

educational requirements are rising as larger, more complex treatment plants are built to meet new drinking water and 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 drinking water or 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 liquid waste treatment plants, water or liquid waste treatment equipment and chemical companies, engineering consulting firms, or vocational-technical schools.

### Job Outlook

Employment of water and liquid waste treatment plant and system operators is expected to grow as fast as the average for all occupations through the year 2010. Because the number of applicants in this field is normally low, job prospects will be good for qualified applicants.

The increasing population and growth of the economy are expected to boost demand for essential water and liquid waste treatment services. As new plants are constructed to meet this demand, employment of water and liquid waste treatment plant and system operators will increase. In addition, many job openings will occur as experienced operators transfer to other occupations or leave the labor force.

Local governments are the largest employers of water and liquid waste treatment plant and system operators. However, Federal certification requirements have increased reliance on private firms specializing in the operation and management of water and liquid waste treatment facilities. As a result, employment in privately owned facilities will grow faster than the average. Increased pretreatment activity by manufacturing firms also will create new job opportunities.

### Earnings

Median annual earnings of water and liquid waste treatment plant and system operators were \$31,380 in 2000. The middle 50 percent earned between \$24,390 and \$39,530. The lowest 10 percent earned less than \$19,120, and the highest 10 percent earned more than \$47,370. Median annual earnings of water and liquid waste treatment plant and systems operators in 2000 were \$31,120 in local government and \$29,810 in water supply.

In addition to their annual salaries, water and liquid waste treatment plant and system operators usually receive benefits that may 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 chemical plant and system operators; gas plant operators; petroleum pump system operators, refinery operators, and gaugers; power plant operators, distributors, and dispatchers; and stationary engineers and boiler operators.

### Sources of Additional Information

For information on employment opportunities, contact State or local water pollution control agencies, State water and liquid waste operator associations, State environmental training centers, or local offices of the State employment service.

For information on certification, contact:

► Association of Boards of Certification, 208 Fifth St., Ames, IA 50010-6259. Internet: <http://www.abccert.org>

For educational information related to a career as a water or liquid waste treatment plant and system operator, contact:

► American Water Works Association, 6666 West Quincy Ave., Denver, CO 80235.

► Water Environment Federation, 601 Wythe St., Alexandria, VA 22314-1994. Internet: <http://www.wef.org>

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## Printing Occupations

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### Bookbinders and Bindery Workers

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(O\*NET 51-5011.01, 51-5011.02, 51-5012.00)

#### Significant Points

- Most workers train on the job.
- Employment is expected to grow more slowly than average, reflecting increasingly productive bindery operations.
- Opportunities for hand bookbinders are limited because of the small number of establishments that do this highly specialized work.

#### Nature of the Work

The process of combining printed sheets into finished products such as books, magazines, catalogs, folders, directories, or product packaging is known as "binding." Binding involves cutting,

folding, gathering, gluing, stapling, stitching, trimming, sewing, wrapping, and other finishing operations. Bindery workers operate and maintain the machines that perform these various tasks.

Job duties depend on the kind of material being bound. In firms that do *edition binding*, for example, workers bind books produced in large numbers, or "runs." *Job binding* workers bind books produced in smaller quantities. In firms specializing in *library binding*, workers repair books and provide other specialized binding services to libraries. *Pamphlet binding* workers produce leaflets and folders, and *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 types of binding and finishing consist of only one step. Preparing leaflets or newspaper inserts, for example, require only folding. Binding of books and magazines, on the other hand, requires a number of steps.

Bookbinders and bindery workers assemble books and magazines from large, flat, printed sheets of paper. Skilled workers



*Some bookbinders and bindery workers in small shops may perform many binding tasks, while those in large shops usually specialize.*

operate machines that first fold printed sheets into “signatures,” which are groups of pages arranged sequentially. Bookbinders then sew, stitch, or glue the assembled signatures together, shape the book bodies with presses and trimming machines, and reinforce them with glued fabric strips. Covers are created separately, and glued, pasted, or stitched onto the book bodies. The books then undergo a variety of finishing operations, often including wrapping in paper jackets.

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 creativity, knowledge of binding materials, and a thorough background in the history of binding. Hand bookbinding gives individuals the opportunity to work in the greatest variety of jobs.

Bookbinders and bindery workers in small shops may perform many binding tasks, while those in large shops usually are assigned only one or a few operations, such as operating complicated manual or electronic guillotine paper cutters or folding machines. Others specialize in adjusting and preparing equipment, and may perform minor repairs as needed.

### Working Conditions

Binderies often are noisy and jobs can be fairly strenuous, requiring considerable lifting, standing, and carrying. They also may require stooping, kneeling, and crouching. Binding often resembles an assembly line where workers perform repetitive tasks.

### Employment

In 2000, bookbinders and bindery workers held about 115,000 jobs, including 9,600 working as skilled bookbinders and 105,000 working as bindery workers.

Although some large libraries and commercial book publishers have their own bindery operations, employing some bookbinders and bindery workers, the majority of jobs are in commercial printing plants. The largest employers of bindery workers are bindery trade shops—these companies specialize in providing binding services for printers without binderies or whose printing production exceeds their binding capabilities. Few publishers maintain their own manufacturing facilities, so most contract out the printing and assembly of books to commercial printing plants or bindery trade shops.

Bindery jobs are concentrated near large metropolitan areas such as New York, Chicago, Washington, DC, Los Angeles, Philadelphia, and Dallas.

### Training, Other Qualifications, and Advancement

Most bookbinders and bindery workers learn the craft through on-the-job training. Inexperienced workers usually are assigned simple tasks such as moving paper from cutting machines to folding machines. They learn basic binding skills, 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 learn to operate one or more pieces of equipment. Usually, it takes one to three months to learn to operate the simpler machines but it can take up to one year to become completely familiar with more complex equipment, such as computerized binding machines.

Formal apprenticeships are not as common as they used to be, but still are offered by some employers. Apprenticeships provide a more structured program that enables workers to acquire the high levels of specialization and skill needed for some bindery jobs. For example, a 4-year apprenticeship usually is necessary to teach workers how to restore rare books and to produce valuable collectors’ items.

Employers prefer to hire experienced individuals, but will train workers with some basic knowledge of binding operations. High school students interested in bindery careers should take shop courses or attend a vocational-technical high school. Occupational skill centers, usually operated by labor unions, also provide an introduction to a bindery career. To keep pace with changing technology, retraining is increasingly important for bindery workers. Students with computer skills and mechanical aptitudes are especially in demand.

Bindery workers need basic mathematics and language skills. Bindery work requires careful attention to detail so accuracy, patience, neatness, and good eyesight also are important. Manual dexterity is essential in order to count, insert, paste, and fold. Mechanical aptitude is needed to operate the newer, more automated equipment. Artistic ability and imagination are necessary for hand bookbinding.

Training in graphic arts also can be an asset. Vocational-technical institutes offer postsecondary programs in the graphic arts, as do some skill updating or retraining programs, and community colleges. Some updating and retraining programs require students to have bindery experience; other programs are available through unions for members. Four-year colleges also offer programs, but their emphasis is on preparing people for careers as graphic artists, educators, or managers in the graphic arts field.

Without additional training, advancement opportunities outside of bindery work are limited. In large binderies, experienced bookbinders or bindery workers may advance to supervisory positions.

### Job Outlook

Overall employment of bookbinders and bindery workers is expected to grow more slowly than the average for all occupations through 2010 as demand for printed material grows, but productivity in bindery operations increases. Most job openings will result from the need to replace experienced workers who change jobs or leave the labor force.

Binding is increasingly mechanized as computers are attached to or associated with binding equipment. New “in-line” equipment performs a number of operations in sequence, beginning with raw stock and ending with a complete finished product. Technological advances such as automatic tabbers, counters, palletizers, and jiggers reduce labor and improve the appearance of the finished product. These improvements are increasingly inducing printing com-

panies to acquire in-house binding and finishing equipment. However, growth in demand for specialized bindery workers who assist skilled bookbinders will be slowed as binding machinery continues to become more efficient. New technology requires a considerable investment in capital expenditures and employee training; therefore, computer skills and mechanical aptitude are increasingly important.

The small number of establishments that do hand bookbinding limits opportunities for these specialists. Experienced workers will continue to have the best opportunities.

### Earnings

Median hourly earnings of bookbinders were \$11.42 in 2000. The middle 50 percent earned between \$9.14 and \$15.71 an hour. The lowest 10 percent earned less than \$7.28, and the highest 10 percent earned more than \$20.11.

Median hourly earnings of bindery workers were \$10.05 in 2000. The middle 50 percent earned between \$7.88 and \$13.27 an hour. The lowest 10 percent earned less than \$6.57, and the highest 10 percent earned more than \$17.22. Workers covered by union contracts usually had higher earnings.

### Related Occupations

Other workers who set up and operate production machinery include prepress technicians and workers; printing machine operators; machine setters, operators, and tenders—metal and plastic; and various other precision machine operators.

### Sources of Additional Information

Information 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:

► Bindery Industries Association, International, 70 East Lake St., #300, Chicago, IL 60601.

► Graphic Communications International Union, 1900 L St. NW., Washington, DC 20036. Internet: <http://www.gciu.org>

For information on careers and training programs in printing and the graphic arts, contact:

► Graphic Communications Council, 1899 Preston White Dr., Reston, VA 20191. Internet: <http://www.npes.org/edcouncil/index.html>

► Printing Industries of America, 100 Daingerfield Rd., Alexandria, VA 22314. Internet:

[http://www.gain.org/servlet/gateway/PIA\\_GATF/non\\_index.html](http://www.gain.org/servlet/gateway/PIA_GATF/non_index.html)

► Graphic Arts Technical Foundation, 200 Deer Run Rd., Sewickley, PA 15143. Internet: <http://www.gatf.org>

## Prepress Technicians and Workers

(O\*NET 51-5021.00, 51-5022.01, 51-5022.02, 51-5022.03, 51-5022.04, 51-5022.05, 51-5022.06, 51-5022.07, 51-5022.08, 51-5022.09, 51-5022.10, 51-5022.11, 51-5022.12, 51-5022.13)

### Significant Points

- Most workers train on-the-job; some complete formal graphics arts programs or other postsecondary programs in printing technology.
- Most employers prefer to hire experienced prepress technicians and workers.
- Employment is projected to decline as the increased use of computers in typesetting and page layout eliminates many prepress jobs.

### Nature of the Work

The printing process has three stages—prepress, press, and binding or postpress. Prepress technicians and workers prepare material for printing presses. They perform a variety of tasks involved with transforming text and pictures into finished pages and making printing plates of the pages.

Advances in computer software and printing technology continue to change prepress work. Customers, as well as prepress technicians and workers, use their computers to produce material that looks like the desired finished product. Customers, using their own computers, increasingly do much of the typesetting and page layout work formerly done by prepress technicians and workers. This process, called “desktop publishing,” poses new challenges for the printing industry. (A separate statement on desktop publishers appears elsewhere in the *Handbook*.) Instead of receiving simple typed text from customers, prepress technicians and workers get the material on a computer disk. Because of this, customers are increasingly likely to have already settled on a format on their own, rather than relying on suggestions from prepress technicians and workers. Furthermore, the printing industry is rapidly moving toward complete “digital imaging,” by which customers’ material received on computer disks is converted directly into printing plates. Other innovations in prepress work are digital color page makeup systems, electronic page layout systems, and off-press color proofing systems.

Typesetting and page layouts also have been affected by technological changes. The old “hot type” method of text composition—which used molten lead to create individual letters, paragraphs, and full pages of text—is nearly extinct. Today, composition work is done with computers and “cold type” technology. Cold type, which is any of a variety of methods creating type without molten lead, has traditionally used “photo typesetting” to ready text and pictures for printing. Although this method has many variations, all use photography to create images on paper. The images are assembled into page format and re-photographed to create film negatives from which the actual printing plates are made. However, newer cold type methods are becoming more common. These automate the photography or make printing plates directly from electronic files.

In one common form of phototypesetting, text is entered into a computer programmed to hyphenate, space, and create columns of text. Typesetters or data entry clerks may do keyboarding of text at the printing establishment. (See the *Handbook* statement on data entry and information processing workers.) Increasingly, however, authors do this work before the job is sent out for composition. The coded text then is 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.

New technologies have had a significant impact on the role of other composition workers. Sophisticated publishing software allows an entire newspaper, catalog, or book page, complete with artwork and graphics, to be made up on the computer screen exactly as it will appear in print. Although generally this is the work of desktop publishers, which are discussed separately in the *Handbook*, improvements in packaged software allow customers to do more of their own typesetting and layout work. Operators, however, still transmit the pages for production into film and then into plates or directly into plates. “Imagesetters” read text from computer memory and then “beam” it directly onto film, paper, or plates, bypassing the slower photographic process traditionally used. In small shops, *job printers* may be responsible for composition and page layout, reading proofs for errors and clarity, correcting mistakes, and printing.