is transmitted for production into film and then into plates, or directly into plates, eliminating the role of paste-up artists.

Emerging technologies are also affecting the roles of other composition workers. Laser printers, for instance, are likely to play an increasing role in the printing process. These devices read text from computer memory and then "beam" it directly onto film, paper, or plate, bypassing the slower photographic process now being used.

After the material has been arranged and typeset, it is passed on to workers who further prepare it for the presses. *Camera operators*—who generally are classified as line camera operators, halftone operators, or color separation photographers—start the process of making a lithographic plate by photographing and developing film negatives or positives of the material to be printed. Continuous-tone photographs cannot be reproduced by most printing processes. Therefore, halftone camera operators photograph pictures that are broken into dots which can be reproduced. Operators adjust light and expose film for a specified length of time, and then develop film in a series of chemical baths.

Camera operators may also mount unexposed film in machines that automatically develop and fix the image. Color separation photography is more complex. During this process, camera operators produce four-color separation negatives from a continuous-tone color print or transparency which is being reproduced. More of this separation work will be done electronically in the future on scanners.

Scanner operators use computerized equipment to create film negatives or positives of photographs or art. The operator reviews all work to determine if corrections to the original are necessary and adjusts the equipment accordingly. The operator then uses a densitometer to measure the density of the colored areas, and the scanner is adjusted to obtain the best results. Once the settings are entered, the scanner is started. To reproduce color, an original color photograph or transparency is scanned for each color to be printed. Each scan produces a dotted, or halftone image of the original in one of four primary colors—yellow, magenta, cyan, and black. The images are used to produce printing plates that will print each of these colors, one at a time. The printing is done with primary process color inks which are transparent, creating "secondary" color combinations of red, green, blue, and black. These secondary colors can be combined to produce all the colors and hues of the original photograph. The computer controls the color separation or the scanning process, correcting for mistakes or compensating for deficiencies in the original color print or transparency.

Film negatives or positives may need retouching. *Lithographic dot etchers* take care of this by sharpening or reshaping images on the negatives. They do the work by hand, using chemicals, dyes, and special tools. Dot etchers must know the characteristics of all types of paper and must produce fine shades of color. Like camera operators, they are usually assigned to only one phase of the work, and may have job titles such as dot etcher, retoucher, or letterer. The skills of dot etchers are gradually being replaced by scanners which can perform color correction during the color separation procedure.

Strippers cut the film to required size and arrange and tape the negatives onto "flats," or layout sheets, used by platemakers to make press plates. When completed, flats resemble large film negatives of the text in its final form. In large printing establishments like newspapers, arrangement is done automatically.

Platemakers use a photographic process to make printing plates. The film assembly or flat, which closely resembles a photographic negative of the text, is placed on top of a thin metal plate treated with a light-sensitive chemical. Exposure to ultraviolet light activates the chemical in those parts not protected by the film's dark areas. The plate is then developed in a special solution that removes the unexposed non-image area, exposing bare metal. The chemical on areas of the plate exposed to the light hardens and becomes water repellent. The hardened parts of the plate form the text.

In a growing number of printing plants, platemakers use machines that process the plates automatically. Entering, storing, and retrieving information from computer-aided equipment require technical skills. In addition to operating and maintaining the equipment, lithographic platemakers must make sure that plates meet quality standards.

During the printing process, the plate is first covered with a thin coat of water. The water adheres only to the bare metal non-image areas, and is repelled by the hardened areas that were exposed to light. Next, the plate comes in contact with a rubber roller covered with an oil-based ink. Because oil and water do not mix, the ink is repelled by the water-coated area and sticks to the hardened areas. The ink covering the hardened text can now be transferred to paper.

Technological changes will continue in the prepress area as manual processes become automated. The effect these innovations will have on employment is uncertain at this time since many of the changes will be refinements to existing technology. In any case, retraining will be necessary in the future to help workers keep abreast of the changes taking place in the industry. Technical skills, particularly in computers and electronics, will be very beneficial to workers involved in this phase of printing.

Working Conditions

Prepress workers usually work in clean, air-conditioned areas with little noise. Some workers, such as typesetters and compositors, may be subject to eyestrain from working in front of a video display terminal, as well as musculoskeletal problems, such as backaches. Lithographic artists and strippers may find working with fine detail tiring and fatiguing to the eyes. Platemakers, who work with toxic chemicals, face the hazard of skin irritations.

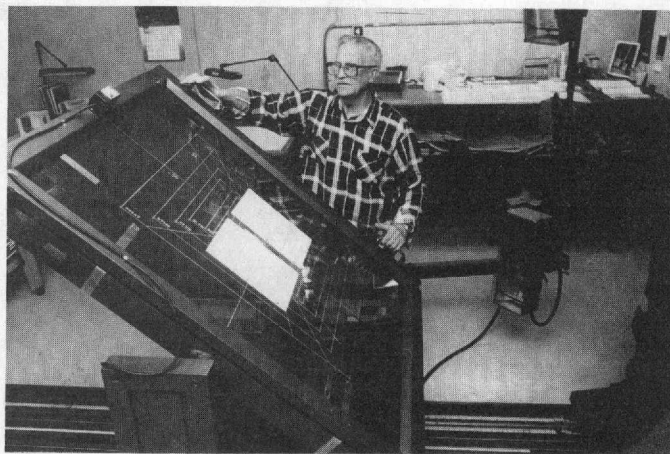
Prepress employees generally work an 8-hour day. The work can sometimes be stressful since workers are often subject to the pressures of deadlines and tight work schedules. Some workers—particularly those employed by newspapers—work night shifts, weekends, and holidays.

Employment

Prepress workers held about 186,000 jobs in 1990. Employment was distributed as follows:

Prepress Precision Workers	
Strippers, printing.....	32,000
Paste-up workers.....	30,000
Camera operators.....	17,000
Job printers.....	15,000
Compositors and typesetters.....	14,000
Platemakers.....	14,000
Electronic pagination system workers.....	12,000
Photoengravers.....	8,000
All other precision workers.....	12,000
Prepress Machine Operators	
Typesetting and composing machine operators.....	26,000
Photoengraving and lithographic machine operators and tenders.....	6,000

Most jobs were found in firms that handle commercial or business printing and in newspaper plants. Commercial printing firms print newspaper inserts, catalogs, pamphlets, and advertisements, while business form establishments print material such as sales receipts and paper used in computers. Additional jobs are found in printing trade service firms and "in-plant" operations. Establishments in printing



Prepress workers prepare material for printing presses.

trade services typically perform custom typesetting, platemaking, and related prepress services.

The printing and publishing industry is one of the most geographically dispersed in the United States, and prepress jobs are found throughout the country. However, job prospects may be best in large printing centers such as New York, Chicago, Los Angeles, Philadelphia, Washington D.C., and Dallas.

Training, Other Qualifications, and Advancement

The length of training varies by occupation. In some occupations, such as typesetter, new technologies have lowered skill requirements and workers can often learn the job within a few months. In other occupations, such as stripper, it may take years of on-the-job training before a person is considered highly skilled. These workers often start as helpers who are selected for on-the-job training programs once they demonstrate their reliability and interest in learning the job. They begin instruction with an experienced craft worker and advancement is based upon their demonstrated mastery of skills at each level of instruction. Frequent retraining may be necessary to keep abreast of the latest technology.

Apprenticeship provides another way of becoming a skilled worker, although few apprenticeships have been offered in recent years. Apprenticeship programs emphasize a specific craft, such as camera operator, stripper, lithographic etcher, scanner operator, or platemaker, but the apprentice is introduced to all phases of the operation.

Generally, job applicants must be high school graduates who possess good communication skills, both oral and written. Applicants need basic mathematical skills. In small shops, workers may help take customer orders, and the ability to add, subtract, multiply, divide, and compute ratios is important to properly estimate job costs. Mathematical skills are also essential for doing conversions. Compositors may have to change points (type size) to picas (line length) to inches (page length) to determine the best page layout.

Candidates interested in working for firms that use advanced printing technology need sufficient knowledge of electronics and computers. Manual dexterity and the ability to pay attention to detail and to work independently are important qualities for prospective prepress workers. Good eyesight, including visual acuity, depth perception, field of view, color vision, and the ability to focus quickly, is an asset. Artistic ability is often a plus. Employers seek prepress candidates who are even-tempered and adaptable. These qualities are necessary since workers often have to handle the pressure of meeting deadlines and the challenge of learning how to operate new equipment.

Formal graphic arts programs, offered by community and junior colleges and some 4-year colleges, provide an introduction to the industry. Such programs provide job-related training, and enrolling in one of them demonstrates an interest in the graphic arts industry, a factor likely to impress an employer favorably. Bachelor's degree programs in graphic arts generally enroll students who may eventually move into management positions, while 2-year associate degree programs are designed to produce skilled workers.

Courses in various aspects of printing are also available at vocational-technical institutes, industry-sponsored update and retraining programs, and private trade and technical schools.

As workers gain experience, they may advance to positions with greater responsibility. Some move into supervisory positions.

Job Outlook

Employment of prepress workers is expected to grow about as fast as the average for all occupations through the year 2005, spurred by rapidly rising demand for printed material. Factors stimulating the demand for printed material include rising levels of personal income, increasing school enrollments, and higher levels of educational attainment.

In addition, new technologies are expected to spur demand by creating new markets for printed matter, effectively capturing some of the advertising dollars currently allotted to nonprint media, such as television. Work previously requiring a week or more can now be completed in several days. Much faster turnaround time will permit printers to compete with nonprint media for time-sensitive business, providing advertisers with specialty advertisements used to target specific market segments, for example.

Technological advances will have a varying effect on the rate of employment growth among the prepress occupations. Growth is expected to be fastest for strippers and electronic pagination operators and slowest for precision compositors and typesetters. Employment of strippers should grow faster than the average for all occupations as computers enable printers to produce more material in less time. Employment of electronic pagination workers also is expected to grow faster than average, reflecting the increasing proportion of page layout and design that will be performed electronically.

In contrast, little change is expected in employment of precision compositors and typesetters as typesetting work is increasingly performed on computers, dampening the demand for workers who perform this process manually. Other occupations that may grow more slowly than average as manual processes become automated include paste-up workers and photoengravers. Employment in the remaining occupations, including platemakers, camera operators, job printers, and prepress machine operators, is expected to grow about as fast as the average for all occupations through the year 2005.

Job prospects also will vary by industry, most notably for compositors and typesetters. Changes in technology have shifted many employment opportunities away from the traditional printing plants into advertising agencies, public relations firms, and large corporations. Many companies are turning to in-house typesetting or "desktop publishing" due to the advent of inexpensive personal computers with graphic capabilities. Corporations are finding it more profitable to print their own newsletters and other reports than to send them out to trade shops.

Compositors and typesetters will find competition extremely keen in the newspaper industry, which is currently the largest employer of these workers. Computerized equipment that allows reporters and editors to specify type and style and to format pages at a desktop computer terminal has already eliminated many typesetting and composition jobs, and more are certain to disappear in the years ahead.

Many new jobs for prepress workers will emerge in commercial printing establishments. By introducing equipment that reduces the time needed to complete a printing job, commercial printers have begun to make inroads into new markets, in particular those that require fast turnaround because of the time-sensitive nature of their business. Because small establishments predominate, commercial printing should provide the best opportunities for inexperienced workers looking to gain a good background in all facets of printing.

Employment opportunities should also be good in the printing trade services industry. Despite the fact that companies may have their own typesetting and printing capabilities, they usually turn to professionals in printing trade services if quality and time are of the essence.

Most employers prefer to hire experienced workers. However, employment opportunities for inexperienced individuals should be best for those who have completed postsecondary programs in printing technology. Many employers prefer to hire applicants who have

completed these programs because the comprehensive training they receive helps them learn the printing process and adapt more rapidly to new processes and techniques.

Earnings

Wage rates for prepress workers vary according to the job, level of experience and training, location and size of the firm, and whether employees are unionized. According to limited data, in 1990, the estimated median weekly salary for lithographers and photoengravers was approximately \$446 to \$516, while the estimated salary for typesetters and compositors was about \$359 to \$435.

A relatively small proportion of prepress workers are unionized. According to the Graphic Communications International Union, the principal union for prepress workers, scanner operators earned an hourly wage rate of \$21.86 in 1990, while strippers earned \$17.57 per hour.

Related Occupations

Prepress workers use artistic skills in their work. These skills are also essential for sign painters, jewelers, decorators, engravers, and graphic artists. Workers who operate machines equipped with keyboards that typesetters use include clerk-typists, computer terminal system operators, keypunch operators, and telegraphic-typewriter operators.

Sources of Additional Information

Details about apprenticeship and other training programs may be obtained from local employers such as newspapers and printing shops or the local office of the State employment service.

For general information on prepress occupations, write to:

- The Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, PA 15213.
- National Composition and Prepress Association of the Printing Industries of America, Inc., 100 Daingerfield Rd., Alexandria, VA 22314.
- Graphic Communications International Union, 1900 L St. NW., Washington, DC 20036.

Printing Press Operators

(A list of D.O.T. codes is available on request from the Chief, Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.)

Nature of the Work

Printing press operators prepare and operate the printing presses in a pressroom. They are responsible for the preparation, operation, and maintenance of the press. Press operators are generally classified according to the type of press they operate—offset, gravure, flexography, screen printing, or letterpress—and duties vary accordingly. Offset is the dominant printing process and is expected to remain so into the next century. Gravure and flexography will increase in use, while letterpress is being phased out and in the next few years will no longer rank as a major printing process without major breakthroughs in plate technology. In addition to the major printing processes, plateless or nonimpact processes are coming into general use. Plateless processes—including electronic, electrostatic, and ink-jet printing—are used for copying, duplicating, and document and specialty printing, generally by quick and in-house printing shops.

Press preparation involves installing and adjusting the printing plate, mixing fountain solution, adjusting pressure, inking presses, loading paper, and adjusting the press to paper size. Press operators must make sure that paper and ink meet specifications, and they adjust control margins and the flow of ink to the inking roller accordingly. They then feed paper through the press cylinders and adjust feed and tension controls.

Operation involves running the press and maintaining the feeders. Press operators monitor the presses as they run, correcting uneven ink distribution, speed, and temperatures in the drying chamber, if the press has one. If the paper jams or tears, which can happen with some offset presses, the press stops. The operator then quickly corrects the problem to minimize downtime. Similarly, operators working with other high-speed presses constantly look for problems, making quick

corrections to avoid expensive losses of paper and ink. Throughout the run, operators must also pull sheets to check for any imperfections and make adjustments accordingly.

In many shops, press operators are responsible for preventive maintenance. Press operators oil and clean the presses and make minor repairs to keep presses running smoothly. Operators who work with large presses have assistants and helpers.

Press operators' jobs differ from one shop to another because of differences in the kinds and sizes of presses. Small commercial shops generally have relatively small presses which print only one or two colors at a time and are operated by one person. Large newspaper, magazine, and book printers use giant "in-line web" presses that require a crew of several press operators and press assistants. These presses are fed paper in big rolls, called "webs," up to 50 inches or more in width. Presses print the paper on both sides; trim, assemble, score, and fold the pages; and count the finished sections as they come off the press.

Many modern plants have installed printing presses that incorporate computers and sophisticated instrumentation which control press operations, making it possible to set up for another job in much less time. With this equipment, the press operator operates a control panel that monitors the printing process. To adjust the press, the operator pushes the proper button on the control panel.

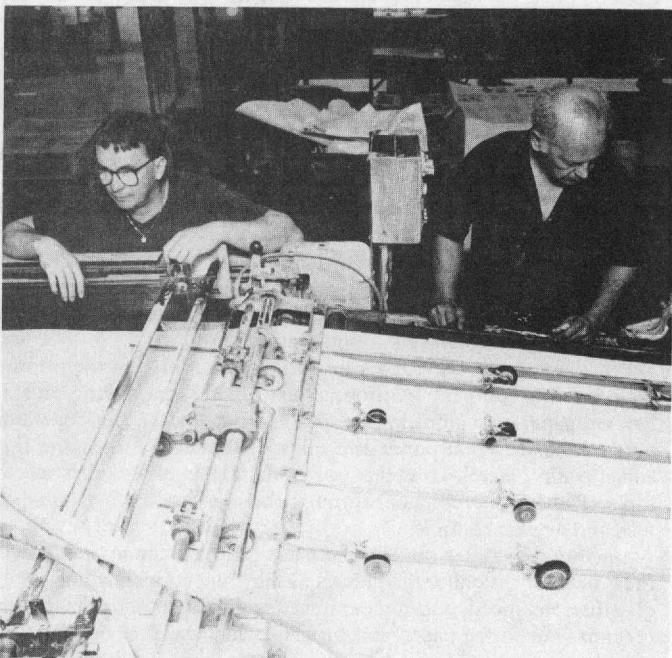
Working Conditions

Operating a press can be physically and mentally demanding, and the work can sometimes be tedious. Press operators are on their feet most of the time. Most printing presses are capable of high printing speeds, and adjustments must be made quickly to avoid waste. Pressrooms are noisy, and workers in certain areas wear ear protectors. Because press operators are subject to hazards when working near machinery, employers emphasize safe work habits. Often, operators work under pressure to meet deadlines. Many press operators work evening, night, and overtime shifts.

Employment

Press operators held about 251,000 jobs in 1990. Employment was distributed as follows:

Printing press machine setters	104,000
Offset lithographic operators	91,000
Screen printing machine operators	26,000
All other	14,000



Printing press operators monitor presses, making necessary corrections and adjustments.

Most jobs were in newspaper plants or in firms that handle commercial or business printing. Commercial printing firms print newspaper inserts, catalogs, pamphlets, and the advertisements found in your mailbox, while business form establishments print items such as sales receipts and paper used in computers. Additional jobs were in the "in-plant" section of organizations and businesses that do their own printing—among them, banks, insurance companies, and government agencies.

The printing and publishing industry is one of the most geographically dispersed in the United States, and press operators can find jobs throughout the country. However, jobs are concentrated in large printing centers such as New York, Los Angeles, Chicago, Philadelphia, Washington, D.C., and Dallas.

Training, Other Qualifications, and Advancement

As is the case in other printing occupations, entry level workers, even those with formal training, generally start at the bottom and work their way up. Beginning duties may include loading, unloading, and cleaning the presses. With time, workers move up to operating one-color sheet-fed presses and may eventually advance to multicolor presses. Operators are likely to gain experience on many kinds of printing presses during the course of their career.

Apprenticeship, once the dominant method of preparing for this occupation, is becoming less prevalent as formal programs of retraining and skill updating for experienced operators become more important. In the future, it is expected that workers will need to retrain several times during their career. The apprenticeship period in commercial shops is 4 years for press operators. In addition to on-the-job instruction, the apprenticeship includes related classroom or correspondence school courses.

Courses in printing provide a good background. Because of technical developments in the printing industry, courses in chemistry, electronics, color theory, and physics are helpful. Postsecondary education is increasingly important because of the theoretical knowledge needed to operate advanced equipment.

Press operators need good mechanical aptitude in order to make press adjustments and repairs. An ability to visualize color is essential for work on color presses. Oral and writing skills also are required. Applicants should be able to compute percentages, weights, and measures, and should possess enough mathematics skills to calculate the amount of ink and paper needed to do a job.

Technological changes have had a tremendous effect on the skills needed by press operators. Printing plants that change from sheet-fed offset presses to web-offset presses have to retrain the entire press crew because the skill requirements for the two types of presses are very different. Web-offset presses, with their faster operating speeds, require faster decisions, monitoring of more variables, and greater physical effort.

Press operators may advance in pay and responsibility by taking a job working on a more complex printing press. For example, a one-color sheet-fed press operator may, through experience and demonstrated ability, become a four-color sheet-fed press operator. Others may advance to pressroom supervisor and be responsible for the work of the entire press crew.

Job Outlook

Employment of press operators is expected to grow about as fast as the average for all occupations through the year 2005 because of anticipated growth in the demand for printed materials. However, employment growth will vary among various press operator jobs. Employment of offset, gravure, and flexographic operators will increase, while employment of letterpress operators will decline. Most openings will result from replacement needs.

Most new openings will result from industry expansion due to rising demand for printed material associated with demographic trends, U.S. expansion into foreign markets, and growing use of print media by advertisers. Changes in the age structure of the population are expected to spur demand for books and magazines as school enrollments rise, even as substantial growth in the middle-aged and older population spurs adult education and leisure reading. Additional growth should stem from increasing foreign demand for domestic

trade publications, professional and scientific works, and mass-market books such as paperbacks.

Much of the growth in commercial printing, however, will be spurred by increased expenditures for print advertising aimed at particular market segments. New market research techniques are expected to lead advertisers to increase spending on messages targeted to specific audiences. This in turn will stimulate demand for a wide variety of newspaper inserts, catalogs, direct mail enclosures, and other kinds of print advertising.

Other areas such as the newspaper, book, and periodical industries will also provide jobs. Most of these, however, will be filled by experienced individuals because many employers are under severe pressure to meet deadlines and have limited time to train new employees.

Major laborsaving technological advances, similar to those now affecting prepress workers, are not expected to have as great an impact on press operators. Current efforts aimed at achieving higher press speeds and reduced setup time should not significantly affect employment.

Apprenticeship training is more likely to be required of individuals entering this occupation than other printing occupations. They will face keen competition for jobs from experienced workers and workers who have completed retraining programs.

Earnings

The basic wage rate for a press operator depends on the type of press being run and the area of the country in which the work is located. The median weekly salary for a full-time press operator was about \$410 in 1990. The lowest 10 percent earned \$230 or less per week, while the highest 10 percent earned over \$710 per week.

A relatively small proportion of press operators are unionized. According to the Graphic Communications International Union, the principal union for press operators, average hourly earnings for a press operator were \$18.38 in 1990.

Related Occupations

Other workers who set up and operate production machinery include papermaking machine operators, shoemaking machine operators, bindery machine operators, and precision machine operators.

Sources of Additional Information

Details about apprenticeships and other training opportunities may be obtained from local employers such as newspapers and printing shops, local offices of the Graphic Communications International Union, local affiliates of Printing Industries of America, or local offices of the State employment service.

For general information about press operators, write to:

- Graphic Communications International Union, 1900 L St. NW., Washington, DC 20036.
- Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, PA 15213.

For information on schools offering printing programs, write to:

- Printing Industries of America, 100 Daingerfield Rd., Alexandria, VA 22314.

Shoe and Leather Workers and Repairers

(D.O.T. 365.361; 780.381-030; 781.381-018; 783.361-010, and .381-018 through 026; 788.261-010 and .381)

Nature of the Work

Creating stylish and durable leather products is the job of precision shoe and leather workers; keeping them in good condition is the work of repairers. Among the workers who do leather work and repair are custom luggage makers and orthopedic shoemakers, saddlemakers, and harnessmakers. Job duties of these workers are similar, even though the finished products differ.

Depending on the size of the factory or shop, a leather worker may perform one or many of the steps that it takes to complete the product. In smaller factories or shops, workers generally perform several tasks while those in larger facilities tend to specialize. However, most

workers eventually move from one task to another to learn and master different skills in the production of leather goods.

Workers first check the leather for texture, color, and strength. Then the worker places a pattern of the item being produced on the leather, traces the pattern onto the leather, cuts the pattern along the outline, and sews the pieces together.

Shoemakers attach the insoles to shoe lasts (a wooden form shaped like a foot), affix the shoe uppers, and apply heels and outsoles. They shape the heels with a knife and then sand them on a buffing wheel for smoothness. Finally, they dye and polish the shoes. Custom shoe workers also modify existing footwear for people with foot problems and special needs. Workers may prepare inserts, heel pads, and lifts from casts of customers' feet.

Saddlemakers apply leather dyes and liquid top coats to produce gloss, and decorate the saddle surface either by hand stitching or by stamping the leather with decorative patterns and design. Luggage makers fasten leather to a frame and attach handles and other hardware. They also cut and secure linings inside the frames, and then sew or stamp decorations onto the luggage.

Shoe and leather repairers use their knowledge of leatherworking to give worn leather goods extended wearability. The most common type of shoe repair is replacing soles and heels. Repairers place the shoe on a last and remove the old sole and heel with a knife or pliers or both. They attach new soles and heels to shoes either by stitching them in place or by using cement or nails. Other leather goods, suitcases or handbags, for example, may need seams re-sewn or handles and linings replaced.

Leather workers and repairers use handtools and machines. The most commonly used handtools are knives, hammers, awls (used to poke holes in leather to make sewing possible), and skivers (for splitting leather). Power-operated equipment includes sewing machines, heel nailing machines, hole punching machines, and sole stitchers.

Self-employed shoe repairers and owners of custom-made shoe and leather shops have managerial responsibilities in addition to their regular duties. They must maintain good relations with their customers, make business decisions, and keep accurate records.

Working Conditions

Working conditions of leather workers vary according to the type of work performed, the size of the factory or business, and the place of employment.

Workers employed in custom leather goods manufacturing establishments generally work a regular 40 hour week. Those in repair shops work nights and weekends and often work irregular hours. For those who own their own repair shop, overtime is common. Although there are few health hazards if precautions are followed, work areas can be noisy and odors from leather dyes and stains are often present.

Employment

Shoe and leather workers and repairers held about 27,000 jobs in 1990. Self-employed individuals, who typically own and operate small shoe repair shops or specialty leather manufacturing firms, held about 7,000 of these jobs. Of the remaining workers, over half were employed in the manufacture of footwear products and an additional one sixth were employed in production of leather goods such as luggage and apparel. Another one-fifth were employed in shoe and leather repair shops.

Training, Other Qualifications, and Advancement

Precision shoe and leather workers and repairers generally learn their craft on the job, either through in-house training programs or working as helpers to experienced workers. Helpers generally begin by performing simple tasks and then progress to more difficult projects such as cutting or stitching leather. Trainees generally become fully skilled in 6 months to 2 years; the length of training varies greatly according to the aptitude and dedication of the individual and the nature of the work.

A limited number of schools offer vocational training in shoe repair and leather work. These programs may last from 6 months to 1 year and impart basic skills including leather cutting, stitching, and dying. Students learn shoe construction, practice shoe repair, and study the fundamentals of running a small business. Graduates are



Soles are replaced to extend the life of shoes and boots.

encouraged to gain additional training by working with an experienced leather worker or repairer. National and regional associations also offer specialized training seminars and workshops in custom shoe making, shoe repair, and other leather work.

Manual dexterity and the mechanical aptitude to work with handtools and machines are important in the shoe repair and leatherworking occupations. Shoe and leather workers who produce custom-made goods should have artistic ability as well. These workers must have self-discipline to work alone under little supervision. In addition, leather workers and repairers who own shops must have a pleasant manner when dealing with customers and knowledge of business practices and management.

Many individuals who begin as workers or repairers advance to salaried supervisory and managerial positions, or open their own shop or business.

Job Outlook

Employment of shoe and leather workers is expected to decline through the year 2005. Inexpensive imports have made the cost of replacing shoes and leather goods cheaper or more convenient than repairing them, thus reducing the demand for shoe and leather repairers. Repair of more expensive, high-end products will continue to create some demand for these workers and therefore moderate their decline. However, most job openings will arise from the need to replace experienced workers who transfer to other occupations or leave the workforce.

Prospects for workers employed in the manufacture and modification of custom-made molded or orthopedic shoes are better than those for most other leather workers. Substantial growth is expected in the population age 75 and above. Since this age group is most likely to suffer from footwear problems that require molded or orthopedic shoes, the need for custom shoe workers should increase. Nevertheless, manufactured shoes that can be easily modified to specification are being used in place of totally custom made shoes. This greatly increases productivity of the workers making these shoes and therefore reduces the potential increase in demand.

Earnings

Data on earnings of shoe and leather workers are very limited. Their earnings vary greatly depending upon the place of employment. Beginning workers often start near the minimum wage and can advance in just a few months. Owners of shoe repair and custom shoe manufacturing shops can earn substantially more.

Related Occupations

Other workers who make or repair items using handtools and machinery include dressmakers, designers and patternmakers, and furriers.

Sources of Additional Information

For information about the custom-made prescription shoe business, and about training opportunities in this field, contact:

- Prescription Footwear Association, 9861 Broken Land Pky., Suite 255, Columbia, MD 21046.

For information about opportunities in shoe repair, contact:

- Shoe Service Institute of America, Educational Library, 5024-R Campbell Blvd., Baltimore, MD 21236-5974.

Stationary Engineers

(D.O.T. 950.362-014, .382 except -014 and -022)

Nature of the Work

Large buildings require a considerable amount of equipment to provide heating, air-conditioning, and ventilation. Industrial plants often have facilities to provide electrical power, steam, or other services in addition to heating and ventilation. Stationary engineers operate and maintain this equipment, which can include boilers, air-conditioning and refrigeration equipment, diesel engines, turbines, generators, pumps, condensers, and compressors. These workers are called stationary engineers because much of the equipment they operate is similar to the equipment operated by locomotive or marine engineers except that it is not in a moving vehicle.

Stationary engineers start up, regulate, and shut down equipment in order to meet demands for heating, cooling, or power. They insure that equipment is operating safely and economically and within established limits by monitoring meters, gauges, and other instruments attached to equipment. They make adjustments and perform repairs and maintenance whenever necessary. They also keep a log of all relevant events and facts concerning the operation and maintenance of the equipment. On a steam boiler, for example, they observe, control, and keep records of steam pressure, temperature, water level, power output, and the amount of fuel consumed.

These workers must identify and correct any trouble that develops. They watch and listen to their machinery and routinely check safety devices. Stationary engineers often use hand or power tools to make repairs, ranging from a complete overhaul to replacing defective valves, gaskets, or bearings.

Stationary engineers also perform routine maintenance, such as lubricating moving parts, replacing filters, and removing soot and corrosion that can reduce operating efficiency. They also may test boiler water and add necessary chemicals to prevent corrosion and buildup of harmful deposits.

Computers are increasingly being used to help stationary engineers perform their duties. Much of the instrumentation on the equipment they operate is now computer controlled. This allows the stationary engineer to monitor the system from a central location and reduces the time necessary to check each piece of equipment. The engineer must read the computer's output to determine if the system is operating properly. If the automated systems malfunction, the stationary engineer must manually control the equipment.

In a large building or industrial plant, a stationary engineer may be in charge of all mechanical systems in the building or an industrial powerplant or engine room. The engineer might direct the work of assistant stationary engineers, turbine operators, boiler tenders, and air-conditioning and refrigeration operators and mechanics. In a small building or industrial plant, there may be only one stationary engineer at a time operating and maintaining the equipment.

Working Conditions

Stationary engineers generally have steady year-round employment. They usually work a 5-day, 40-hour week. Many work one of three daily 8-hour shifts, and weekend and holiday work often is required.

Engine rooms, powerplants, and boiler rooms usually are clean and well lighted. Even under the most favorable conditions, however, some stationary engineers are exposed to high temperatures, dust, dirt, and high noise levels from the equipment. General maintenance duties may cause contact with oil and grease, as well as fumes or smoke. Workers spend much of their time on their feet; they also may have to crawl inside boilers and work in crouching or kneeling positions to inspect, clean, or repair equipment.

Because stationary engineers work around boilers as well as electrical and mechanical equipment, they must be alert to avoid burns, electric shock, and injury from moving parts.

Employment

Stationary engineers held about 35,000 jobs in 1990. They worked in a wide variety of places, including office and apartment buildings, hospitals, schools, factories, shopping malls, and hotels.

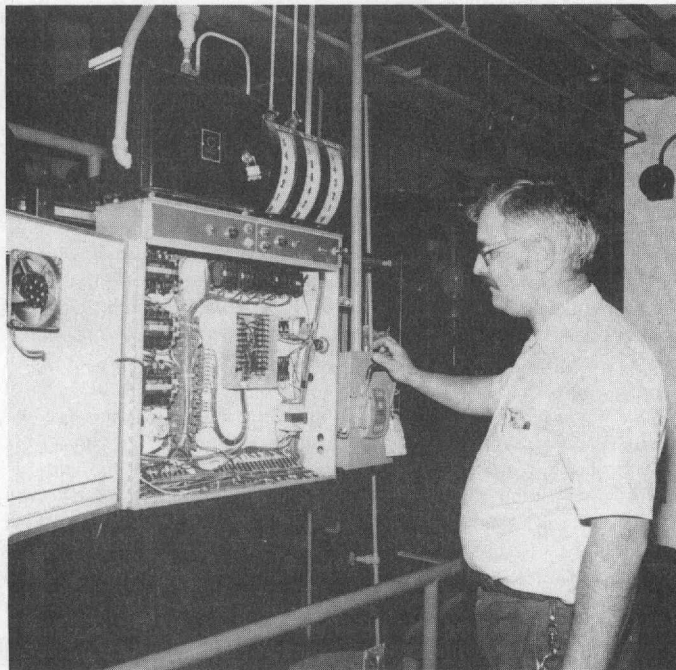
Although stationary engineers work throughout the country, most work in the more heavily populated areas, where large industrial and commercial establishments are usually located.

Training, Other Qualifications, and Advancement

Most stationary engineers acquire their skills through a formal apprenticeship program or through informal on-the-job training which usually is supplemented by courses at trade or technical schools. In addition, a good background can be obtained in the Navy or the Merchant Marine because of the similarity of marine engineering plants to many stationary power and heating plants. The increasing complexity of the equipment with which these operators work has made a high school diploma or its equivalent necessary; many stationary engineers have some college education.

Apprenticeship programs are sponsored by the International Union of Operating Engineers, the principal union to which stationary engineers belong. In selecting apprentices, most local labor-management apprenticeship committees prefer applicants who have received instruction in mathematics, computers, mechanical drawing, machine-shop practice, physics, and chemistry. Mechanical aptitude, manual dexterity, and good physical condition also are important qualifications.

The apprenticeship usually lasts 4 years. In addition to on-the-job training, apprentices receive classroom instruction in practical chemistry, elementary physics, blueprint reading, applied electricity, instrumentation, electronics, and other technical subjects.



Stationary engineers check electrical control panels in boiler rooms.

Those who acquire their skills on the job usually start as helpers to experienced stationary engineers or as boiler tenders. This practical experience may be supplemented by postsecondary vocational training in computerized controls and instrumentation. However, becoming a stationary engineer without going through a formal apprenticeship program usually requires many years of work experience.

Skill-improvement training varies by the size and type of establishment. Most large and some small employers encourage and pay for additional training for their employees. Additional training is almost always provided when new equipment is introduced, usually by a representative of the machinery manufacturer.

Most States and cities have licensing requirements for stationary engineers. Although requirements differ from place to place, applicants usually must be at least 18 years of age, reside for a specified period in the State or locality, meet the experience requirements for the class of license requested, and pass a written examination. Because of regional differences in licensing requirements, a stationary engineer who moves from one State or city to another may have to pass an examination for a new license.

Generally, there are several classes of stationary engineer licenses. Each class specifies the type of equipment or the steam pressure or horsepower of the equipment the engineer can operate without supervision. A first-class license permits the stationary engineer to operate equipment of all types and capacities. A licensed first-class stationary engineer is qualified to run a large complex and to supervise others. An applicant for this license may be required to have a high school education, apprenticeship or on-the-job training, and several years of experience. Lower class licenses limit the types or capacities of equipment the engineer may operate without the supervision of a higher rated engineer.

Stationary engineers advance to more responsible jobs by being placed in charge of larger, more powerful, or more varied equipment. Generally, engineers advance to these jobs as they obtain higher class licenses. Advancement, however, is not automatic. For example, an engineer who has a first-class license may work for some time as a boiler tender or an assistant to another first-class engineer before a vacancy occurs. Some stationary engineers eventually advance to jobs as boiler inspectors, chief plant engineers, building and plant superintendents, or building managers. A few obtain jobs as examining engineers or technical instructors.

Job Outlook

Little change in employment of stationary engineers is expected through the year 2005. Although increased commercial and industrial development will increase the amount of equipment to be operated and maintained, automated and computerized controls will make newly installed equipment more efficient and reduce the number of stationary engineers needed. Nevertheless, the need to replace experienced workers who transfer to other occupations or leave the labor force will result in a significant number of job openings.

Due to the increasing complexity of power-generating systems, job opportunities will be best for those with apprenticeship training or vocational school courses in computerized controls and instrumentation.

Earnings

In 1990, the median weekly earnings for stationary engineers who worked full time were about \$562. The middle 50 percent earned between \$399 and \$710 a week; 10 percent earned less than \$315 a week; and 10 percent earned more than \$937.

According to a survey of metropolitan areas, stationary engineers had average hourly earnings of \$15.98 in 1990. This was about 50 percent higher than the average for all nonsupervisory workers in private industry, except farming. Average hourly rates in 4 regions, selected to show how rates differ in various parts of the country, appear in the accompanying table. In addition to wages, stationary engineers usually receive a variety of benefits, such as health and life insurance, reimbursement for work-related courses, and vacation and sick leave.

Table 1. Average hourly earnings of stationary engineers in selected areas, 1990

Area	Earnings
All metropolitan areas	\$15.98
West	18.49
Midwest	16.35
Northeast	15.80
South	13.88

SOURCE: Bureau of Labor Statistics

Related Occupations

Other workers who monitor and operate stationary machinery include nuclear reactor operators, power station operators, water and wastewater treatment plant operators, waterworks pump-station operators, chemical operators, and refinery operators.

Sources of Additional Information

Information about training or work opportunities is available from local offices of State employment services, locals of the International Union of Operating Engineers, and from State and local licensing agencies.

Specific questions about the occupation should be addressed to:

- International Union of Operating Engineers, 1125 17th St. NW., Washington, DC 20036.
- National Association of Power Engineers, Inc., 2350 East Devon St., Suite 115, Des Plaines, IL 60018.

Textile Machinery Operators

(A list of D.O.T. codes is available on request from the Chief, Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.)

Nature of the Work

Textile machinery operators tend machines that manufacture textile goods used in all types of consumer and industrial products. Shirts, sweaters, and socks are familiar examples of textile products, but many are surprised to find that textile products are used in such things as tires and roads. There are many phases in the textile production process, and operators' duties and responsibilities depend on the product and the type of machinery in use.

The textile production process begins with the preparation of manufactured or natural fibers for spinning. *Textile machine operators and tenders* operate machinery that cleans, cards, combs, and draws the fiber; spins the fiber into yarn; and weaves, knits, or tufts the yarn into textile products. They are responsible for numerous machines that they must start, stop, clean, and monitor for proper functioning.

Fibers are cleaned and aligned through carding and combing. To prepare the fiber for the spinning process, very short fibers and any foreign matter are removed and the fibers are drawn into a form called sliver. During this process, different types of fibers may be combined to give products the desired textures, durability, or other characteristics. Operators constantly monitor their machines during this stage, checking the movement of the fiber, removing and replacing canisters of sliver, repairing breaks in the sliver, and making minor repairs to the machinery.

The full canisters of sliver are then taken to the spinning area. Spinning draws and twists the sliver to produce yarn which is then wound onto conical structures called bobbins.

Some workers oversee machinery that makes manufactured fibers. These fibers, used in many textile products, are created from materials that, unlike cotton, wool, and flax, are not fibrous in their natural form. To make this fiber, wood pulp or chemical compounds are melted or dissolved in a liquid which is then extruded, or forced, through holes in a metal plate, called a spinneret. The sizes and

shapes of the holes in the spinneret determine the shape and the uses of the fiber.

Extruding and forming machine operators and tenders maintain machinery that produces manufactured fiber. They may adjust the flow of fiber base through the spinneret, repair breaks in the fiber, or make minor adjustments to the machinery. Because this fiber is created by a chemical process, the majority of these workers are employed by chemical companies.

When the yarn is ready, it is taken to be woven, knitted, or tufted. Each of these processes produces a different type of textile product and requires a different type of machine. For example, woven fabrics are made on looms that interlace the yarn. Knit products, such as socks or women's hosiery, are produced by intermeshing loops of yarn. Carpeting is made through the tufting process, in which the loops of yarn are pushed through a material backing. Although operators work with many different kinds of machines, many of their responsibilities are similar. Each operator oversees numerous machines—repairing breaks in the yarn, monitoring the supply of yarn, and making minor repairs to the machinery. As increasingly sophisticated machinery is used in textile mills, more processes will be controlled by computers, making it possible for each operator to monitor a larger area or number of machines.

Textile machine setters and setup operators prepare the machinery prior to a production run. They also maintain this equipment. For example, they may adjust the timing on a machine, activate the loom controller that creates patterns in textile goods, or repair machinery.

Because of the complexity of textile machinery, these workers usually specialize in one type of machine. Many setters and setup operators have advanced from the ranks of textile machine operators and tenders, so they are familiar with the production process and the machinery. They must work closely with textile machine operators and tenders to determine the cause of a problem and to correct it as quickly as possible.

Once the yarn has been woven, knitted, or tufted, the resulting fabric is ready to be dyed and finished either at the textile mill or at a plant specializing in textile finishing. *Textile bleaching and dyeing machine operators and tenders* oversee machines that finish the textile product before it is shipped to the consumer.

Because of the variety of consumer preferences, manufacturers must print and dye textiles in thousands of different designs and colors. Depending upon the end use of the yarn, it may be dyed before or after it is woven, knitted, or tufted. Some fabric is treated before it is dyed to remove other chemical additives that could affect the quality of the dyed product.

In addition to dyeing and printing, products are often finished by treating them to prevent excessive shrinkage, to provide strength, or to give a silky luster. In the production of hosiery and socks, for example, the stocking or sock is placed on a form and then exposed to steam and heat to give it shape.

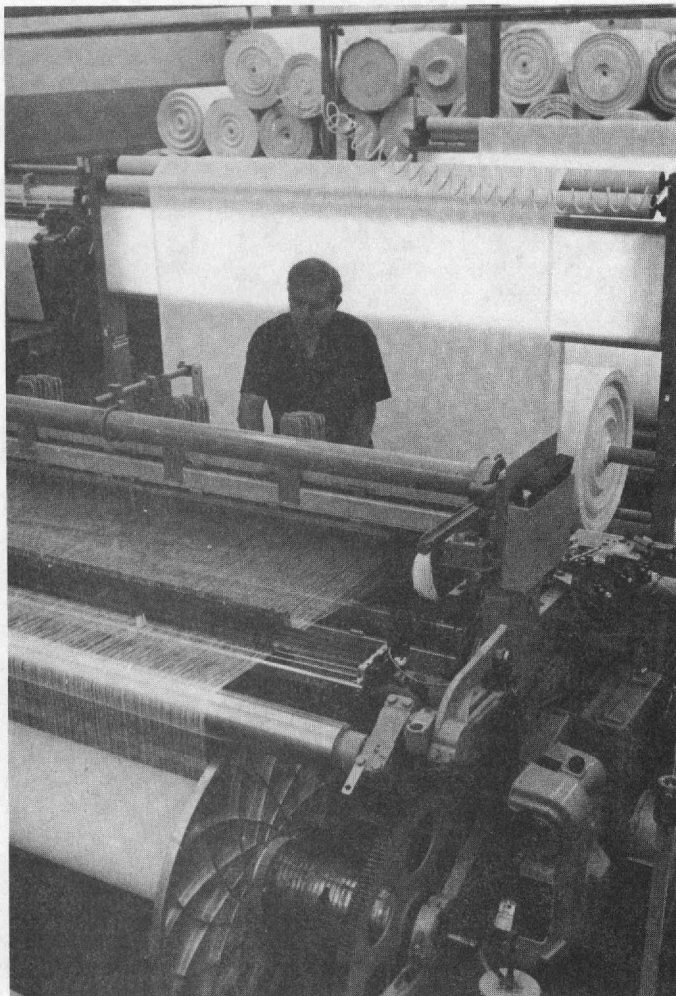
Working Conditions

Most textile machine operators work in a textile mill or a chemical plant. Working conditions depend upon the age of the facility or equipment and its degree of modernization. Newer facilities offer better ventilation and climate control that reduce potential problems caused by airborne fibers and fumes often encountered in older facilities. Workers in areas with high levels of these airborne materials often use protective glasses and masks that cover their nose and mouth.

Although some of the newer machinery has reduced the level of noise, workers in some areas still must wear ear protection. Because many machines operate at high speeds, workers must be careful not to wear clothing or jewelry that could get caught in moving parts. In addition, extruding and forming machine operators may wear protective shoes and clothing when working with some types of chemical compounds.

The average workweek for textile production workers is 40 hours. Most textile and fiber mills operate 24 hours a day. Many employers use a rotating schedule of shifts so operators don't consistently work nights or weekends. Operators are on their feet moving between machines during most of their shift.

Although workers have traditionally worked under close supervi-



Employment of textile workers will continue to decline.

sion, new management philosophies are placing an increasing emphasis on teamwork, which will allow operators greater interpersonal contact and more initiative.

Employment

Textile machinery operators held about 289,000 jobs in 1990. About 70 percent worked as textile draw-out and winding machine operators and tenders. Machine setters and setup operators were the next largest group, followed by bleaching and dyeing and extruding machine operators.

The majority of these workers were employed in weaving, finishing, yarn, and thread mills. Other employers with a substantial number of these workers were knitting mills and manufactured fiber producers.

North Carolina was the leading State in the employment of textile workers, accounting for about 30 percent of the total. Georgia and South Carolina combined accounted for another 30 percent. Most of the remaining workers were employed in other southern States and in the northeast.

Training, Other Qualifications, and Advancement

Physical stamina and manual dexterity are important skills for these jobs. However, education and training are becoming increasingly important for working with complex machinery and advanced manufacturing methods.

A high school diploma in addition to extensive technical training is becoming a prerequisite for entry to many jobs. This training may be obtained, in part, at a formal training institution such as a technical school. Extensive on-the-job training by more experienced workers or representatives of machinery manufacturers is also common.

As the textile industry becomes more highly automated, operators and setters will need to understand the complex machinery and be able

to diagnose problems. Because textile machinery is increasingly electronically controlled, many operators will need good computer skills.

Self-direction and interpersonal skills will become increasingly important for textile machinery operators. Business attitudes promoting teamwork and fewer levels of management offer operators greater responsibility and the opportunity to take more initiative in running the production facility.

Textile machinery operatives can advance in several ways. Some workers become instructors and train new employees. Others advance by taking positions requiring higher skills and greater responsibility. Since machine setters and setup operators are the most highly skilled operatives, first-line supervisory positions usually are filled from their ranks.

Job Outlook

Employment of textile machinery operators is expected to decline through the year 2005. Greater productivity through the introduction of labor-saving machinery, changing business practices, and a loosening of import restrictions are expected to reduce the demand for these workers.

The textile industry will continue to undergo change in order to compete in the global marketplace. New machinery such as faster shuttleless and air jet looms and computer-integrated production processes are expected to significantly increase the productivity of workers. In addition, this technology will allow each operator to monitor a larger number of machines. Many factories are reorganizing production floors to further increase productivity.

Although employment will continue to decline in the years ahead, many job opportunities will arise from the need to replace persons who transfer to other occupations or who retire or stop working for other reasons. Persons with technical skills will have better opportunities than others.

Earnings

Average weekly earnings for production workers in the textile and manufactured fiber industries were \$320 in 1990, compared to \$442 for production workers in all manufacturing industries. Moreover, earnings vary significantly depending upon the type of mill and by shift, job specialty, and seniority.

Benefits usually include paid holidays and vacations, health and life insurance, a retirement plan, and sick leave. Some firms provide on-site daycare facilities. Additionally, employees often receive discounts in company-owned outlet stores.

Related Occupations

Metalworking and plastics-working machine operators perform similar duties and have the same entry and training requirements as extruding and forming machine operators and tenders; textile machine operators and tenders; and textile bleaching and dyeing machine operators. Setters and setup operators in other industries, such as in metal fabrication and plastics manufacturing, perform duties comparable to those of textile machine setters and setup operators.

Sources of Additional Information

Information about job opportunities in textile and manmade fiber production is available from local employers or local offices of the State employment service.

For general information on careers, technology, or trade regulations in the textile industry, write to:

- American Textile Manufacturers Institute, Inc. 1801 K St. NW., Suite 900, Washington, DC 20006.
- Institute of Textile Technology, P.O. Box 391, Charlottesville, VA 22901.

Upholsterers

(D.O.T. 780.381 except -030 and -034; 681-010; 684-122)

Nature of the Work

Upholsterers are skilled craft workers who make new furniture and recondition old furniture. Whether making a new piece of furniture,

restoring a treasured antique, or simply giving an ordinary living room couch a facelift, upholsterers combine knowledge of fabrics and other materials with artistic flair and manual skill. Some repair and replace automobile upholstery and convertible and vinyl tops.

Upholsterers who make new furniture start with the bare wooden frame. Those who recondition old furniture first remove the old cover, padding, and springs, using hammers and tack pullers. They remove the burlap and padding that cover the arms, back, sides, and seat. They examine the springs and replace broken or bent ones. The springs sit on a cloth mat called webbing that is attached to the frame. If webbing is worn, upholsterers remove all the springs and webbing. Upholsterers may reglue loose sections of the frame and refinish exposed wood.

The first step in upholstering new furniture or reupholstering old pieces is to install webbing of nylon, jute, or cotton in the frame to hold the springs. Upholsterers tack webbing to one side of the frame, stretch it tight, and tack it to the opposite side. Other webbing is woven across the first row of webbing and attached to the frame to form a new mat. After putting springs on the mat so they compress evenly, upholsterers sew or staple each spring to the webbing or frame and tie each spring to the ones next to it. Burlap then is stretched over the springs, cut and smoothed, and tacked to the frame. To form a smooth rounded surface over the springs and other parts of the frame, upholsterers cover the furniture with filling material, cover this with a layer of felt and heavy cloth, and tack the cloth to the frame. Upholsterers measure and cut fabric for arms, backs, and other sections with as little waste as possible. They temporarily stitch pieces together for fitting and after assuring tight and smooth fit of the cover—or noting where adjustments are necessary—they remove it, sew it together, and tack, staple, or glue it to the frame. To complete the job, upholsterers sew, tack, or glue on fringe, buttons, or other ornaments.

Upholsterers use common handtools, including tack hammers, staple guns, tack and staple removers, pliers, and shears, and special tools such as webbing stretchers and upholstery needles. They also use sewing machines.

Sometimes upholsterers pick up and deliver furniture or help customers select new furniture coverings. Those who manage an upholstery shop order supplies and equipment and keep business records.

Working Conditions

Most upholsterers work inside a shop or factory. Working conditions in these facilities vary—many are spacious, adequately lighted, well ventilated, and well heated; others are small and dusty.

The work is not dangerous, but upholsterers must be careful to avoid cuts and bruises when they use sharp tools and when they lift and handle furniture or springs. Upholsterers stand most of the workday, and they do a lot of bending and heavy lifting. They also have to work in awkward positions for short periods of time.

Employment

Furniture upholsterers held about 64,000 jobs in 1990. Nearly 1 out of 3 were self-employed. Companies that manufacture household and office furniture employed 60 percent of all upholsterers. About 20 percent worked in shops that reupholster and repair furniture. Over 10 percent worked in shops that specialize in reupholstering the seats of automobiles and other motor vehicles, while small numbers worked in furniture stores.

Training, Other Qualifications, and Advancement

Most upholsterers are trained on the job as a helper to an experienced worker. Usually about 3 years of on-the-job training are required to become a fully skilled upholsterer. On-the-job training in a furniture factory usually is much shorter because the range of skills required is more limited. Others learn upholstery through apprenticeship or formal training.

When hiring helpers, employers generally prefer people with some knowledge of the trade. Inexperienced persons may get basic training in upholstery in high school, vocational and technical schools, and some community colleges. Programs include sewing machine operation, measuring, cutting, springing, frame repair, tufting, and channeling; as well as business and interior design courses. However, addi-



Upholsterers use common handtools, including tack hammers, to make or recondition furniture.

tional training and experience usually are required before graduates can perform as quickly and efficiently as experienced upholsterers.

Upholsterers should have manual dexterity, good coordination, and strength to lift heavy furniture. An eye for detail and flair for color and creative use of fabrics are helpful.

The major form of advancement for upholsterers is opening their own shop. It is easy to open a shop because a small investment in handtools and a sewing machine are all that is needed. However, the upholstery business is extremely competitive, so operating a shop successfully is difficult. Experienced, highly skilled upholsterers in large shops and factories may become supervisors.

Job Outlook

Employment of upholsterers is expected to grow more slowly than the average for all occupations through the year 2005. Almost all growth will be in furniture manufacturing. Demand for reupholstering will not keep pace with the growth in manufacturing because, increasingly, consumers prefer to replace worn furniture rather than reupholster it. Each upholstery job is unique and therefore upholstery work does not lend itself to automation; consequently, technology is not expected to have any impact on employment of upholsterers. Most job openings will arise because of the need to replace experienced workers who transfer to other occupations or leave the labor force.

Opportunities for experienced upholsterers should be good. The number of upholsterers with experience is limited because few young people want to enter the occupation and because few shops are willing to train people.

Earnings

Median weekly earnings of upholsterers were \$300 in 1990; the middle 50 percent earned between \$220 and \$420 per week. The lowest 10 percent earned less than \$180, and the top 10 percent earned more than \$550.

Earnings of self-employed upholsterers depend not only on the size and location of the shop but also on the number of hours worked.

Related Occupations

Other workers who combine manual skills and knowledge of materials such as fabrics and wood are fur cutters, furniture finishers, pattern and model makers, webbing tackers, and casket coverers.

Sources of Additional Information

For details about work opportunities for upholsterers in your area, contact local upholstery shops, the local office of the State employment service, or a local of the Upholstery Division of the United Steel Workers of America.

General information about a career as an upholsterer is available from:

- National Association of Professional Upholsterers, 200 South Main St., P.O. Box 2754, High Point, NC 27261.
- Upholstery and Allied Industries Division, United Steelworkers of America, Local 18, 5320 W. North Ave., Chicago, IL 60639.

Water and Wastewater Treatment Plant Operators

(D.O.T. 954.382-010, -014; and 955.362, .382, and .585)

Nature of the Work

Clean water is essential for many things: Health, recreation, fish and wildlife, and industry. Water treatment plant operators treat water so that it is safe to drink. Wastewater treatment plant operators remove harmful pollution from domestic and industrial wastewater.

Water is pumped from wells, rivers, and streams to water treatment plants where it is treated and distributed to customers. Waste materials are collected from customers, carried by water through sewer pipes to wastewater treatment plants where it is treated and returned to streams, rivers, and oceans. Operators in both types of plants control processes and equipment to remove solid materials, chemical compounds, and micro-organisms from the water or to render them harmless. Operators control pumps, valves, and other processing equipment to move the water or wastewater through the various treatment processes, and dispose of the waste materials removed from the water.

Operators read and interpret meters and gauges to make sure plant equipment and processes are working properly and adjust controls as needed. They operate chemical-feeding devices; take samples of the water or wastewater; perform chemical and biological laboratory analyses; and test and adjust the level of chemicals such as chlorine in the water. Operators also make minor repairs to valves, pumps, and other equipment. They use gauges, wrenches, pliers, and other common handtools, as well as special tools.

Water and wastewater treatment plant operators increasingly are relying on computers to help them monitor equipment and processes. They may use specialized software to store sampling results. When problems occur, operators may retrieve data in order to determine the cause of the malfunction.

Occasionally operators must work under emergency conditions. A heavy rainstorm, for example, may cause large amounts of wastewater to flow into sewers, exceeding a plant's treatment capacity. Emergencies also can be caused by conditions inside a plant, such as chlorine gas leaks or oxygen deficiencies. During these periods, operators may have to work under extreme pressure to correct the problem as quickly as possible. These periods may create dangerous working conditions and operators must be extremely cautious.

The specific duties of plant operators depend on the type and size of plant. In smaller plants, one operator may control all machinery, perform tests, keep records, handle complaints, and do repairs and maintenance. Some operators may handle both a water treatment and a wastewater treatment plant. In larger plants with many employees, operators may be more specialized and only monitor one process. The staff may also include chemists, engineers, laboratory technicians, mechanics, helpers, supervisors, and a superintendent.

Water pollution standards have become increasingly stringent since adoption of the Federal Water Pollution Control Act of 1972, which implemented a national system of uniform controls on the discharge of pollutants. Under the 1972 law and subsequent reauthorizations in 1977 and 1987, it is illegal to discharge any pollutant without a permit. Industrial facilities that send their wastes to municipal treatment plants must meet certain minimum standards and insure that these wastes have been adequately pretreated so that they do not damage municipal treatment facilities. Municipal treatment plants also must meet discharge standards. Operators must be familiar with the guidelines established by the Federal Clean Water Act and how they affect their plant. In addition to Federal regulations, operators also must be aware of any guidelines imposed by the State or locality in which the plant operates.

Working Conditions

Water and wastewater treatment plant operators work both indoors and outdoors and may be exposed to noise from machinery and some



Wastewater treatment plant operators take samples frequently to measure levels of contaminants.

unpleasant odors, although chlorine and other chemicals are used to minimize these. Operators have to stoop, reach, and climb and sometimes get their clothes dirty. They must pay close attention to safety procedures for they may be confronted with hazardous conditions, such as slippery walkways, dangerous gases, and malfunctioning equipment. Because plants operate continuously for 24 hours every day, operators work one of three 8-hour shifts and on a rotational basis, weekends and holidays. Whenever emergencies arise, operators may be required to work overtime.

Employment

Water and wastewater treatment plant operators held about 78,000 jobs in 1990. The vast majority worked for local governments; some worked for private water supply and sanitary services companies, some of which provide operation and management services to local governments on a contract basis. About half worked as water treatment plant operators and half worked as wastewater treatment plant operators.

Water and wastewater treatment plant operators are employed throughout the country. Geographically, employment is distributed much like the Nation's population, with most jobs in larger towns and cities. Although most work full time, those who work in small towns may only work part time at the water or wastewater treatment plant—the remainder of their time may be spent handling other municipal duties.

Training, Other Qualifications, and Advancement

Trainees usually start as attendants or operators-in-training and learn their skills on the job under the direction of an experienced operator. They learn by observing the processes and equipment in operation

and by doing routine tasks such as recording meter readings; taking samples of wastewater and sludge; and doing simple maintenance and repair work on pumps, electric motors, and valves. They also clean and maintain plant equipment. Larger treatment plants generally combine this on-the-job training with formal classroom or self-paced study programs.

Operators need mechanical aptitude and should be competent in basic mathematics. Because of the introduction of computer-controlled equipment and more sophisticated instrumentation, a high school diploma generally is required. In addition, employers prefer those who have had high school courses in chemistry, biology, and mathematics.

Some positions, particularly in larger cities and towns, are covered by civil service regulations, and applicants may be required to pass written examinations testing elementary mathematics skills, mechanical aptitude, and general intelligence.

Some 2-year programs leading to an associate degree in wastewater technology and 1-year programs leading to a certificate are available; these provide a good general knowledge of water pollution control as well as basic preparation for becoming an operator. Because plants are becoming more complex, completion of such courses increases an applicant's chances for employment and promotion.

Most State water pollution control agencies offer training courses to improve operators' skills and knowledge. These courses cover principles of treatment processes and process control, laboratory procedures, odors and their control, safety, chlorination, sedimentation, biological oxidation, sludge treatment and disposal, and flow measurements. Some operators take correspondence courses on subjects related to wastewater treatment, and some employers pay part of the tuition for related college courses in science or engineering.

As operators are promoted, they become responsible for more complex treatment processes. Some operators are promoted to plant supervisor or superintendent, while others advance by transferring to a larger facility. Some postsecondary training in water and wastewater treatment coupled with increasingly responsible experience as an operator may be sufficient to qualify for superintendent of a small plant, since at many small plants the superintendent also serves as an operator. However, educational requirements are rising as larger, more complex treatment plants are built to meet new water pollution control standards. With each promotion, the operator must have greater knowledge of Federal, State, and local regulations. Superintendents of large plants generally need an engineering or science degree. A few operators get jobs with State water pollution control agencies as technicians, who monitor and provide technical assistance to plants throughout the State. Vocational-technical school or community college training generally is preferred for technician jobs. Experienced operators may transfer to related jobs with industrial wastewater treatment plants, companies selling wastewater treatment equipment and chemicals, engineering consulting firms, or vocational-technical schools.

In most States, operators must pass an examination to certify that they are capable of overseeing wastewater treatment plant operations. Voluntary certification programs are in effect in the remaining States. Water plant operators must also be certified in most States. Typically, there are different classes of certification for different size treatment plants, and certification requirements vary by State.

There is no nationally mandated certification program for operators, and relocation may mean having to become certified in a new location. However, several States have begun accepting other States' certifications.

Job Outlook

Employment of water and wastewater treatment plant operators is expected to grow faster than the average for all occupations through the year 2005. The expanding population and growth of the economy are expected to increase demand for water and wastewater treatment services. As new plants are constructed to meet this demand, employment of water and wastewater treatment plant operators should increase. In addition, many job openings will occur as experienced operators transfer to other occupations or leave the labor force.

Although local government traditionally has been the largest employer of water and wastewater treatment plant operators, increased

reliance on private firms specializing in the operation and management of water and wastewater treatment facilities should shift some employment demand to these companies. Increased pre-treatment activity by manufacturing firms should also create new job opportunities.

Water and wastewater treatment plant operators generally have steady employment because the services they provide are essential even during economic downturns.

Earnings

Annual salaries of wastewater treatment plant operators averaged \$24,400 in 1990; the lowest paid 10% of the occupation earned about \$14,100, the middle 50% of the occupation earned between \$18,700 and \$30,300, and the top 10% earned about \$38,900. Salaries depend, among other things, on the size and location of the plant, the complexity of the operator's job, and the operator's level of certification.

In addition to their annual salaries, water and wastewater treatment plant operators generally receive benefits that include health and life insurance, a retirement plan, and educational reimbursement for job-related courses.

Related Occupations

Other workers whose main activity consists of operating a system of machinery to process or produce materials include boiler operators, gas-compressor operators, powerplant operators, power reactor operators, stationary engineers, turbine operators, chemical plant operators, and petroleum refinery operators..

Sources of Additional Information

For information on certification, contact:

- Association of Boards of Certification, P.O. Box 786, Ames, IA 50010.

For information on opportunities as a water treatment plant operator, contact:

- American Waterworks Association, 6666 West Quincy, Denver, CO 80235.

Additional information is available from:

- Water Pollution Control Federation, 601 Wythe St., Alexandria, VA 22314.

For information on jobs, contact State or local water pollution control agencies or local offices of the State employment service.

Woodworking Occupations

(A list of D.O.T. codes is available on request from the Chief, Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.)

Nature of the Work

Wood is one of the oldest, most basic building materials. Woodworkers comprise a variety of occupations. Some woodworkers produce the structural elements of buildings; others produce hardwood and softwood lumber; still others produce finished wood products. Production woodworkers are found in primary industries such as sawmills and plywood mills, as well as in secondary industries such as furniture, kitchen cabinet, musical instrument, and other fabricated wood product manufacturing. Precision woodworkers are found in small shops making architectural woodwork, furniture, and many other specialty items.

Woodworkers are found throughout the process of transforming wood in log form into finished products. They operate machines that cut, shape, assemble, and finish raw wood to make the doors, windows, cabinets, trusses, plywood, flooring, paneling, molding, and trim that are components of most homes. They fashion home accessories such as beds, sofas, tables, dressers, and chairs. They also make sporting goods items, including baseball bats, racquets, skis, oars, and surfboards, as well as musical instruments, toys, caskets, tool handles, and thousands of other wooden items.

Working from blueprints, instructions from supervisors, or shop drawings often developed by themselves, woodworkers determine the method of shaping and sequence of assembling parts. To begin, they do a layout—measuring and marking the materials to be cut. Production workers set up, operate, and tend woodworking machines—such as power saws, planers, sanders, lathes, jointers, and routers—to cut

and shape components from lumber, plywood, and other wood panel products. They verify dimensions to adhere to specifications and may trim parts to insure a tight fit, using handtools such as planes, chisels, or wood files and sandpaper.

After the machining process, assemblers produce subassemblies using fasteners and adhesives. Subassemblies are then brought together to form a complete unit. The product is then finish sanded, stained, sealed, and if necessary, finish coated with a material such as lacquer or varnish. Woodworkers may work in teams or be assisted by a helper.

Production woodworkers generally operate a specific woodworking machine; however, some wood machine operators may set up their equipment, cut and shape wooden parts, and verify dimensions using a template, calipers, or rule. Other operators may press a switch on a woodworking machine and monitor or tend the automatic operation.

Wood machine operators in sawmills cut logs into planks, timbers, or boards. In veneer mills, they cut veneer sheets from logs for making plywood. And in furniture plants, they make furniture components such as table legs, drawers, rails, and spindles.

Precision or custom woodworkers, such as cabinetmakers, wood pattern and model makers, wood machinists, and furniture and wood finishers, work on a customized basis, often building one-of-a-kind items. For this reason, they normally need substantial training and an ability to work from detailed instructions and specifications. They often are required to exercise independent judgment when undertaking an assignment. Precision woodworkers generally perform a complete cycle of cutting, shaping, surface preparation, and assembling prepared parts of complex wood components into a finished wood product, such as a piece of furniture.

Many companies have installed computer-controlled machinery, which lends itself to precision, accuracy, and less waste. With computerized numerical controls, an operator can program a machine to perform a sequence of operations automatically, resulting in greater precision and reliability. The integration of computers with equipment has improved production speeds and capabilities, simplified setup and maintenance requirements, and increased the demand for trained workers, particularly those with strong mathematical skills.

Working Conditions

Working conditions vary from industry to industry, and job to job. In primary industries, such as logging and sawmilling, working conditions are physically demanding due to the handling of heavy bulky material. Workers in this area may also encounter excessive noise and dust and other air quality pollutants. However, these factors can be controlled to provide a safe work place. Rigid adherence to safety precautions minimizes risk of injury from contact with rough woodstock, and from the use of sharp tools and power equipment.

In secondary industries, such as furniture and kitchen cabinet manufacturing, working conditions also depend on the industry and the particular job. Those employees who operate machinery must wear ear and eye protection, and must always follow safety regulations concerning machine operation and the use of safety shields or guards. Those who work in the finishing area must either be provided with an appropriate dust or vapor mask, or with a complete protective safety suit, or be in a finishing environment which removes all vapors and particle matter from the atmosphere. Prolonged standing, lifting, and fitting heavy objects are also characteristic of the job.

Employment

Workers in woodworking occupations held about 349,000 jobs in 1990. Over 10 percent, mostly cabinetmakers and furniture and wood finishers, were self-employed. Employment was distributed as follows:

Woodworkers, precision	213,000
Woodworking machine setters and operators	136,000
Head sawyers	72,000
Woodworking machine operators	64,000

About 85 percent of all salaried woodworkers worked in manufacturing industries. Approximately 21 percent were employed in establishments fabricating household and office furniture; 21 percent were

in establishments making millwork, plywood, and structural wood members, used primarily in construction; and 11 percent worked in sawmills and planing mills manufacturing a variety of raw, intermediate, and finished woodstock. Woodworkers also were employed by wholesale and retail lumber dealers, furniture stores, reupholstery and furniture repair shops, and construction firms.

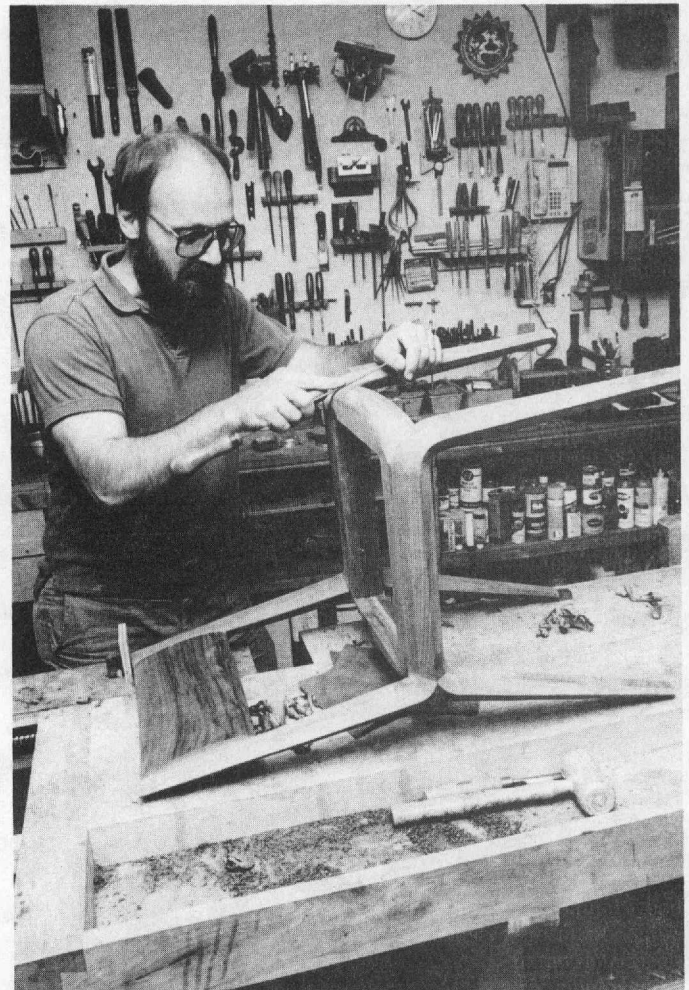
Woodworking jobs are found throughout the country. However, manufacturing jobs are concentrated in the South and Northwest, close to the supply of wood, while furniture makers are more prevalent in the East. Custom shops can be found everywhere, but are generally concentrated in or near highly populated areas.

Training, Other Qualifications, and Advancement

Most woodworkers learn their jobs through on-the-job training, picking up skills informally from experienced workers. Some acquire skills through vocational education or by working as carpenters on construction jobs. Others may attend colleges or universities which offer training in many areas including wood technology, furniture manufacturing, wood engineering, and production management. These programs prepare students for positions in production, supervision, engineering, or management.

Beginners usually observe and help experienced machine operators. They may supply material, remove fabricated products from the machine, and stack them. Trainees do simple machine operating jobs, supervised closely by experienced workers. As they gain experience, they perform more complex jobs with less supervision. Some may learn to read blueprints, set up machines, and plan the sequence of their work.

Most woodworkers learn the basic machine operations or job tasks in a few months, but becoming a skilled woodworker often requires 2



Precision woodworkers build customized items.

years or more. However, many firms hire workers to perform specialized tasks on a machine. These jobs may offer little opportunity to develop all-round skills.

In the past, a high school education was seldom required. However, persons seeking woodworking jobs can enhance their employment and advancement opportunities by completing high school. Training in mathematics, science, and computer applications will be beneficial in the future as woodworking technology becomes more sophisticated, and as more companies install computerized equipment. Employers often look for individuals with mechanical ability, manual dexterity, and the ability to pay attention to detail.

Advancement opportunities are often limited, and depend upon availability, seniority, and a worker's skills and initiative. Experienced woodworkers may become inspectors or supervisors responsible for the work of a group of woodworkers. Production workers can advance into these positions by assuming additional responsibilities and by attending workshops and seminars or college programs. Those with all-round skills may set up their own woodworking shops.

Job Outlook

Employment in the woodworking occupations is expected to grow more slowly than the average for all occupations through the year 2005. As the Nation's population, personal income, and business expenditures grow, the demand for wood products will increase. Demand for wood products is also stimulated by the rising demand for repair and renovation of residential and commercial property. Opportunities for woodworkers who specialize in such items as moldings, cabinets, stairs, and windows, should be particularly good.

Several factors may limit the growth of woodworking occupations. Materials such as metal, plastic, and fiberglass are used as alternatives to wood in many products, primarily because they are cheaper, stronger, or easier to shape. In addition, some jobs may be lost to imports. Job growth may also be dampened by increased environmental measures to control various pollutants used in or generated by woodworking processes, as well as old growth timber set aside for endangered species such as the spotted owl. The use of improved machinery, tools, and other technological advances—including computerized numerical control machinery and computer-aided design packages—will also prevent employment from rising as fast as the demand for wood products, particularly in the mills and manufacturing plants where many of the processes can be automated.

Although employment growth will be modest, thousands of open-

ings will arise each year because of the need to replace experienced workers who transfer to other occupations or leave the labor force.

Employment of woodworkers, like that of many other manufacturing workers, is sensitive to cyclical changes in the economy.

Earnings

Median weekly earnings for salaried full-time precision woodworkers were about \$355 in 1990. The middle 50 percent earned between \$270 and \$520. The lowest 10 percent earned less than \$200, while the highest 10 percent earned over \$710. Median weekly earnings for full-time woodworking machine operators were around \$295 in 1990. The middle 50 percent earned between \$230 and \$385. The lowest 10 percent earned less than \$190, while the highest 10 percent earned over \$470. Earnings vary by industry, geographic region, skill, and educational level, and by the complexity of the machinery operated.

Woodworkers usually receive a basic benefit package including medical and dental benefits and a pension plan.

Some woodworkers who are engaged in processing primary wood/building materials, such as those in logging or sawmills, are members of the International Woodworkers of America. Others may belong to the United Furniture Workers of America, and the United Brotherhood of Carpenters and Joiners of America, all AFL-CIO affiliates.

Related Occupations

Many woodworkers follow blueprints and drawings and use machines to shape and form raw wood into a final product. Workers who perform similar functions working with other materials include precision metalworkers, metalworking and plastic-working machine operatives, metal fabricators, molders and shapers, and leather workers.

Sources of Additional Information

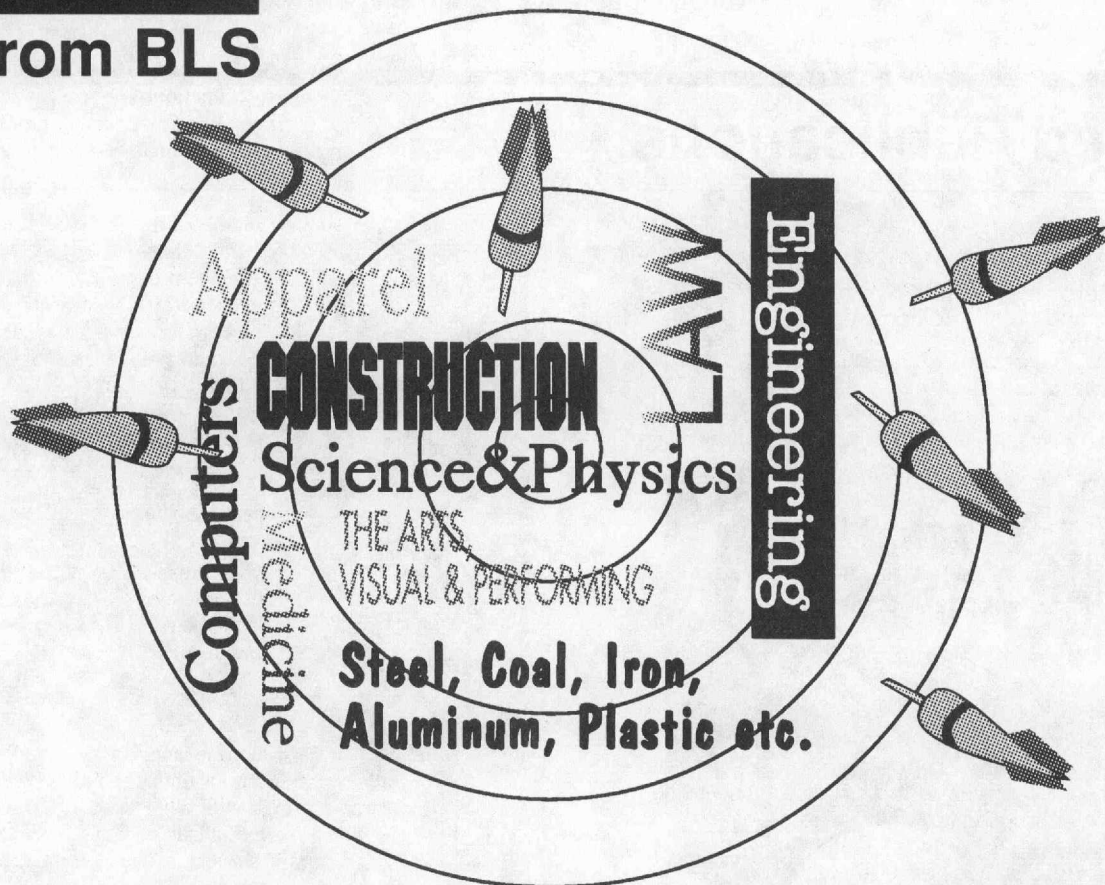
For information about woodworking occupations, contact local furniture manufacturers, sawmills and planing mills, cabinetmaking or millwork firms, lumber dealers, a local office of one of the unions mentioned above, or the nearest office of the State employment service.

For general information about furniture woodworking occupations, contact:

• American Furniture Manufacturers Association, Manufacturing Services Division, P.O. Box HP-7, High Point, NC 27261.

• Institute for Woodworking Education, 1012 Tenth St., Manhattan Beach, CA 90266.

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- Opportunities for acquiring skills
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- Long-term employment outlook
- Reasons for changing staffing patterns
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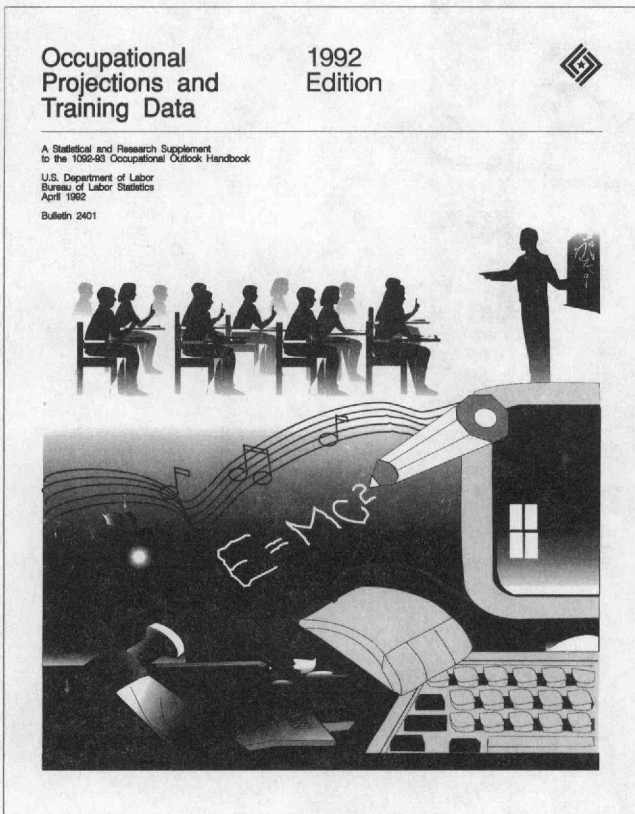
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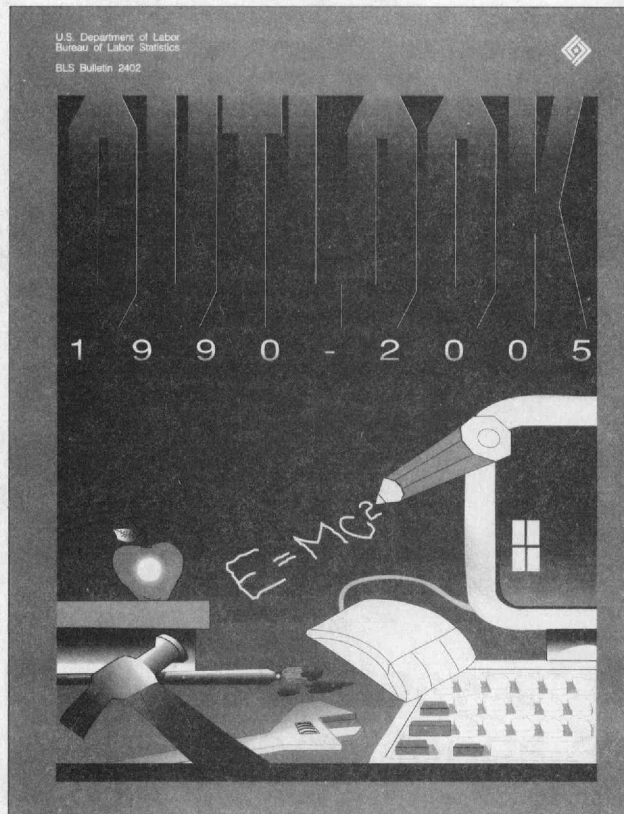
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