

basements, and lay water and sewer lines, increasing the need for periodic service and repair. In addition, the construction and repair of highways and bridges also requires more technicians to service equipment. Also, as equipment becomes more complex, repairs increasingly must be made by specially trained technicians. Job openings for farm equipment mechanics and railcar repairers are mostly expected to arise due to replacement needs.

Construction and mining are particularly sensitive to changes in the level of economic activity; therefore, heavy and mobile equipment may be idled during downturns. In addition, winter is traditionally the slow season for construction and farming activity, particularly in cold regions. Few technicians may be needed during periods when equipment is used less; however, employers usually try to retain experienced workers. Employers may be reluctant to hire inexperienced workers during slow periods though.

Earnings

Median hourly earnings of mobile heavy equipment mechanics were \$16.32 in 2000. The middle 50 percent earned between \$13.32 and \$19.86. The lowest 10 percent earned less than \$10.93, and the highest 10 percent earned more than \$23.29. Median hourly earnings in the industries employing the largest numbers of mobile heavy equipment mechanics in 2000 were as follows:

Federal Government	\$18.67
Local government	17.09
Machinery, equipment, and supplies	16.05
Miscellaneous equipment rental and leasing	15.95
Heavy construction, except highway	15.54

Median hourly earnings of farm equipment mechanics were \$12.38 in 2000. The middle 50 percent earned between \$9.99 and \$15.29. The lowest 10 percent earned less than \$8.15, and the highest 10 percent earned more than \$18.23.

Median hourly earnings of railcar repairers were \$16.19 in 2000. The middle 50 percent earned between \$12.31 and \$19.34. The lowest 10 percent earned less than \$9.78, and the highest 10 percent earned more than \$21.19.

About one-fourth of all service technicians and mechanics are members of unions including the International Association of Machinists and Aerospace Workers, the International Union of Operating Engineers, and the International Brotherhood of Teamsters.

Related Occupations

Workers in related repair occupations include aircraft and avionics equipment mechanics and service technicians; automotive service technicians and mechanics; diesel service technicians and mechanics; heating, air-conditioning, and refrigeration mechanics and installers; and small engine mechanics.

Sources of Additional Information

More details about job openings for heavy vehicle and mobile equipment service technicians and mechanics may be obtained from local heavy and mobile equipment dealers and distributors, construction contractors, and government agencies. Local offices of the State employment service also may have information on job openings and training programs.

For general information about a career as a heavy vehicle and mobile equipment service technician or mechanic, contact:

- ▶ The Equipment Maintenance Counsel, P.O. Box 1368, Glenwood Springs, CO 81602. Internet: <http://www.equipment.org>
- ▶ Specialized Carriers and Rigging Association, 2750 Prosperity Ave., Suite 620, Fairfax, VA 22031-4312.

- ▶ The AED Foundation (Associated Equipment Dealers affiliate), 615 W. 22nd St., Oak Brook, IL 60523. Internet:

http://www.aednet.org/aed_foundation

For a directory of public training programs in heavy and mobile equipment mechanics, contact:

- ▶ SkillsUSA-VICA, P.O. Box 3000, 1401 James Monroe Hwy., Leesburg, VA 22075. Internet: <http://www.skillsusa.org>

A list of certified diesel service technician training programs can be obtained from:

- ▶ National Automotive Technician Education Foundation (NATEF), 13505 Dulles Technology Dr., Herndon, VA 20171-3421. Internet:

<http://www.natef.org>

Information on certification as a heavy-duty diesel service technician is available from:

- ▶ ASE, 101 Blue Seal Dr. SE., Suite 101, Leesburg, VA 20175. Internet: <http://www.asecert.org>

Small Engine Mechanics

(O*NET 49-3051.00, 49-3052.00, 49-3053.00)

Significant Points

- Employment is expected to grow slowly, but persons with formal mechanic training should enjoy good job prospects.
- Because the use of motorcycles, motorboats, and outdoor power equipment is seasonal in many areas, mechanics may service other types of equipment or work reduced hours in the winter.

Nature of the Work

Though smaller, engines powering motorcycles, motorboats, and outdoor power equipment share many characteristics with their larger counterparts, including breakdowns. Small engine mechanics repair and service power equipment ranging from racing motorcycles to chain saws.

Small engines, like large engines, require periodic service to minimize the chance of breakdowns and to keep them operating at peak performance. During routine equipment maintenance, mechanics follow a checklist including the inspection and cleaning of brakes, electrical systems, fuel injection systems, plugs, carburetors, and other parts. Following inspection, mechanics usually repair or adjust parts that do not work properly, or replace unfixable parts. Routine maintenance is normally a major part of the mechanic's work.

When equipment breakdowns occur, mechanics use various techniques to diagnose the source and extent of the problem. The mark of a skilled mechanic is the ability to diagnose mechanical, fuel, and electrical problems, and to make repairs in a minimal amount of time. Quick and accurate diagnosis requires problem-solving ability and a thorough knowledge of the equipment's operation.

In larger repair shops, mechanics may use special computerized diagnostic testing equipment as a preliminary tool in analyzing equipment. These computers provide a systematic performance report of various components to compare them to normal ratings. After pinpointing the problem, the mechanic makes the needed adjustments, repairs, or replacements. Some jobs require minor adjustments or the replacement of a single item, such as a carburetor or fuel pump. In contrast, a complete engine overhaul requires a number of hours to disassemble the engine and replace worn valves, pistons, bearings, and other internal parts. Some highly skilled

mechanics use highly specialized components and the latest computerized equipment to customize and tune motorcycles and motorboats for racing.

Small engine mechanics use common handtools such as wrenches, pliers, and screwdrivers. They also use power tools, such as drills and grinders when customized repairs warrant. Computerized engine analyzers, compression gauges, ammeters and voltmeters, and other testing devices help mechanics locate faulty parts and tune engines. Hoists may be used to lift heavy equipment such as motorcycles, snowmobiles, or motorboats. Mechanics often refer to service manuals for detailed directions and specifications while performing repairs.

Motorcycle mechanics repair and overhaul motorcycles, motor scooters, mopeds, dirt bikes, and all-terrain vehicles. Besides engines, they may work on transmissions, brakes, and ignition systems, and make minor body repairs. Mechanics usually specialize in the service and repair of one type of equipment, although they may work on closely related products. Mechanics may only service a few makes and models of motorcycles because usually the dealers only service the products they sell.

Motorboat mechanics, or *marine equipment mechanics*, repair and adjust the electrical and mechanical equipment of inboard and outboard boat engines. Most small boats have portable outboard engines that are removed and brought into the repair shop. Larger craft, such as cabin cruisers and commercial fishing boats, are powered by diesel or gasoline inboard or inboard-outboard engines,



Motorcycle mechanics may schedule time-consuming engine overhauls during winter downtime.

which are only removed for major overhauls. Most of these repairs are performed at the docks or marinas. Motorboat mechanics may also work on propellers, steering mechanisms, marine plumbing, and other boat equipment.

Outdoor power equipment and other small engine mechanics service and repair outdoor power equipment such as lawnmowers, garden tractors, edge trimmers, and chain saws. They may also occasionally work on portable generators and go-carts. In addition, small engine mechanics in northern parts of the country may work on snowblowers and snowmobiles, but demand for this type of repair is seasonal.

Working Conditions

Small engine mechanics usually work in repair shops that are well-lighted and ventilated, but are sometimes noisy when testing engines. Motorboat mechanics may work outdoors at docks or marinas, as well as in all weather conditions when making repairs aboard boats. They may work in cramped or awkward positions to reach a boat's engine.

During the winter months in the northern United States, mechanics may work fewer than 40 hours a week because the amount of repair and service work declines when lawnmowers, motorboats, and motorcycles are not in use. Many mechanics only work during the busy spring and summer seasons. However, many mechanics schedule time-consuming engine overhauls or work on snowmobiles and snowblowers during winter downtime. Mechanics may work considerably more than 40 hours a week when demand is strong.

Employment

Small-engine mechanics held about 73,000 jobs in 2000. Motorcycle mechanics held about 14,000 jobs; motorboat mechanics held about 25,000; and outdoor power equipment and other small engine mechanics held about 33,000. About one-third worked for retail hardware and garden stores, or retail dealers of motorboats, motorcycles, and miscellaneous vehicles. Most of the remainder were employed by independent repair shops, marinas and boat yards, equipment rental companies, wholesale distributors, and landscaping services. About 1 in 4 were self-employed.

Training, Other Qualifications, and Advancement

Due to the increasing complexity of motorcycles and motorboats, most employers prefer to hire mechanics who graduate from formal training programs for small engine mechanics. Because the number of these specialized postsecondary programs is limited, most mechanics learn their skills on the job or while working in related occupations. For trainee jobs, employers hire persons with mechanical aptitude who are knowledgeable about the fundamentals of small 2- and 4-stroke engines. Many trainees develop an interest in mechanics and acquire some basic skills through working on automobiles, motorcycles, motorboats, or outdoor power equipment as a hobby. Others may be introduced to mechanics through vocational automotive training in high school, or one of many postsecondary institutions.

Trainees learn routine service tasks under the guidance of experienced mechanics by replacing ignition points and spark plugs or by taking apart, assembling, and testing new equipment. As trainees gain experience and proficiency, they progress to more difficult tasks such as advanced computerized diagnosis and engine overhauls. Up to 3 years of on-the-job training may be necessary before a novice worker becomes competent in all aspects of the repair of motorcycle and motorboat engines.

Employers often send mechanics and trainees to special training courses conducted by motorcycle, motorboat, and outdoor power

equipment manufacturers or distributors. These courses, which can last as long as 2 weeks, upgrade the worker's skills and provide information on repairing new models. They are usually a prerequisite for any mechanic who performs warranty work for manufacturers or insurance companies.

Most employers prefer to hire high school graduates for trainee mechanic positions, but will accept applicants with less education if they possess adequate reading, writing, and arithmetic skills. Many equipment dealers employ students part time and during the summer to help assemble new equipment and perform minor repairs. Helpful high school courses include small engine repair, automobile mechanics, science, and business arithmetic.

Knowledge of basic electronics is essential for small engine mechanics. Electronic components control engine performance, instrument displays, and a variety of other functions of motorcycles, motorboats, and outdoor power equipment. To recognize and fix potential problems, mechanics should be familiar with the basic principles of electronics.

The most important work possessions of mechanics are their hand tools. Mechanics usually provide their own tools and many experienced mechanics have invested thousands of dollars in them. Employers typically furnish expensive powertools, computerized engine analyzers, and other diagnostic equipment, but mechanics accumulate hand tools with experience.

The skills used as a small engine mechanic generally transfer to other occupations such as automobile, diesel, or heavy vehicle and mobile equipment mechanics. Experienced mechanics with leadership ability may advance to shop supervisor or service manager jobs. Mechanics with sales ability sometimes become sales representatives or open their own repair shops.

Job Outlook

Employment of small engine mechanics is expected to grow slower than the average for all occupations through the year 2010. The majority of job openings are expected to be replacement jobs because many experienced small engine mechanics leave each year to transfer to other occupations, retire, or stop working for other reasons. Job prospects should be especially favorable for persons who complete mechanic training programs.

Growth of personal disposable income over the 2000-10 period should provide consumers with more discretionary dollars to buy motorboats, lawn and garden power equipment, and motorcycles. This will require more mechanics to keep the growing amount of equipment in operation. In addition, routine service will always be a significant source of work for mechanics. While advancements in technology will lengthen the interval between checkups, the need for qualified mechanics to perform this service will increase.

Employment of motorcycle mechanics should increase slowly as the popularity of motorcycles rebounds. Motorcycle usage should continue to be popular with persons between the ages of 18 and 24, an age group which historically has had the greatest proportion of motorcycle enthusiasts. Motorcycles also are increasingly popular with persons over the age of 40. Traditionally, this group has disposable income to spend on recreational equipment such as motorcycles and motorboats.

Over the next decade, more people will be entering the 40 and over age group; this group is responsible for the largest segment of marine craft purchases. These potential buyers will help expand the market for motorboats, while helping to maintain the demand for qualified mechanics. Construction of new single-family houses will

result in an increase in the lawn and garden equipment in operation, increasing the need for mechanics. However, equipment growth will be slowed by trends toward smaller lawns and contracting out their maintenance to lawn service firms. Growth also will be tempered by the tendency of many consumers to dispose of and replace relatively inexpensive items rather than have them repaired.

Earnings

Median annual earnings of motorcycle mechanics were \$25,100 in 2000. The middle 50 percent earned between \$19,660 and \$32,490. The lowest 10 percent earned less than \$15,980, and the highest 10 percent earned more than \$41,180. Median annual earnings in 2000 in motorcycle dealers, the industry employing the largest numbers of motorcycle mechanics, were \$25,650.

Median annual earnings of motorboat mechanics were \$26,660 in 2000. The middle 50 percent earned between \$20,760 and \$33,680. The lowest 10 percent earned less than \$17,320, and the highest 10 percent earned more than \$41,490. Median annual earnings in 2000 in boat dealers, the industry employing the largest numbers of motorboat mechanics, were \$26,350.

Median annual earnings of outdoor power equipment and other small engine mechanics were \$23,780 in 2000. The middle 50 percent earned between \$18,930 and \$29,370. The lowest 10 percent earned less than \$14,830, and the highest 10 percent earned more than \$35,250.

Small engine mechanics tend to receive few benefits in small shops, but those employed in larger shops often receive paid vacations, sick leave, and health insurance. Some employers also pay for work-related training and provide uniforms.

Related Occupations

Mechanics and repairers who work on other types of mobile equipment include automotive service technicians and mechanics, diesel service technicians and mechanics, and heavy vehicle and mobile equipment service technicians and mechanics.

Sources of Additional Information

For more details about work opportunities, contact local motorcycle, motorboat, and lawn and garden equipment dealers, boat yards, and marinas. Local offices of the State employment service may also have information about employment and training opportunities.

General information about motorcycle mechanic careers may be obtained from:

- ▶ American Motorcycle Institute, 3042 West International Speedway Blvd., Daytona Beach, FL 32124. Telephone (tollfree): 800-874-0645. Internet: <http://www.amiwrench.org>

- ▶ Motorcycle Mechanics Institute, 2844 West Deer Valley Rd., Phoenix, AZ 85027. Telephone (tollfree): 800-582-7995. Internet: <http://www.uticorp.com/techtraining>

General information about motorboat mechanic careers is available from:

- ▶ American Marine Institute, 3042 West International Speedway Blvd., Daytona Beach, FL 32124. Telephone (tollfree): 800-874-0645. Internet: <http://www.amiwrench.org>

- ▶ American Watercraft Institute, 3042 West International Speedway Blvd., Daytona Beach, FL 32124. Telephone (tollfree): 800-342-9253. Internet: <http://www.amiwrench.org>

- ▶ Marine Mechanics Institute, 9751 Delegates Dr., Orlando, FL 32827. Telephone (tollfree): 800-342-9253. Internet: <http://www.uticorp.com/techtraining>