

Motor Vehicle and Parts Manufacturing

(NAICS 3361, 3362, 3363)

SIGNIFICANT POINTS

- Nearly a quarter of all the industry’s jobs are located in Michigan.
- Average earnings are very high compared with those in other industries.
- Employment is highly sensitive to cyclical swings in the economy.
- Employment is expected to grow in firms that manufacture motor vehicle parts, bodies, and trailers, but to decline in firms that make complete vehicles.

Nature of the Industry

The motor vehicle is an intricate series of systems, subsystems, and components assembled into a final product. Each manufactured part or component is integrated into the vehicle—none is developed to exist separately. Vehicles are constantly changing as new technology or reengineered components are incorporated, and as new and updated models are designed in response to changing consumer preferences. Motor vehicle and parts manufacturers must continually evolve to maximize efficiency and maintain continuing streams of commercially viable products in a highly competitive market.

Motor vehicles—passenger cars, sport utility vehicles, pickup trucks and vans, heavy-duty trucks, buses, and other special purpose motor vehicles ranging from limousines to garbage trucks—play a central role in our society. Most U.S. residents rely on them daily to travel to work or school, shop, or visit family and friends. Businesses depend on motor vehicles to transport people and goods. The United States is the world’s largest marketplace for motor vehicles due to the size and affluence of its population. According to the U.S. Department of Transportation, more than 230 million motor vehicles—nearly 138 million automobiles, 92 million trucks, and 750,000 buses—were registered in the United States in 2001. The number of light trucks has shown especially steady growth since the mid- to late 1980s.

The vehicles we drive are only a small part of the story in motor vehicle and parts manufacturing. In 2002, about 9,600 establishments manufactured motor vehicles and parts; these ranged from small parts plants with only a few workers to huge assembly plants that employ thousands. Table 1 shows that about 7 out of 10 establishments in the industry manufactured motor vehicle parts—including electrical and electronic equipment, gasoline engines and parts, brake systems, seating and interior trim, steering and suspension components, transmission and power train parts, air-conditioners, and motor vehicle stampings, such as fenders, tops, body parts, trim, and molding. Manufacturing parts requires less assembly, and the establishments that manufacture only parts are not as vertically integrated as those that make complete vehicles. Other establishments specialized in manufacturing truck trailers, motor homes, travel trailers, campers, and car, truck, and bus bodies placed on separately purchased chassis.

The motor vehicle and parts manufacturing industry in the United States has become increasingly integrated into the inter-

Table 1. Percent distribution of establishments in motor vehicle and parts manufacturing by detailed industry sector, 2002

Industry sector	Establishments
Total	100.0
Motor vehicle parts manufacturing	70.1
Motor vehicle body and trailer manufacturing	24.9
Motor vehicle manufacturing	4.9

national economy. In fact, “domestic” vehicles often are produced using the components, manufacturing plants, and distribution methods of other nations around the world, as U.S. and foreign manufacturers of motor vehicles benefit from competitive cooperation in the design, production, and distribution of vehicles and parts. Collaboration in manufacturing practices has dramatically increased productivity and improved efficiency. These cooperative practices have also resulted in manufacturers from the United States, Europe, and the Pacific Rim locating production plants in the countries in which they plan to sell their vehicles, to reduce distribution time and costs. Foreign motor vehicle and parts makers with production sites in the United States are known as “transplants,” and account for a growing share of U.S. production and employment.

Globalization of the industry has boosted competition among U.S. motor vehicle manufacturers, prompting innovations in product design and in the manufacturing process. One result of these product innovations is a proliferation of rapidly designed and produced new models aimed at niches in the market. Firms also must be fast and flexible in implementing new production techniques. Smaller production runs and mass customization result from attempts to reduce waste in the production cycle, develop more adaptive production facilities, and allow customer demand to drive changes in design and marketing. Customer-driven markets force manufacturers to replace traditional assembly lines with modern systems using computers, robots, and interchangeable workers and tools. Customized plants put resources in the right place at the right time, allowing manufacturers to change production inputs quickly and accurately.

Competition has led manufacturers to adopt innovative approaches to research and development, often in response to evolving consumer and regulatory demands. For example, demand for vehicles that can run on alternative fuels derived from batteries or solar power will put pressure on manufacturers to develop a

great deal of new technology, a challenge that likely will necessitate cooperation among both domestic and foreign manufacturers.

Motor vehicle and parts manufacturers have a major influence on other industries in the economy. They are major consumers of steel, rubber, plastics, glass, and other basic materials, thus creating jobs in industries that produce those materials. The production of motor vehicles also spurs employment growth in other industries, including automobile and other motor vehicle dealers, automotive repair and maintenance shops, gasoline stations, highway construction companies, and automotive parts, accessories, and tire stores.

Working Conditions

In 2002, about a third of workers in the motor vehicle and parts manufacturing industry worked, on average, more than 40 hours per week. Overtime is especially common during periods of peak demand. Most employees, however, typically work an 8-hour shift: either from 7:00 a.m. to 3:30 p.m. or from 4:00 p.m. to 12:30 a.m., with two breaks per shift and a half-hour for meals. A third shift often is reserved for maintenance and cleanup.

Although working conditions have improved in recent years, some production workers are still subject to uncomfortable conditions. Heat, fumes, noise, and repetition are not uncommon in this industry. In addition, many workers come into contact with oil and grease and may have to lift and fit heavy objects. Employees also may operate powerful, high-speed machines that can be dangerous. Accidents and injuries usually are avoided when protective equipment and clothing are worn and safety practices are observed.

Newer plants are more automated and have safer, more comfortable conditions. For example, these plants may have ergonomically designed work areas and job tasks that accommodate the worker's physical size and eliminate awkward reaching and bending and unnecessary heavy lifting. Workers may function as part of a team, doing more than one job and thus reducing the repetitiveness of assembly line work.

Workers in this industry experience higher rates of injury and illness than do workers in most other industries. In 2002, cases of work-related injury and illness averaged 12.1 per 100 full-time workers in motor vehicle and equipment manufacturing, compared with 7.2 in all manufacturing industries and 5.3 in the entire private sector.

As in other industries, professional and managerial workers normally have clean, comfortable offices, and are not subject to the hazards of assembly line work. Improved ergonomics help office and administrative support workers avoid repetitive strain injuries, but employees using computer terminals for long periods may develop eye strain and fatigue.

Employment

Motor vehicle and parts manufacturing was among the largest of the manufacturing industries in 2002, providing 1.2 million jobs. The majority of jobs, about 63 percent, were in firms that make motor vehicle parts. About 23 percent of workers in the industry were employed in firms assembling complete motor vehicles, while about 13 percent worked in firms producing truck trailers, motor

homes, travel trailers, campers, and car, truck, and bus bodies placed on separately purchased chassis.

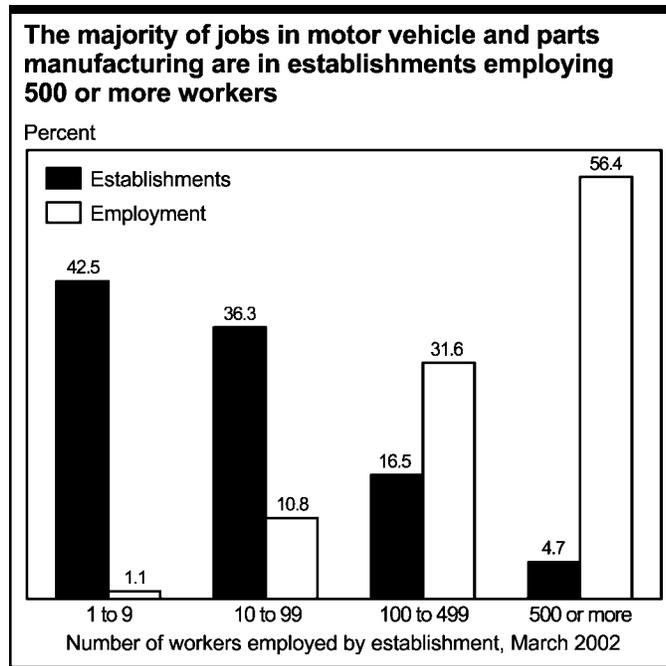
Although motor vehicle and parts manufacturing jobs are scattered throughout the Nation, certain States account for the greatest numbers of jobs. Michigan, for example, accounts for nearly a quarter of all jobs. Combined, Michigan, Ohio, and Indiana include nearly half of all the jobs in this industry. Other States that account for significant numbers of jobs include California, Tennessee, Texas, Kentucky, and Missouri.

Employment is concentrated in a relatively small number of very large establishments. More than half of motor vehicle and parts manufacturing jobs were in establishments employing 500 or more workers (chart). Motor vehicle manufacturing employment in particular is concentrated in large establishments, whereas many motor vehicle parts manufacturing jobs are found in small and medium-sized establishments.

Occupations in the Industry

Prior to assembling components in the manufacturing plant, extensive design, engineering, testing, and production planning go into the manufacture of motor vehicles. These tasks often require years to complete and cost millions of dollars.

Using artistic talent, computers, and information on product use, marketing, materials, and production methods, *commercial and industrial designers* create designs they hope will make the vehicle competitive in the marketplace. Designers use sketches and computer-aided design techniques to create computer models of proposed vehicles. These computer models eliminate the need for physical body mockups in the design process because they give designers complete information on how each piece of the vehicle will work with others. Workers may repeatedly modify and redesign models until the models meet engineering, production, and marketing specifications. Designers working in parts production increasingly collaborate with manufacturers in the initial de-



sign stages to integrate motor vehicle parts into the design specifications for each vehicle.

Engineers—the largest professional occupation in the industry—play an integral role in all stages of motor vehicle manufacturing. They oversee the building and testing of the engine, transmission, brakes, suspension, and other mechanical and electrical components. Using computers and assorted models, instruments, and tools, engineers simulate various parts of the vehicle to determine whether each part meets cost, safety, performance, and quality specifications. *Mechanical engineers* design improvements for engines, transmissions, and other working parts. *Electrical and electronics engineers* design the vehicle's electrical and electronic systems, as well as industrial robot control systems used to assemble the vehicle. *Industrial engineers* concentrate on plant layout, including the arrangement of assembly line stations, material-moving equipment, work standards, and other production matters.

Under the direction of engineers, *engineering technicians* prepare specifications for materials, devise and run tests to ensure product quality, and study ways to improve manufacturing efficiency. For example, testing may reveal how metal parts perform under conditions of heat, cold, and stress, and whether emissions control equipment meets environmental standards. Finally, prototype vehicles incorporating all the components are built and tested on test tracks, on road simulators, and in test chambers that can duplicate almost every driving condition, including crashes.

Computer programmers write detailed instructions for computers, and *computer systems analysts* work with computer systems to improve manufacturing efficiency. After working out the many details involved, computer specialists help put in place the machinery and tools required for assembly line production of the vehicle.

Management workers establish guidelines for the design of motor vehicles to provide direction for the teams of experts in engineering, design, marketing, sales, finance, and production. From the earliest stages of planning and design, these specialists help assess whether the vehicle will satisfy consumer demand, meet safety and environmental regulations, and prove economically practical to make. These executives also serve as public representatives for the company—they are the face of the company.

Industrial production managers oversee *first-line supervisors and managers of production and operating workers*. These supervisors oversee inspectors, precision workers, machine setters and operators, assemblers, fabricators, and plant and system operators. They coordinate a variety of manufacturing processes and production activities, including scheduling, staffing, equipment, quality control, and inventory control.

Production workers account for about 64 percent of motor vehicle and parts manufacturing jobs (table 2). *Assemblers and fabricators* and *metal workers and plastic workers* put together various parts to form subassemblies, and then put the subassemblies together to build a complete motor vehicle. Some may perform other routine tasks such as mounting and inflating tires; adjusting brakes; and adding gas, oil, brake fluid, and coolant. Metal parts are welded, plastic and glass parts are molded and cut, seat cushions are sewn, and many parts are painted. Many

manufacturing processes are highly automated; robots, computers, and programmable devices are an integral part of motor vehicle manufacturing. Throughout the manufacturing process, “statistical process control” (teamwork and quality control) is emphasized. From initial planning and design to final assembly, numerous tests and inspections ensure that vehicles meet quality and safety standards. Modern manufacturing facilities integrate interchangeable tools on the assembly line so that they can quickly be changed to meet the needs of various models and specifications.

Although robots perform most of the welding, *welding, soldering, and brazing workers* still are needed for some welding and for maintenance and repair duties. *Machinists* produce precision metal parts that are made in numbers too small to produce with automated machinery. *Tool and die makers* produce tools, dies, and special guiding and holding devices used in machines. *Computer-controlled machine tool operators* use computer-controlled machines or robots programmed to manufacture parts of different dimensions automatically.

Workers in other production occupations run various machines that produce an array of motor vehicle bodies and parts. These workers set up and operate machines and make adjustments according to their instructions. In computer-controlled systems, they monitor computers controlling the machine processes and may have little interaction with the machinery or materials. Some workers specialize in one type of machine; others operate more than one type.

Grinding and polishing workers use hand tools or hand-held power tools to sand and polish metal surfaces, and *painting workers* paint surfaces of motor vehicles. *Sewing machine operators* sew together pieces of material to form seat covers and other parts.

Throughout the manufacturing process, *inspectors, testers, sorters, samplers, and weighers* ensure that motor vehicles and parts meet quality standards. They inspect raw materials, check parts for defects, check the uniformity of subassemblies, and test drive vehicles. *Helpers* supply or hold materials or tools, and clean work areas and equipment.

Motor vehicle operators and material-moving workers are essential to keeping the plant running smoothly. *Industrial truck and tractor operators* carry components, equipment, and other materials from factory warehouse and outdoor storage areas to assembly areas. *Truckdrivers* carry raw materials to plants, components and materials between plants, and finished motor vehicles to dealerships for sale to consumers. *Laborers and hand freight, stock, and material movers* manually move materials to and from storage areas, loading docks, delivery vehicles, and containers. *Machine feeders* and *offbearers* feed materials into, or remove materials from, machines or equipment on the assembly line, and *hand packers and packagers* manually package or wrap materials.

Workers in construction, installation, maintenance, and repair occupations set up, maintain, and repair equipment. *Electricians* service complex electrical equipment. *Industrial machinery mechanics* and *machinery maintenance workers* maintain machinery and equipment to prevent costly breakdowns and, when necessary, perform repairs. *Millwrights* install and move machinery and heavy equipment according to the factory's lay-

Table 2. Employment of wage and salary workers in motor vehicle and parts manufacturing by occupation, 2002 and projected change, 2002-12
(Employment in thousands)

Occupation	Employment, 2002		Percent change, 2002-12
	Number	Percent	
All occupations	1,152	100.0	2.6
Management, business, and financial occupations	76	6.6	14.7
Top executives	10	0.8	13.4
Industrial production managers	10	0.8	13.5
Professional and related occupations	91	7.9	14.0
Electrical and electronics engineers	2	0.2	10.5
Industrial engineers	17	1.5	23.2
Mechanical engineers	19	0.9	5.2
Drafters, engineering, and mapping technicians	21	1.9	13.0
Commercial and industrial designers	2	0.2	11.0
Office and administrative support occupations	61	5.3	-0.7
Construction and extraction occupations	31	2.7	18.6
Electricians	17	1.5	22.6
Installation, maintenance, and repair occupations	70	6.1	10.0
Automotive service technicians and mechanics	7	0.6	10.3
Industrial machinery mechanics	9	0.8	13.6
Millwrights	9	0.8	-3.8
Production occupations	735	63.9	-1.4
First-line supervisors/managers of production and operating workers	35	3.0	14.6
Electrical and electronic equipment assemblers	12	1.0	-10.6
Engine and other machine assemblers	14	1.2	-6.0
Team assemblers	181	15.7	-8.8
All other assemblers and fabricators	86	7.5	-15.8
Computer-controlled machine tool operators, metal and plastic	13	1.1	6.9
Forming machine setters, operators, and tenders, metal and plastic	15	1.3	-3.4
Machine tool cutting setters, operators, and tenders, metal and plastic	64	5.6	4.1
Machinists	18	1.6	4.4
Molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic	13	1.1	3.8
Multiple machine tool setters, operators, and tenders, metal and plastic	23	2.0	4.5
Tool and die makers	22	1.9	-5.4
Welding, soldering, and brazing workers	54	4.7	13.4
Miscellaneous metalworkers and plastic workers	26	2.3	1.5
Inspectors, testers, sorters, samplers, and weighers	36	3.1	-0.7
Painting workers	15	1.3	12.0
Miscellaneous production workers	61	5.3	-0.1
Transportation and material moving occupations	67	5.8	1.2
Industrial truck and tractor operators	21	1.9	0.4
Laborers and freight, stock, and material movers, hand	23	2.0	-6.3

Note: May not add to totals due to omission of occupations with small employment.

out plans. *Automotive service technicians and mechanics* fix bodies, engines, and other parts of motor vehicles, industrial trucks, and other mobile heavy equipment.

Training and Advancement

Faced with technological advances and the continued need to cut costs, manufacturers increasingly emphasize continuing education and cross-train many workers—that is, they train workers to do more than one job. This has led to a change in the profile of the industry's workers. Standards for new hires are much higher now than in the past. Employers increasingly require at least a high school diploma as the number of unskilled jobs declines. Manual dexterity will continue to be necessary for many production jobs, but employers also look for employees with good communication and math skills, as well as an aptitude for computers, problem-solving, and critical thinking. Because many plants now emphasize the team approach, employees interact more with co-workers and supervisors to determine the best way to get the job done. They are expected to work with much less supervision than in the past and to be responsible for ensuring that their work conforms to guidelines.

Opportunities for training and advancement vary considerably by occupation, plant size, and sector. Training programs in larger auto and light truck assembly plants usually are more extensive than those in smaller parts, truck trailer, and motor home factories. Production workers receive most of their training on the job or through more formal apprenticeship programs. Training normally takes from a few days to several months and may combine classroom with on-the-job training under the guidance of more experienced workers. Attaining the highest level of skill in some production jobs requires several years, however. Training often includes courses in health and safety, teamwork, and quality control. With advanced training and experience, production workers can advance to inspector or more skilled production, craft, operator, or repair jobs.

Skilled production workers—such as tool and die makers, millwrights, machinists, pipefitters, and electricians—normally are hired on the basis of previous experience and, in some cases, a competitive examination. Alternatively, the company may train inexperienced workers in apprenticeship programs that last up to 5 years, and combine on-the-job training with classroom instruction. Typical courses include mechanical drawing, tool designing and programming, blueprint reading, shop mathematics, hydraulics, and electronics. Training also includes courses on health and safety, teamwork, quality control, computers, and diagnostic equipment. With training and experience, workers who excel can advance to become supervisors or managers.

Motor vehicle manufacturers provide formal training opportunities to all workers, regardless of educational background. Manufacturers offer some classes themselves and pay tuition for workers who enroll in colleges, trade schools, or technical institutes. Workers sometimes can get college credit for training received on the job. Subjects of company training courses range from communication skills to computer science. Formal educational opportunities at postsecondary institutions range from courses in English, basic mathematics, electronics, and computer programming languages to work-study programs leading to as-

sociate, bachelor's, and graduate degrees in engineering and technician specialties, management, and other fields.

Earnings

Average weekly earnings of production or nonsupervisory workers in the motor vehicle and parts manufacturing industry are relatively high. At \$1,184 per week, earnings of production workers in establishments that manufacture complete motor vehicles were among the highest in the Nation in 2002. Workers in establishments that make motor vehicle parts averaged \$848 weekly, and those in motor vehicle body and trailer manufacturing earned \$625 per week, compared with \$619 for workers in all manufacturing industries, and \$506 for those in the entire private sector. Earnings in selected occupations in motor vehicle and parts manufacturing appear in table 3.

Table 3. Median hourly earnings of the largest occupations in motor vehicle and parts manufacturing, 2002

Occupation	Motor vehicles and parts	All industries
Industrial engineers	\$30.10	\$29.88
Tool and die makers	25.64	20.54
Maintenance and repair workers, general	19.00	14.12
Inspectors, testers, sorters, samplers, and weighers	16.49	13.01
Welders, cutters, solderers, and brazers	16.02	14.02
Computer-controlled machine tool operators, metal and plastic	13.08	13.97
Laborers and freight, stock, and material movers, hand	13.03	9.48
Molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic	13.01	11.17
Engine and other machine assemblers	12.45	14.02
Team assemblers	12.36	10.90

These hourly earnings may increase during overtime or special shifts. Workers generally are paid 1-1/2 times their normal wage rate for working more than 8 hours a day or 40 hours a week, or for working on Saturdays. They may receive double their normal wage rate for working on Sundays and holidays. The largest manufacturers and suppliers often offer other benefits, including paid vacations and holidays; life, accident, and health insurance; education allowances; nonwage cash payment plans, such as performance and profit-sharing bonuses; and pension plans. Some laid-off workers in the motor vehicle and parts manufacturing industry have access to supplemental unemployment benefits, which can provide them with nearly full pay and benefits for up to 3 years, depending on the worker's seniority.

In 2002, about a third of workers in motor vehicle and parts production were union members or were covered by union contracts, more than double the proportion of workers in all industries. A greater proportion of workers in motor vehicle production were members of unions than in parts production. The primary union in the industry is the United Automobile, Aerospace, and Agricultural Implement Workers of America, also known as the United Auto Workers (UAW). Nearly all produc-

tion workers in motor vehicle assembly plants, and most in motor vehicle parts plants, are covered by collective bargaining agreements negotiated by the UAW. Other unions—including the International Association of Machinists and Aerospace Workers, the United Steelworkers of America, and the International Brotherhood of Electrical Workers—cover certain plant locations or specified trades in the industry.

Outlook

Overall wage and salary employment in the motor vehicle and parts manufacturing industry is expected to increase 3 percent over the 2002-12 period, compared with 16 percent for all industries combined. Job loss in motor vehicle manufacturing will be more than offset by gains in firms manufacturing motor vehicle parts, bodies, and trailers. Employment is expected to decline by 6 percent in motor vehicle manufacturing, but increase by 4 percent in motor vehicle parts manufacturing and 12 percent in motor vehicle body and trailer manufacturing.

In addition to job openings due to growth in firms manufacturing motor vehicle parts, bodies, and trailers, the need to replace workers who retire or transfer to jobs in other industries will also generate job openings. Not all of the motor vehicle manufacturing workers who leave jobs in the industry will be replaced, and many of the new workers will be hired for occupations different from those vacated by departing employees.

Employment in the motor vehicle and parts manufacturing industry is expected to grow with demand for motor vehicles and parts, but jobs will be lost due to downsizing and productivity increases. The growing intensity of international and domestic competition has increased cost pressures on manufacturers. In response, they have sought to improve productivity and quality through the application of high-technology production techniques, including robots, computers, and programmable equipment. Increasing productivity should mostly offset the increasing output of the motor vehicle and parts manufacturing industry, resulting in slow job growth. In addition, the industry is increasingly turning to contract employees in an effort to reduce costs. Contract workers are less costly to hire and lay off than permanent employees; contract jobs also serve as a screening tool for candidates for permanent jobs that are more complex and require more skills.

Growth in demand for domestically manufactured motor vehicles could be limited by a number of factors. A slowdown in the growth of the driving-age population, as the smaller post baby-boom generation comes of age may curb demand for cars and trucks. Also, foreign motor vehicle and parts producers will continue to control a substantial share of the U.S. market and, should they increasingly meet demand with imported vehicles and parts instead of products manufactured in U.S. transplant factories, domestic motor vehicle and parts output would be lower. Other factors that may limit growth of domestic motor vehicle production include improvements in vehicle quality and durability, which extend longevity, and more stringent safety and environmental regulations, which increase the cost of producing and operating motor vehicles.

Employment in motor vehicle and parts manufacturing is highly sensitive to cyclical swings in the economy. During periods of

economic prosperity, consumers are more willing and able to purchase expensive goods such as motor vehicles, which may require large down payments and extended loan payments. During recessions, however, consumers are more likely to delay such purchases. Motor vehicle manufacturers respond to these changes in demand by hiring or laying off workers.

Expanding factory automation, robotics, efficiency gains, and the need to cut costs are expected to keep employment from growing as fast as output. The movement towards efficiency and automation will force employment declines in assembler and fabricator occupations. Employment of office and administrative support workers will decline due to expanding office and warehouse automation. Automation and continued global competition, however, are expected to produce job growth for engineers, industrial production managers, business operations specialists, and computer specialists. These workers will increasingly be relied upon for further innovation in reducing costs and enhancing competitive advantage.

Sources of Additional Information

Information on employment and training opportunities in the motor vehicle and parts manufacturing industry is available from local offices of the State employment service, employment of-

fices of motor vehicle and parts manufacturing firms, and locals of the unions mentioned above.

Detailed information on most occupations in this industry, including the following, appears in the 2004-05 edition of the *Occupational Outlook Handbook*:

- Designers
- Drafters
- Electricians
- Engineering technicians
- Engineers
- Industrial production managers
- Inspectors, testers, sorters, samplers, and weighers
- Machine setters, operators, and tenders—metal and plastic
- Machinists
- Material moving occupations
- Material recording, scheduling, dispatching, and distributing occupations
- Painting and coating workers, except construction and maintenance
- Tool and die makers
- Welding, soldering, and brazing workers