



Important Skill Sets for Advanced Technology Career Pathways

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INTRODUCTION

One of the CACT CTE Hub Director's tasks is to align K-12 and community colleges in creating advanced technology (AT) career pathways. To do this, it's beneficial to understand the important skill sets needed for such positions.

If we can teach students skill sets which are common across many different types of jobs and industries, then this will give students more flexibility in choosing their careers – thus helping to ensure they have a wide range of opportunities. Such “Flex skills” help make it possible for a student to choose a career path later in their education, while still building a core knowledge set for their jobs or for community college courses.

For instance, knowing how to read an engineering drawing, how to troubleshoot a problem, or how to do basic quality control are important to a wide-range of advanced technology careers – and thus allow students to enter into a number of different career paths with those core skills.

Research Objective

The objective for this research is to understand the needed skill sets in California for advanced technology careers. To do this, I have used community college and economic development resources to compile findings about economic trends, new and emerging technologies & industry skills relevant to California. At the end of this report, I list skill sets which I believe should be explored for incorporation into career pathway courses in K-12, and in community colleges.

PROCESS

To gather information about important skill sets, I used three different approaches.

- 1) Analyzed California job growth in CACT-related OCCUPATIONS that require significant on-the-job training or up to a 2-year degree. Looked for job clusters that have similar attributes to determine the common skill sets applicable to those jobs.
- 2) Analyzed California job growth in CACT-related INDUSTRIES. Used industry growth trends to indicate additional skill sets that might not have been covered in the Occupations category.
- 3) Looked at new and emerging trends / technologies (e.g., solar, wind, nanotech, etc.) and other industry trends (e.g., Six Sigma, lean manufacturing) – made assessments on what additional skill sets will be important to future California companies based on these trends and emerging technologies.

This analysis will help in developing career pathways which cover the important skills needed by the future California workforce.

1) Occupations

The SOC data (see Figure 1 below) shows the top growth jobs in California in the AT area which require an associates degree, vocational education, or significant OTJ training.¹

Figure 1: California Growth in Advanced Technology Jobs

SOC 17-xxx, 51-xxxx, 49-9041 to 49-9044; Jobs requiring 2 year degrees or significant OTJ training
2006 – 2016, Sorted by annual total job growth

<http://www.labormarketinfo.edd.ca.gov/?PageID=145>

SOC Code	Occupational Title	2006 Employment	Annual Total job growth (2006 – 2016) ²	Median Annual Income	Education & Training Levels ³
49-9042	Maintenance and Repair Workers, General	133,000	1,960	\$36,601	9
51-4121	Welders, Cutters, Solderers, and Brazers	31,200	1,080	\$33,056	7
51-4041	Machinists	32,500	850	\$37,358	9
17-3023	Electrical and Electronic Engineering Technicians	23,000	680	\$57,683	6
49-9041	Industrial Machinery Mechanics	14,200	540	\$50,438	9
17-3011	Architectural and Civil Drafters	18,100	520	\$51,386	7
17-3029	Engineering Technicians, Except Drafters, All Other	12,000	420	\$56,914	6
17-3026	Industrial Engineering Technicians	6,500	290	\$53,991	6
17-3022	Civil Engineering Technicians	8,400	240	\$58,401	6
17-3027	Mechanical Engineering Technicians	6,000	180	\$51,786	6
51-9141	Semiconductor Processors	9,400	160	\$35,900	6
	TOTALS	294,300	6,920		

This shows some clustering of job types in the following areas (in order of descending education levels):

<i>Job Types</i>	<i>Annual New Jobs</i>
1) Technician (electronic, mechanical, and others)	2,350
2) Drafters	520
3) Welders	1,080
4) Machinists	850
5) <u>Mechanics, Maintenance and machinery repair</u>	<u>2,500</u>
TOTAL	6,920

¹ Thanks to John Carrese and the Center of Excellence for help with data collecting and their environmental scans.

² Total jobs in these categories in 2016 is estimated at 327,500. Adding the estimated 35,000 job replacements needed in these categories, this gives a total job growth of 69,200 jobs, or 6,920 per year. As a point of reference, there were 423,000 seniors in the state of California in 2006, in approximately 1300 high schools. Another point of reference, estimated nursing jobs in 2017 is 307,000, a change of 60,000 from 2007. Adding in replacements, nursing will have a total job growth of 99,000 during that 10-year period.

³ Occupational training and education classifications were developed by the Bureau of Labor Statistics (BLS). For more information on the classifications, please see the BLS Training Definitions at: <http://www.labormarketinfo.edd.ca.gov/?PAGEID=172>

- 1 - First Professional Degree - LLD/MD
- 2 - Doctoral Degree
- 3 - Master's Degree
- 4 - Bachelor's Degree or Higher and Some Work Experience
- 5 - Bachelor's Degree
- 6 - Associate Degree**
- 7 - Post-Secondary Vocational Education**
- 8 - Work Experience in a Related Occupation**
- 9 - Long-Term On-the-Job Training**
- 10 - Moderate-Term On-the-Job Training
- 11 - Short-Term On-the-Job Training

While mechanics, maintenance, and repair workers are the highest growth cluster in our dataset (2500 annual new jobs estimated), they are also on the lower-end of the educational level for the jobs we are considering (requiring long-term OTJ training vs. an associates degree for a technician). Interestingly, though, mechanics are at the higher end of the pay scale (\$50,000 median)⁴.

Skill sets for these job types

Technicians require a range of skills, and depending on the industry and company, will require specialization in different areas. However, there are core skills for technicians, such as knowledge of computers, ability to use test equipment, ability to read drawings and schematics and the ability to repair equipment (soldering being an important skill). Softer skills around troubleshooting, problem solving, design, and basic understanding of different manufacturing processes are also important.

Drafters need skills in computer aided drafting (CAD) approaches, as well as specific knowledge of different software (e.g., Solidworks, ProE, AutoCAD, etc.) depending on the industry and company. In addition, they need skills in reading (and creating) drawings, GD&T (geometric dimensioning and tolerancing), PDM (product data management), and basic understanding of manufacturing processes.

Welders and machinists are more specialized and require specific skills in welding and machining. At a common level, though, they both need to be able to read drawings, troubleshoot, have materials knowledge, and do various levels of quality control – depending on the industry and products.

Mechanics and maintenance employees will have an aptitude for working on machines, and skill sets around basic electronics, troubleshooting, working with electronic and test equipment, and reading drawings.

2) Industry

Using the CA EDD NAICs database, I looked at what industries (e.g., medical devices, food manufacturing) were growing in manufacturing (NAICs 31-33). The top job growth industries are shown in Figure 2 below.

⁴ Industrial machinery mechanics might be the type of job that interests students involved in automotive mechanics. While the skill sets are different, there's still a lot of overlap, and the type of person who likes to get underneath a car, troubleshoot, and do repairs might be interested in this career.

Figure 2: California Manufacturing Industry Employment (NAICs 31-33) ⁵

2006 – 2016, Sorted by “# of New Jobs”

<http://www.labormarketinfo.edd.ca.gov/?PageID=145>

NAICs	INDUSTRY	2006 Employment ⁶	2016 est. Employment	# of New Jobs ⁷	% Change
3254	Pharmaceutical and Medicine Manufacturing	44,900	56,100	11,200	24.9
312	Beverage and Tobacco Product Manufacturing	41,800	51,200	9,400	22.5
3391	Medical Equipment and Supplies Manufacturing	48,300	54,600	6,300	13.0
327	Nonmetallic Mineral Product Manufacturing	47,400	52,100	4,700	9.9
3115	Dairy Product Manufacturing	16,800	20,600	3,800	22.6
	Machine Shops, Turned Product, and Screw, Nut and Bolt Manufacturing	41,600	45,200	3,600	8.7
3327	Manufacturing	41,600	45,200	3,600	8.7
3119	Other Food Manufacturing	21,400	24,900	3,500	16.4
3323	Architectural and Structural Metals Manufacturing	37,600	40,300	2,700	7.2
3116	Animal Slaughtering and Processing	20,300	21,600	1,300	6.4
3342	Communications Equipment Manufacturing	27,400	28,600	1,200	4.4
	Veneer, Plywood, and Engineered Wood Product Manufacturing	7,000	8,100	1,100	15.7
3212	Residual-Agriculture, Construction and Mining Machinery Mfg (includes 3331,3334)	11,600	12,600	1,000	8.6
3364	Aerospace Product and Parts Manufacturing	72,800	73,700	900	1.2
	Residual-Iron and Steel Mills and Feralloy (includes 3311-3312,3314-3315)	19,000	19,800	800	4.2
3399	Other Miscellaneous Manufacturing	41,200	42,000	800	1.9
3343	Audio and Video Equipment Manufacturing	7,700	8,400	700	9.1
3361	Motor Vehicle Manufacturing	8,700	9,400	700	8.0
	Residual-Other Chemical Prods and Prep Mfg (includes 3251-3253,3255,3259)	27,600	28,300	700	2.5
3335	Metalworking Machinery Manufacturing	13,600	14,200	600	4.4
	Residual-Other Transportation Equipment Manufacturing (includes 3362,3365,3369)	17,000	17,400	400	2.4
3151	Apparel Knitting Mills	4,200	4,600	400	9.5
3219	Other Wood Product Manufacturing	23,600	23,900	300	1.3
	Engine, Turbine, and Power Transmission Equipment Manufacturing	5,800	6,100	300	5.2
3336	Manufacturing	5,800	6,100	300	5.2
	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	12,500	12,800	300	2.4
3256	Manufacturing	12,500	12,800	300	2.4
	Residual-Animal Food Manufacturing (includes 3111-3112,3117)	10,600	10,800	200	1.9
3329	Other Fabricated Metal Product Manufacturing	17,500	17,600	100	0.6
	Residual-Other Furniture Related Product Manufacturing (includes 3372,3379)	19,200	19,300	100	0.5
3159	Apparel Accessories and Other Apparel Manufacturing	4,000	4,100	100	2.5
3221	Pulp, Paper. and Paperboard Mills	3,000	2,900	-100	-3.3
3332	Industrial Machinery Manufacturing	15,400	15,200	-200	-1.3

⁵ One thing to note about the NAICs data – the “# of new jobs” indicates growth in the total jobs, but does not account for job replacements (workers who retire or leave the industry). Because of this, the number of new workers required for these industries will actually be higher than the “# of new jobs” shown. Even industries showing a decrease in the number of employees might need to hire new workers because of retirees and other leaving the industry.

⁶ For comparison purposes, there were 17.3 million employed in 2007 in California, and 1.48 million in manufacturing (8.6% of total). This is down from 1.5 million in 2006. Despite this, the long-term forecast is for manufacturing employment to remain relatively steady around 1.5 million up until 2016.

⁷ Clicking on the “# of New Jobs” quantities for some industries will link you to the EDD website showing job information by *occupation* for that industry. Note that the information on that EDD site is for 2014 data estimates. Also, it does not include all occupations for those industries due to the data collection method used. Because of this, the numbers will not add up to the “# of new jobs” and may be glaring in the differences. The links are there to provide general information on typical job types associated with that industry.

3313	Alumina and Aluminum Production	6,300	6,000	-300	-4.8
3346	Manufacturing and Reproducing Magnetic and Optical Media	8,000	7,700	-300	-3.8
3113	Sugar and Confectionery Product Manufacturing	7,900	7,600	-300	-3.8
316	Leather and Allied Product Manufacturing	3,900	3,600	-300	-7.7
3211	Sawmills and Wood Preservation	6,900	6,400	-500	-7.2
	Residual-Forging and Stamping Mfg. (includes 3321-3322,3324-3326)	27,600	27,100	-500	-1.8
3366	Ship and Boat Building	9,400	8,900	-500	-5.3
3328	Coating, Engraving, Heat Treating, and Allied Activities	17,900	17,300	-600	-3.4
3262	Rubber Product Manufacturing	7,100	6,400	-700	-9.9
313	Textile Mills	12,600	11,800	-800	-6.3
3222	Converted Paper Product Manufacturing	24,700	23,900	-800	-3.2
3333	Commercial and Service Industry Machinery Manufacturing	15,500	14,600	-900	-5.8
3363	Motor Vehicle Parts Manufacturing	20,000	18,800	-1,200	-6.0
3371	Household and Institutional Furniture Manufacturing	38,200	36,900	-1,300	-3.4
3118	Bakeries and Tortilla Manufacturing	40,500	39,000	-1,500	-3.7
	Electrical Equipment, Appliance, and Component Manufacturing	32,100	30,300	-1,800	-5.6
335	Textile Product Mills	14,100	12,300	-1,800	-12.8
3339	Other General Purpose Machinery Manufacturing	18,700	16,800	-1,900	-10.2
324	Petroleum and Coal Products Manufacturing	14,600	12,600	-2,000	-13.7
3261	Plastics Product Manufacturing	48,900	46,500	-2,400	-4.9
	Fruit and Vegetable Preserving and Specialty Food Manufacturing	33,500	30,700	-2,800	-8.4
3114	Navigation, Measuring, Electromedical, and Control Instruments Manufacturing	106,000	102,100	-3,900	-3.7
3345	Printing and Related Support Activities	59,300	52,800	-6,500	-11.0
323	Computer and Peripheral Equipment Manufacturing	58,300	51,100	-7,200	-12.3
3341	Semiconductor and Other Electronic Component Manufacturing	113,000	104,800	-8,200	-7.3
3344	Cut and Sew Apparel Manufacturing	69,900	50,700	-19,200	-27.5

While it's difficult to generalize skills across a whole industry, there are a couple of growing industries that have skill sets which merit adding to those discussed in the occupations section.

Food Manufacturing

One area of high growth is indicated in food-related manufacturing (NAICs 312⁸, 3115, 3119). The 17,000+ jobs estimated to be created in this area is a trend to watch.

Many food manufacturing companies use automated manufacturing technology – and because of this they will need well-trained technicians and operators to run the equipment. In addition, the food industry is regulated by the FDA, so training and education in these areas should include information about FDA regulations (e.g., FDA HACCP & GMP) and other industry-specific standards and equipment.

Knowledge of various food manufacturing processes might also be beneficial to employees involved with design, manufacturing, and maintenance of food-service machinery and processes.

Pharmaceutical and Medical Device Manufacturing

Another high growth industry (17,000+ jobs) involves manufacturing of medically-related products (NAICs 3254, 3391). While the pharmaceutical industry jobs are heavily tilted towards

⁸ Unfortunately the 312 code also includes “tobacco manufacturing”, and so the specific data around beverage manufacturing wasn't available.



4-year degrees, due to the size of the industry, there are still a large number of jobs for technicians, maintenance personnel, and production workers. For medical devices, there will also be a need for technicians and maintenance personnel.

These industries are also regulated, and have strict FDA standards for both the design and manufacturing of the products. Knowledge of, or at least awareness of, these FDA standards is beneficial to practically every employee.

Both the food and medical industries also have manufacturing environments that range from very clean to sterile, and basic understanding of how to work in these environments is an important skill to have.

While there are certainly other industries that we can look to for additional needed skill sets, the high-growth in these two, coupled with their high industry margins make them important to focus on.

3) TRENDS / TECHNOLOGIES

Another approach to assessing potential skill sets is to look at emerging trends and technologies (T&T). By looking at Center of Excellence environmental scans, talking with CACT directors, reading trade publications, and using my knowledge of the manufacturing industry, I've listed some of major trends and technologies which are relevant to California industry.

For each of these T&T's, I have listed beneficial skills that are beyond the basic skill sets (math, writing, basic computer knowledge, etc.) and are useful to many different jobs in those fields. While certainly not every job in that area would require the particular skill(s) listed, they are ones which might be beneficial for a large number of jobs.

TRENDS / TECHNOLOGIES	Beneficial SKILLS ⁹
Nanotech	Semiconductor processes
MEMS	Semiconductor processes
Solar cells	Semiconductor processes, Understanding electrical systems
Solar installation	Electrical & construction
Hybrid & electric cars	Understanding electrical systems
Energy efficiency	Troubleshooting, Understanding electrical and building systems
Sustainable Design	ISO standards, Life-cycle analysis
Automation	Mechatronics, robotics, electrical systems, computer programming
Composites	Knowledge of composite processing (including repair techniques)
Mass customization	Dealing with complexity, Understanding logistics
Lean manufacturing	Statistics, problem solving
6 sigma	Statistics, problem-solving, scientific method
Increased supply chain complexity	Dealing with complexity, Understanding logistics & inventory flow
Design services	CAD, Design processes, Understanding manufacturing processes
Logistics	Dealing with complexity, Understanding logistics & inventory flow

⁹ These are skills that are beyond the basics - such as math, writing, basic computer knowledge, etc. – and that are generally applicable across these trends and technologies.



SUMMARY

In developing K-12 career pathways in advanced technology, it will be important to give students skill sets which can be useful in multiple pathways. In addition to specialized courses such as machining or welding, we can also start to look at adding more generalized skill training that will be useful in a number of pathways.

Below are some important skill sets which can be used across a number of high-growth, well-paying careers – as discussed in the previous sections.

1. Troubleshooting & problem solving (while this is basically the scientific method, there are tools such as basic statistics, Fishbone diagrams, histograms, flow charts, etc. which can be taught in a contextualized setting related to advanced technology)
2. Reading drawings
3. Using test equipment (e.g., ohm-meter)
4. Understanding different types of manufacturing processes (e.g., machining, semiconductor processes)
5. Understanding electricity and electrical systems
6. Understanding quality control (which might include some basic statistics)
7. Equipment repair (including soldering, basic machining)
8. Understanding regulations and their effects on industry (e.g., paperwork). Specifically, FDA food, pharmaceutical, and medical device regulations are of interest – as well as sustainable design standards (LEEDS, ISO 14040).
9. Experience working in cleanroom-type environments can be beneficial.
10. Understanding supply chain and logistics

There are certainly others skill sets, which will be added to this list as we progress – and we should look closely at all of these to determine if, and how, they might be incorporated into K-14 career pathways to ensure students are properly prepared for the widest range of opportunities.

We could look at building many of these into existing classes, or even attempt to build a stand-alone elective course that incorporates many of these concepts and the concepts in the California CTE Standards into a cohesive Introduction to Manufacturing class.



APPENDICES



REFERENCE MATERIAL

COE Environmental Scans (my thanks to John Carrese for his assistance).
http://www.coeccc.net/Environmental_Scans/Mfg_Scan_LA_06.pdf

NAICS codes
<http://www.census.gov/naics/2007/NAICOD07.HTM>

BLS Standard Occupational Codes
http://www.bls.gov/soc/soc_majo.htm

Career Voyages
<http://www.careervoyages.gov/advmanufacturing-main.cfm>

Future of Manufacturing in California
<http://www.baybio.org/pdf/CAManufacturingReport8.pdf>

VTEA Best Practices
http://www.vteabp.org/reports_cpk/Manufacturing_Occupations_in_California_High_Wage_High_Demand.pdf

Biotech Companies in California
<http://www.thelabrat.com/jobs/companies/BiotechCalifornia.shtml>

Energy Efficiency Scan
http://www.coeccc.net/Environmental_Scans/Energy_AtAG_SF_07.pdf

EDD Reports
http://www.labor.ca.gov/panel/pdf/Draft_2008_Bay_Area_Economic_Profile_090908.pdf
http://www.labor.ca.gov/panel/pdf/Draft_2008_California_Economic_Profile_%20090908.pdf
http://www.labor.ca.gov/panel/pdf/DRAFT_Green_Economy_031708.pdf

National Council for Advanced Manufacturing
<http://www.nacfam.org/downloads/MfgCompModel.pdf>

California CTE Standards
<http://www.cde.ca.gov/ci/ct/sf/documents/ctestandards.pdf>

California CTE Standards (Engineering & Design)
http://www.cteonline.org/standards/index.cfm?Action=browse&DrillDown=2&Level_Key=164&L1_Key=164&L0_Key=34&lKey=&actK=&currK=&step=stand&ChallengeSTand=#stand

California CTE Standards (Manufacturing & Product Development)
http://www.cteonline.org/standards/index.cfm?Action=browse&DrillDown=2&Level_Key=170&L1_Key=170&L0_Key=34&lKey=&actK=&currK=&step=stand&ChallengeSTand=#stand

2005 NAM Skills Gap Report
http://www.nam.org/~media/Files/s_nam/docs/235800/235731.pdf.ashx



**California Advanced Technology Job Openings
(SOC's 17-xxxx, 51-xxxx, 49-904 to 49-9044)
Years 2006 – 2016
(sorted by “Annual Weighted Impact”)**

SOC Code	Occupational Title	2006	2016	Chg	Annual New Jobs	Annual Net Replacements [1]	New workers needed annually [2]	Median Annual [3]	Educational Training Levels [5]	Annual Weighted impact (new workers x median annual salary)
51-1011	First-Line Supervisors/Managers of Production and Operating Workers	65,800	69,000	3,200	320	1,100	1,420	\$50,863	8	\$72,225,460
49-9042	Maintenance and Repair Workers, General	133,000	149,300	16,300	1,630	330	1,960	\$36,601	9	\$71,737,960
51-2092	Team Assemblers	97,700	104,500	6,800	680	2,030	2,710	\$23,536	10	\$63,782,560
51-9199	Production Workers, All Other	44,100	54,600	10,500	1,050	910	1,960	\$22,955	10	\$44,991,800
17-3023	Electrical and Electronic Engineering Technicians	23,000	25,300	2,300	230	450	680	\$57,683	6	\$39,224,440
51-4121	Welders, Cutters, Solderers, and Brazers	31,200	35,400	4,200	420	660	1,080	\$33,056	7	\$35,700,480
51-4041	Machinists	32,500	36,000	3,500	350	500	850	\$37,358	9	\$31,754,300
51-9198	Helpers--Production Workers	45,900	49,600	3,700	370	1,130	1,500	\$20,203	11	\$30,304,500
49-9041	Industrial Machinery Mechanics	14,200	17,200	3,000	300	240	540	\$50,438	9	\$27,236,520
17-3011	Architectural and Civil Drafters	18,100	17,700	-400	0	520	520	\$51,386	7	\$26,720,720
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	49,200	49,700	500	50	730	780	\$31,619	10	\$24,662,820
51-9111	Packaging and Filling Machine Operators and Tenders	47,200	49,200	2,000	200	880	1,080	\$22,496	11	\$24,295,680
17-3029	Engineering Technicians, Except Drafters, All Other	12,000	13,900	1,900	190	230	420	\$56,914	6	\$23,903,880
51-7011	Cabinetmakers and Bench Carpenters	17,800	19,100	1,300	130	530	660	\$29,091	9	\$19,200,060
51-2099	Assemblers and Fabricators, All Other	32,400	33,500	1,100	110	670	780	\$24,402	10	\$19,033,560
51-5023	Printing Machine Operators	20,900	21,600	700	70	460	530	\$32,720	10	\$17,341,600
51-8031	Water and Liquid Waste Treatment Plant and System Operators	8,300	9,900	1,600	160	150	310	\$53,371	9	\$16,545,010
17-3026	Industrial Engineering Technicians	6,500	8,100	1,600	160	130	290	\$53,991	6	\$15,657,390
17-3022	Civil Engineering Technicians	8,400	9,200	800	80	160	240	\$58,401	6	\$14,016,240

51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	21,400	20,400	-1,000	0	510	510	\$26,563	10	\$13,547,130
51-6011	Laundry and Dry-Cleaning Workers	20,000	22,300	2,300	230	450	680	\$19,459	10	\$13,232,120
51-9012	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	6,400	7,600	1,200	120	150	270	\$44,809	10	\$12,098,430
51-2022	Electrical and Electronic Equipment Assemblers	25,000	20,400	-4,600	0	430	430	\$27,134	11	\$11,667,620
51-6031	Sewing Machine Operators	53,600	44,700	-8,900	0	520	520	\$18,470	10	\$9,604,400
51-8013	Power Plant Operators	2,800	3,200	400	40	100	140	\$67,886	9	\$9,504,040
17-3027	Mechanical Engineering Technicians	6,000	6,600	600	60	120	180	\$51,786	6	\$9,321,480
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	5,400	5,400	0	0	150	150	\$61,597	9	\$9,239,550
51-7042	Woodworking Machine Setters, Operators, and Tenders, Except Sawing	8,600	9,800	1,200	120	220	340	\$24,545	10	\$8,345,300
51-8021	Stationary Engineers and Boiler Operators	4,800	5,400	600	60	80	140	\$58,610	9	\$8,205,400
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	10,400	11,800	1,400	140	120	260	\$31,242	10	\$8,122,920
51-9023	Mixing and Blending Machine Setters, Operators, and Tenders	10,300	11,400	1,100	110	170	280	\$28,673	10	\$8,028,440
51-9122	Painters, Transportation Equipment	7,100	7,600	500	50	140	190	\$40,956	10	\$7,781,640
51-9195	Molders, Shapers, and Casters, Except Metal and Plastic	9,300	10,200	900	90	210	300	\$24,871	10	\$7,461,300
17-3019	Drafters, All Other	3,400	3,800	400	40	100	140	\$52,720	7	\$7,380,800
17-3013	Mechanical Drafters	3,900	4,200	300	30	110	140	\$51,407	7	\$7,196,980
17-3031	Surveying and Mapping Technicians	4,100	4,600	500	50	80	130	\$54,801	10	\$7,124,130
51-9081	Dental Laboratory Technicians	5,900	6,700	800	80	110	190	\$36,940	9	\$7,018,600
51-2041	Structural Metal Fabricators and Fitters	8,000	8,600	600	60	140	200	\$34,616	10	\$6,923,200
17-3012	Electrical and Electronics Drafters	3,900	4,100	200	20	110	130	\$52,350	7	\$6,805,500
51-4072	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	11,900	11,300	-600	0	280	280	\$22,374	10	\$6,264,720
51-9141	Semiconductor Processors	9,400	8,800	-600	0	160	160	\$35,900	6	\$5,744,000

51-8099	Plant and System Operators, All Other	2,600	2,800	200	20	70	90	\$63,187	9	\$5,686,830
51-9196	Paper Goods Machine Setters, Operators, and Tenders	7,200	7,100	-100	0	170	170	\$31,303	10	\$5,321,510
51-7041	Sawing Machine Setters, Operators, and Tenders, Wood	4,700	5,500	800	80	100	180	\$28,958	10	\$5,212,440
17-3025	Environmental Engineering Technicians	2,700	3,200	500	50	50	100	\$49,366	6	\$4,936,600
51-9121	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	9,500	9,200	-300	0	190	190	\$25,931	10	\$4,926,890
51-2023	Electromechanical Equipment Assemblers	10,200	9,800	-400	0	170	170	\$28,704	11	\$4,879,680
51-4111	Tool and Die Makers	4,600	5,000	400	40	60	100	\$46,929	9	\$4,692,900
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	2,700	2,900	200	20	60	80	\$56,724	9	\$4,537,920
51-6052	Tailors, Dressmakers, and Custom Sewers	6,400	7,100	700	70	110	180	\$25,167	9	\$4,530,060
49-9043	Maintenance Workers, Machinery	4,800	5,100	300	30	80	110	\$40,527	9	\$4,457,970
51-4193	Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic	5,400	5,600	200	20	160	180	\$24,423	10	\$4,396,140
51-9132	Photographic Processing Machine Operators	5,300	2,800	-2,500	0	190	190	\$22,751	11	\$4,322,690
51-5022	Prepress Technicians and Workers	6,600	5,600	-1,000	0	100	100	\$40,008	9	\$4,000,800
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	4,200	4,700	500	50	80	130	\$28,826	10	\$3,747,380
49-9044	Millwrights	2,000	2,400	400	40	30	70	\$52,929	9	\$3,705,030
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	4,400	4,500	100	10	120	130	\$27,705	10	\$3,601,650
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	5,600	5,200	-400	0	110	110	\$31,670	10	\$3,483,700
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	2,900	3,300	400	40	60	100	\$32,394	10	\$3,239,400
51-9131	Photographic Process Workers	3,600	2,300	-1,300	0	120	120	\$25,697	10	\$3,083,640
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	12,000	12,000	0	0	120	120	\$25,483	10	\$3,057,960

51-9022	Grinding and Polishing Workers, Hand	6,900	7,100	200	20	110	130	\$23,138	10	\$3,007,940
51-6093	Upholsterers	6,800	6,600	-200	0	110	110	\$26,950	9	\$2,964,500
51-9071	Jewelers and Precious Stone and Metal Workers	5,700	5,800	100	10	100	110	\$26,359	7	\$2,899,490
51-9041	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders	5,200	5,400	200	20	100	120	\$24,096	10	\$2,891,520
51-8092	Gas Plant Operators	1,000	1,100	100	10	30	40	\$71,627	9	\$2,865,080
51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders	5,900	6,100	200	20	90	110	\$25,768	10	\$2,834,480
17-3024	Electro-Mechanical Technicians	2,200	2,300	100	10	40	50	\$53,622	6	\$2,681,100
51-7021	Furniture Finishers	4,300	4,600	300	30	80	110	\$22,883	9	\$2,517,130
51-6092	Fabric and Apparel Patternmakers	2,300	2,000	-300	0	50	50	\$49,966	9	\$2,498,300
51-8091	Chemical Plant and System Operators	1,400	1,400	0	0	40	40	\$58,630	9	\$2,345,200
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	2,100	1,800	-300	0	70	70	\$33,352	10	\$2,334,640
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	2,500	2,800	300	30	50	80	\$28,479	10	\$2,278,320
51-9083	Ophthalmic Laboratory Technicians	2,100	2,400	300	30	40	70	\$30,732	10	\$2,151,240
51-4012	Numerical Tool and Process Control Programmers	1,900	2,100	200	20	20	40	\$51,505	9	\$2,060,200
51-9082	Medical Appliance Technicians	1,300	1,600	300	30	30	60	\$34,035	9	\$2,042,100
51-6063	Textile Knitting and Weaving Machine Setters, Operators, and Tenders	3,100	3,200	100	10	90	100	\$19,326	9	\$1,932,600
51-2031	Engine and Other Machine Assemblers	2,200	2,300	100	10	50	60	\$31,935	11	\$1,916,100
51-6021	Pressers, Textile, Garment, and Related Materials	12,300	12,400	100	10	90	100	\$18,979	11	\$1,897,900
51-9011	Chemical Equipment Operators and Tenders	1,800	1,800	0	0	40	40	\$47,153	10	\$1,886,120
51-7099	Woodworkers, All Other	2,800	3,000	200	20	60	80	\$22,353	10	\$1,788,240
51-9031	Cutters and Trimmers, Hand	6,200	6,100	-100	0	90	90	\$19,795	11	\$1,781,550
51-6062	Textile Cutting Machine Setters, Operators, and Tenders	2,600	2,300	-300	0	90	90	\$19,224	10	\$1,730,160
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	3,000	2,700	-300	0	60	60	\$28,683	10	\$1,720,980

51-9051	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders	1,900	2,000	100	10	50	60	\$28,377	10	\$1,702,620
51-2091	Fiberglass Laminators and Fabricators	2,700	2,700	0	0	60	60	\$27,888	10	\$1,673,280
51-5011	Bindery Workers	4,900	4,100	-800	0	70	70	\$23,729	10	\$1,661,030
51-5021	Job Printers	4,100	4,100	0	0	40	40	\$39,406	9	\$1,576,240
51-9191	Cementing and Gluing Machine Operators and Tenders	2,100	2,100	0	0	60	60	\$25,136	10	\$1,508,160
51-9021	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders	3,200	3,100	-100	0	50	50	\$28,734	10	\$1,436,700
51-9123	Painting, Coating, and Decorating Workers	2,300	2,400	100	10	50	60	\$22,058	11	\$1,323,480
51-9192	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders	2,100	2,100	0	0	60	60	\$21,568	10	\$1,294,080
51-6061	Textile Bleaching and Dyeing Machine Operators and Tenders	3,900	3,600	-300	0	60	60	\$19,999	10	\$1,199,940
17-3021	Aerospace Engineering and Operations Technicians	1,100	1,100	0	0	20	20	\$59,713	6	\$1,194,260
51-4199	Metal Workers and Plastic Workers, All Other	2,600	2,200	-400	0	40	40	\$29,825	10	\$1,193,000
51-6051	Sewers, Hand	3,100	3,000	-100	0	50	50	\$20,182	11	\$1,009,100
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	2,600	2,400	-200	0	30	30	\$33,178	10	\$995,340
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	1,300	1,400	100	10	20	30	\$31,079	10	\$932,370
51-4194	Tool Grinders, Filers, and Sharpeners	1,900	1,900	0	0	30	30	\$28,235	10	\$847,050
51-2021	Coil Winders, Tapers, and Finishers	1,700	1,300	-400	0	30	30	\$26,247	11	\$787,410
51-6099	Textile, Apparel, and Furnishings Workers, All Other	1,800	1,500	-300	0	40	40	\$19,030	11	\$761,200
51-9194	Etchers and Engravers	1,200	1,200	0	0	20	20	\$27,338	9	\$546,760
51-6064	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders	1,000	900	-100	0	20	20	\$18,765	10	\$375,300

[1] Net Replacements openings are an estimate of the number of job openings expected because people have permanently left an occupation. It estimates the net movement of 1) experienced workers who leave an occupation and start working in another occupation,

- [2] Total Job Openings are the sum of new jobs and net replacements. If employment change is negative, job openings due to growth are zero and total job openings equal net replacements.
- [3] Median Hourly and Annual Wages are the estimated 50th percentile of the distribution of wages; 50 percent of workers in an occupation earn wages below, and 50 percent earn wages above the median wage. The wages are from the 1st quarter of 2008 and do not
- [4] In occupations where workers do not work full-time, or year-round, it is not possible to calculate an hourly wage.
- [5] Occupational training and education classifications were developed by the Bureau of Labor Statistics (BLS). For more information on the classifications, please see the BLS Training Definitions at:
<http://www.labormarketinfo.edd.ca.gov/?PAGEID=172>

Education & Training Levels:

- 1 - First Professional Degree - LLD/MD
- 2 - Doctoral Degree
- 3 - Master's Degree
- 4 - Bachelor's Degree or Higher and Some Work Experience
- 5 - Bachelor's Degree
- 6 - Associate Degree**
- 7 - Post-Secondary Vocational Education**
- 8 - Work Experience in a Related Occupation**
- 9 - Long-Term On-the-Job Training**
- 10 - Moderate-Term On-the-Job Training
- 11 - Short-Term On-the-Job Training

APPENDIX A: Standard Occupational Codes (SOC) Major Groups

Below is a table showing the 23 major occupation groups within the SOC. The codes that relate directly to manufacturing and engineering are highlighted (17-0000, 49-9040 to 49-9044, 51-0000). Following this table are the detail listing of those occupations that relate to K-14 career pathways in manufacturing and engineering. Jobs that aren't related to these fields, or that require 4 year degrees (such as engineering) have been ~~marked through~~.

To get more information about the occupations, you may click on them. They are linked to the BLS description for that job.

	<u>11-0000 Management Occupations</u>
	<u>13-0000 Business and Financial Operations Occupations</u>
	<u>15-0000 Computer and Mathematical Occupations</u>
See details below	<u>17-0000 Architecture and Engineering Occupations</u> (All Sub-Codes)
	<u>19-0000 Life, Physical, and Social Science Occupations</u>
	<u>21-0000 Community and Social Services Occupations</u>
	<u>23-0000 Legal Occupations</u>
	<u>25-0000 Education, Training, and Library Occupations</u>
	<u>27-0000 Arts, Design, Entertainment, Sports, and Media Occupations</u>
	<u>29-0000 Healthcare Practitioners and Technical Occupations</u>
	<u>31-0000 Healthcare Support Occupations</u>
	<u>33-0000 Protective Service Occupations</u>
	<u>35-0000 Food Preparation and Serving Related Occupations</u>
	<u>37-0000 Building and Grounds Cleaning and Maintenance Occupations</u>
	<u>39-0000 Personal Care and Service Occupations</u>
	<u>41-0000 Sales and Related Occupations</u>
	<u>43-0000 Office and Administrative Support Occupations</u>
	<u>45-0000 Farming, Fishing, and Forestry Occupations</u>
	<u>47-0000 Construction and Extraction Occupations</u>
See details below	<u>49-0000 Installation, Maintenance, and Repair Occupations</u> (9040-9044 codes)
See details below	<u>51-0000 Production Occupations</u> (All Sub-Codes)
	<u>53-0000 Transportation and Material Moving Occupations</u>
	<u>55-0000 Military Specific Occupations</u>

17-0000 Architecture and Engineering Occupations

17-1000 Architects, Surveyors, and Cartographers

- [17-1010 Architects, Except Naval](#)
 - [17-1011 Architects, Except Landscape and Naval](#)
 - [17-1012 Landscape Architects](#)
- [17-1020 Surveyors, Cartographers, and Photogrammetrists](#)
 - [17-1021 Cartographers and Photogrammetrists](#)
 - [17-1022 Surveyors](#)

17-2000 Engineers

- [17-2010 Aerospace Engineers](#)
 - [17-2011 Aerospace Engineers](#)
- [17-2020 Agricultural Engineers](#)
 - [17-2021 Agricultural Engineers](#)
- [17-2030 Biomedical Engineers](#)
 - [17-2031 Biomedical Engineers](#)
- [17-2040 Chemical Engineers](#)
 - [17-2041 Chemical Engineers](#)
- [17-2050 Civil Engineers](#)
 - [17-2051 Civil Engineers](#)
- [17-2060 Computer Hardware Engineers](#)
 - [17-2061 Computer Hardware Engineers](#)
- [17-2070 Electrical and Electronics Engineers](#)
 - [17-2071 Electrical Engineers](#)
 - [17-2072 Electronics Engineers, Except Computer](#)
- [17-2080 Environmental Engineers](#)
 - [17-2081 Environmental Engineers](#)
- [17-2110 Industrial Engineers, Including Health and Safety](#)
 - [17-2111 Health and Safety Engineers, Except Mining Safety Engineers and Inspectors](#)
 - [17-2112 Industrial Engineers](#)
- [17-2120 Marine Engineers and Naval Architects](#)
 - [17-2121 Marine Engineers and Naval Architects](#)
- [17-2130 Materials Engineers](#)
 - [17-2131 Materials Engineers](#)
- [17-2140 Mechanical Engineers](#)
 - [17-2141 Mechanical Engineers](#)
- [17-2150 Mining and Geological Engineers, Including Mining Safety Engineers](#)
 - [17-2151 Mining and Geological Engineers, Including Mining Safety Engineers](#)
- [17-2160 Nuclear Engineers](#)
 - [17-2161 Nuclear Engineers](#)
- [17-2170 Petroleum Engineers](#)
 - [17-2171 Petroleum Engineers](#)
- [17-2190 Miscellaneous Engineers](#)
 - [17-2199 Engineers, All Other](#)

17-3000 Drafters, Engineering, and Mapping Technicians

- [17-3010 Drafters](#)
 - [17-3011 Architectural and Civil Drafters](#)
 - [17-3012 Electrical and Electronics Drafters](#)
 - [17-3013 Mechanical Drafters](#)
 - [17-3019 Drafters, All Other](#)
- [17-3020 Engineering Technicians, Except Drafters](#)
 - [17-3021 Aerospace Engineering and Operations Technicians](#)
 - [17-3022 Civil Engineering Technicians](#)
 - [17-3023 Electrical and Electronic Engineering Technicians](#)
 - [17-3024 Electro-Mechanical Technicians](#)
 - [17-3025 Environmental Engineering Technicians](#)
 - [17-3026 Industrial Engineering Technicians](#)
 - [17-3027 Mechanical Engineering Technicians](#)
 - [17-3029 Engineering Technicians, Except Drafters, All Other](#)
- [17-3030 Surveying and Mapping Technicians](#)
 - [17-3031 Surveying and Mapping Technicians](#)



49-0000 Installation, Maintenance, and Repair Occupations

49-9000 Other Installation, Maintenance, and Repair Occupations

- [49-9040 Industrial Machinery Installation, Repair, and Maintenance Workers](#)
 - [49-9041 Industrial Machinery Mechanics](#)
 - [49-9042 Maintenance and Repair Workers, General](#)
 - [49-9043 Maintenance Workers, Machinery](#)
 - [49-9044 Millwrights](#)

51-0000 Production Occupations

51-1000 Supervisors, Production Workers

- [51-1010 First-Line Supervisors/Managers of Production and Operating Workers](#)
 - [51-1011 First-Line Supervisors/Managers of Production and Operating Workers](#)

51-2000 Assemblers and Fabricators

- [51-2010 Aircraft Structure, Surfaces, Rigging, and Systems Assemblers](#)
 - [51-2011 Aircraft Structure, Surfaces, Rigging, and Systems Assemblers](#)
- [51-2020 Electrical, Electronics, and Electromechanical Assemblers](#)
 - [51-2021 Coil Winders, Tapers, and Finishers](#)
 - [51-2022 Electrical and Electronic Equipment Assemblers](#)
 - [51-2023 Electromechanical Equipment Assemblers](#)
- [51-2030 Engine and Other Machine Assemblers](#)
 - [51-2031 Engine and Other Machine Assemblers](#)
- [51-2040 Structural Metal Fabricators and Fitters](#)
 - [51-2041 Structural Metal Fabricators and Fitters](#)
- [51-2090 Miscellaneous Assemblers and Fabricators](#)
 - [51-2091 Fiberglass Laminators and Fabricators](#)
 - [51-2092 Team Assemblers](#)
 - [51-2093 Timing Device Assemblers, Adjusters, and Calibrators](#)
 - [51-2099 Assemblers and Fabricators, All Other](#)

51-3000 Food Processing Workers

51-4000 Metal Workers and Plastic Workers

- [51-4010 Computer Control Programmers and Operators](#)
 - [51-4011 Computer-Controlled Machine Tool Operators, Metal and Plastic](#)
 - [51-4012 Numerical Tool and Process Control Programmers](#)
- [51-4020 Forming Machine Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4021 Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4022 Forging Machine Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4023 Rolling Machine Setters, Operators, and Tenders, Metal and Plastic](#)
- [51-4030 Machine Tool Cutting Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4031 Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4032 Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4033 Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4034 Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4035 Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic](#)
- [51-4040 Machinists](#)
 - [51-4041 Machinists](#)
- [51-4050 Metal Furnace and Kiln Operators and Tenders](#)
 - [51-4051 Metal-Refining Furnace Operators and Tenders](#)
 - [51-4052 Pourers and Casters, Metal](#)
- [51-4060 Model Makers and Patternmakers, Metal and Plastic](#)
 - [51-4061 Model Makers, Metal and Plastic](#)
 - [51-4062 Patternmakers, Metal and Plastic](#)
- [51-4070 Molders and Molding Machine Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4071 Foundry Mold and Coremakers](#)
 - [51-4072 Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic](#)
- [51-4080 Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic](#)



- [51-4081 Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic](#)
- [51-4110 Tool and Die Makers](#)
 - [51-4111 Tool and Die Makers](#)
- [51-4120 Welding, Soldering, and Brazing Workers](#)
 - [51-4121 Welders, Cutters, Solderers, and Brazers](#)
 - [51-4122 Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders](#)
- [51-4190 Miscellaneous Metalworkers and Plastic Workers](#)
 - [51-4191 Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4192 Lay-Out Workers, Metal and Plastic](#)
 - [51-4193 Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic](#)
 - [51-4194 Tool Grinders, Filers, and Sharpeners](#)
 - [51-4199 Metal Workers and Plastic Workers, All Other](#)

51-5000 Printing Workers

- [51-5010 Bookbinders and Bindery Workers](#)
 - [51-5011 Bindery Workers](#)
 - [51-5012 Bookbinders](#)
- [51-5020 Printers](#)
 - [51-5021 Job Printers](#)
 - [51-5022 Prepress Technicians and Workers](#)
 - [51-5023 Printing Machine Operators](#)

51-6000 Textile, Apparel, and Furnishings Workers

- [51-6010 Laundry and Dry-Cleaning Workers](#)
 - [51-6011 Laundry and Dry-Cleaning Workers](#)
- [51-6020 Pressers, Textile, Garment, and Related Materials](#)
 - [51-6021 Pressers, Textile, Garment, and Related Materials](#)
- [51-6030 Sewing Machine Operators](#)
 - [51-6031 Sewing Machine Operators](#)
- [51-6040 Shoe and Leather Workers](#)
 - [51-6041 Shoe and Leather Workers and Repairers](#)
 - [51-6042 Shoe Machine Operators and Tenders](#)
- [51-6050 Tailors, Dressmakers, and Sewers](#)
 - [51-6051 Sewers, Hand](#)
 - [51-6052 Tailors, Dressmakers, and Custom Sewers](#)
- [51-6060 Textile Machine Setters, Operators, and Tenders](#)
 - [51-6061 Textile Bleaching and Dyeing Machine Operators and Tenders](#)
 - [51-6062 Textile Cutting Machine Setters, Operators, and Tenders](#)
 - [51-6063 Textile Knitting and Weaving Machine Setters, Operators, and Tenders](#)
 - [51-6064 Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders](#)
- [51-6090 Miscellaneous Textile, Apparel, and Furnishings Workers](#)
 - [51-6091 Extruding and Forming Machine Setters, Operators, and Tenders, Synthetic and Glass Fibers](#)
 - [51-6092 Fabric and Apparel Patternmakers](#)
 - [51-6093 Upholsterers](#)
 - [51-6099 Textile, Apparel, and Furnishings Workers, All Other](#)

51-7000 Woodworkers

- [51-7010 Cabinetmakers and Bench Carpenters](#)
 - [51-7011 Cabinetmakers and Bench Carpenters](#)
- [51-7020 Furniture Finishers](#)
 - [51-7021 Furniture Finishers](#)
- [51-7030 Model Makers and Patternmakers, Wood](#)
 - [51-7031 Model Makers, Wood](#)
 - [51-7032 Patternmakers, Wood](#)
- [51-7040 Woodworking Machine Setters, Operators, and Tenders](#)
 - [51-7041 Sawing Machine Setters, Operators, and Tenders, Wood](#)
 - [51-7042 Woodworking Machine Setters, Operators, and Tenders, Except Sawing](#)
- [51-7090 Miscellaneous Woodworkers](#)
 - [51-7099 Woodworkers, All Other](#)

51-8000 Plant and System Operators

- [51-8010 Power Plant Operators, Distributors, and Dispatchers](#)
 - [51-8011 Nuclear Power Reactor Operators](#)



- [51-8012 Power Distributors and Dispatchers](#)
- [51-8013 Power Plant Operators](#)
- [51-8020 Stationary Engineers and Boiler Operators](#)
- [51-8021 Stationary Engineers and Boiler Operators](#)
- [51-8030 Water and Liquid Waste Treatment Plant and System Operators](#)
- [51-8031 Water and Liquid Waste Treatment Plant and System Operators](#)
- [51-8090 Miscellaneous Plant and System Operators](#)
- [51-8091 Chemical Plant and System Operators](#)
- [51-8092 Gas Plant Operators](#)
- [51-8093 Petroleum Pump System Operators, Refinery Operators, and Gaugers](#)
- [51-8099 Plant and System Operators, All Other](#)

51-9000 Other Production Occupations

- [51-9010 Chemical Processing Machine Setters, Operators, and Tenders](#)
- [51-9011 Chemical Equipment Operators and Tenders](#)
- [51-9012 Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders](#)
- [51-9020 Crushing, Grinding, Polishing, Mixing, and Blending Workers](#)
- [51-9021 Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders](#)
- [51-9022 Grinding and Polishing Workers, Hand](#)
- [51-9023 Mixing and Blending Machine Setters, Operators, and Tenders](#)
- [51-9030 Cutting Workers](#)
- [51-9031 Cutters and Trimmers, Hand](#)
- [51-9032 Cutting and Slicing Machine Setters, Operators, and Tenders](#)
- [51-9040 Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders](#)
- [51-9041 Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders](#)
- [51-9050 Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders](#)
- [51-9051 Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders](#)
- [51-9060 Inspectors, Testers, Sorters, Samplers, and Weighers](#)
- [51-9061 Inspectors, Testers, Sorters, Samplers, and Weighers](#)
- [51-9070 Jewelers and Precious Stone and Metal Workers](#)
- [51-9071 Jewelers and Precious Stone and Metal Workers](#)
- [51-9080 Medical, Dental, and Ophthalmic Laboratory Technicians](#)
- [51-9081 Dental Laboratory Technicians](#)
- [51-9082 Medical Appliance Technicians](#)
- [51-9083 Ophthalmic Laboratory Technicians](#)
- [51-9110 Packaging and Filling Machine Operators and Tenders](#)
- [51-9111 Packaging and Filling Machine Operators and Tenders](#)
- [51-9120 Painting Workers](#)
- [51-9121 Coating, Painting, and Spraying Machine Setters, Operators, and Tenders](#)
- [51-9122 Painters, Transportation Equipment](#)
- [51-9123 Painting, Coating, and Decorating Workers](#)
- [51-9130 Photographic Process Workers and Processing Machine Operators](#)
- [51-9131 Photographic Process Workers](#)
- [51-9132 Photographic Processing Machine Operators](#)
- [51-9140 Semiconductor Processors](#)
- [51-9141 Semiconductor Processors](#)
- [51-9190 Miscellaneous Production Workers](#)
- [51-9191 Cementing and Gluing Machine Operators and Tenders](#)
- [51-9192 Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders](#)
- [51-9193 Cooling and Freezing Equipment Operators and Tenders](#)
- [51-9194 Etchers and Engravers](#)
- [51-9195 Molders, Shapers, and Casters, Except Metal and Plastic](#)
- [51-9196 Paper Goods Machine Setters, Operators, and Tenders](#)
- [51-9197 Tire Builders](#)
- [51-9198 Helpers—Production Workers](#)
- [51-9199 Production Workers, All Other](#)



REVISIONS

9/30/2008	Released
10/9/2008	Added logos
	Added "2006 Employment" column in Figure 1
10/15/2008	Added "Totals" on Figure 1 (not yet released), and footnote 2.
11/13/2008	Rearranged "important skill sets" on page 7 in order of importance (based on author's opinion)