



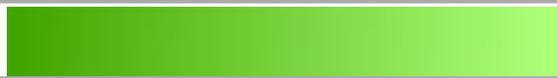
TORO Analysis of Mechanical Engineering Technicians to Commercial and Industrial Designers

INPUT SECTION:

Transfer	Title	O*NET	Filters		
From Title:	Mechanical Engineering Technicians	17-3027.00	Abilities:	Importance Level: 50	Weight: 1
To Title:	Commercial and Industrial Designers	27-1021.00	Skills:	Importance Level: 69	Weight: 1
Labor Market Area:	Maine Statewide		Knowledge:	Importance Level: 69	Weight: 1

OUTPUT SECTION:

Grand TORQ:



91

Ability TORQ		Skills TORQ		Knowledge TORQ	
Level	95	Level	92	Level	85

Gaps To Narrow if Possible				Upgrade These Skills				Knowledge to Add			
Ability	Level	Gap	Impt	Skill	Level	Gap	Impt	Knowledge	Level	Gap	Impt
Fluency of Ideas	55	4	65	Time Management	67	6	81	Design	77	10	84
Speech Recognition	44	2	62	Reading Comprehension	69	5	72	Mathematics	72	11	69
Speech Clarity	46	2	59	Mathematics	64	1	71				

LEVEL and IMPT (IMPORTANCE) refer to the Target Commercial and Industrial Designers. GAP refers to level difference between Mechanical Engineering Technicians and Commercial and Industrial Designers.

ASK ANALYSIS

Ability Level Comparison - Abilities with importance scores over 50

Description	Mechanical Engineering Technicians	Commercial and Industrial Designers	Importance
Oral Comprehension	69	57	72
Oral Expression	69	57	68
Written Comprehension	71	57	65
Fluency of Ideas	51	55	65
Originality	55	55	65
Deductive Reasoning	71	55	65
Problem Sensitivity	66	50	62
Inductive Reasoning	66	50	62



Information Ordering	67	57	62
Near Vision	64	53	62
Speech Recognition	42	44	62
Visualization	64	51	59
Speech Clarity	44	46	59
Category Flexibility	59	48	56
Selective Attention	44	37	56
Finger Dexterity	53	41	56
Written Expression	62	50	53
Perceptual Speed	53	35	53
Far Vision	48	44	53
Mathematical Reasoning	62	41	50
Number Facility	44	42	50
Flexibility of Closure	57	39	50
Visual Color Discrimination	55	44	50

Skill Level Comparison - Abilities with importance scores over 69

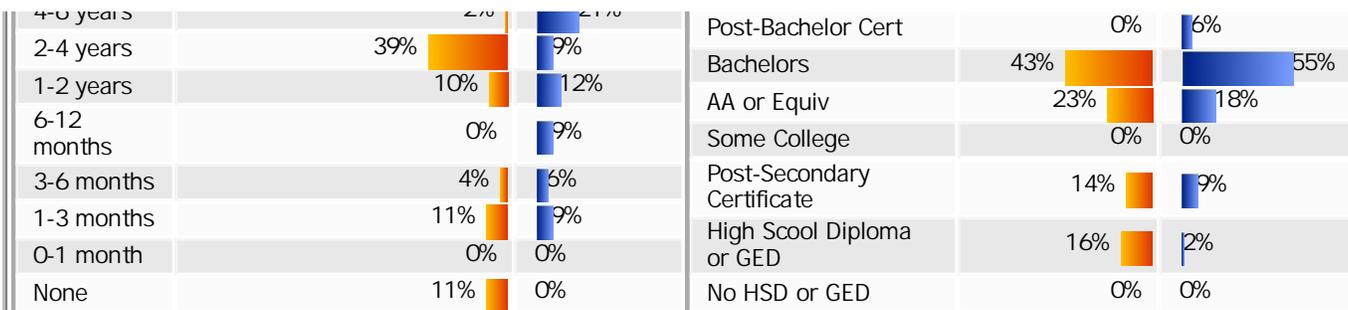
Description	Mechanical Engineering Technicians	Commercial and Industrial Designers	Importance
Time Management	61	67	81
Active Listening	63	57	74
Reading Comprehension	64	69	72
Mathematics	63	64	71
Judgment and Decision Making	64	63	69

Knowledge Level Comparison - Knowledge with importance scores over 69

Description	Mechanical Engineering Technicians	Commercial and Industrial Designers	Importance
Design	67	77	84
Engineering and Technology	73	71	74
Mathematics	61	72	69

Experience & Education Comparison

Related Work Experience Comparison			Required Education Level Comparison		
Description	Mechanical Engineering Technicians	Commercial and Industrial Designers	Description	Mechanical Engineering Technicians	Commercial and Industrial Designers
10+ years	10%	0%	Doctoral	0%	0%
8-10 years	1%	0%	Professional Degree	0%	0%
6-8 years	7%	30%	Post-Masters Cert	0%	0%
4-6 years	2%	21%	Master's Degree	0%	7%



Mechanical Engineering Technicians	Commercial and Industrial Designers
Most Common Educational/Training Requirement:	
Associate degree	Bachelor's degree
Job Zone Comparison	
<p>3 - Job Zone Three: Medium Preparation Needed</p> <p>Previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training, and often must have passed a licensing exam, in order to perform the job.</p> <p>Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree. Some may require a bachelor's degree.</p> <p>Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers.</p>	<p>4 - Job Zone Four: Considerable Preparation Needed</p> <p>A minimum of two to four years of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified.</p> <p>Most of these occupations require a four - year bachelor's degree, but some do not.</p> <p>Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.</p>

Tasks

Mechanical Engineering Technicians	Commercial and Industrial Designers
Core Tasks	Core Tasks
<p>Generalized Work Activities:</p> <ul style="list-style-type: none"> Getting Information - Observing, receiving, and otherwise obtaining information from all relevant sources. Interacting With Computers - Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information. Communicating with Supervisors, Peers, or Subordinates - Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person. Identifying Objects, Actions, and Events - Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events. Evaluating Information to Determine Compliance with Standards - Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards. 	<p>Generalized Work Activities:</p> <ul style="list-style-type: none"> Getting Information - Observing, receiving, and otherwise obtaining information from all relevant sources. Interacting With Computers - Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information. Thinking Creatively - Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions. Updating and Using Relevant Knowledge - Keeping up-to-date technically and applying new knowledge to your job. Communicating with Supervisors, Peers, or Subordinates - Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person. Identifying Objects, Actions, and Events - Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.
Specific Tasks	Specific Tasks
Occupation Specific Tasks:	Specific Tasks



- Analyze test results in relation to design or rated specifications and test objectives, and modify or adjust equipment to meet specifications.
- Calculate required capacities for equipment of proposed system to obtain specified performance and submit data to engineering personnel for approval.
- Confer with technicians and submit reports of test results to engineering department and recommend design or material changes.
- Devise, fabricate, and assemble new or modified mechanical components for products such as industrial machinery or equipment, and measuring instruments.
- Discuss changes in design, method of manufacture and assembly, and drafting techniques and procedures with staff and coordinate corrections.
- Draft detail drawing or sketch for drafting room completion or to request parts fabrication by machine, sheet or wood shops.
- Estimate cost factors including labor and material for purchased and fabricated parts and costs for assembly, testing, or installing.
- Evaluate tool drawing designs by measuring drawing dimensions and comparing with original specifications for form and function using engineering skills.
- Inspect lines and figures for clarity and return erroneous drawings to designer for correction.
- Operate drill press, grinders, engine lathe, or other machines to modify parts tested or to fabricate experimental parts for testing.
- Prepare parts sketches and write work orders and purchase requests to be furnished by outside contractors.
- Read dials and meters to determine amperage, voltage, electrical output and input at specific operating temperature to analyze parts performance.
- Record test procedures and results, numerical and graphical data, and recommendations for changes in product or test methods.
- Review project instructions and blueprints to ascertain test specifications, procedures, and objectives, and test nature of technical problems such as redesign.
- Review project instructions and specifications to identify, modify and plan requirements fabrication, assembly and testing.
- Set up and conduct tests of complete units and components under operational conditions to investigate proposals for improving equipment performance.

Occupation Specific Tasks:

- Advise corporations on issues involving corporate image projects or problems.
- Confer with engineering, marketing, production, or sales departments, or with customers, to establish and evaluate design concepts for manufactured products.
- Coordinate the look and function of product lines.
- Design graphic material for use as ornamentation, illustration, or advertising on manufactured materials and packaging or containers.
- Develop industrial standards and regulatory guidelines.
- Develop manufacturing procedures and monitor the manufacture of their designs in a factory to improve operations and product quality.
- Direct and coordinate the fabrication of models or samples and the drafting of working drawings and specification sheets from sketches.
- Evaluate feasibility of design ideas, based on factors such as appearance, safety, function, serviceability, budget, production costs/methods, and market characteristics.
- Fabricate models or samples in paper, wood, glass, fabric, plastic, metal, or other materials, using hand or power tools.
- Investigate product characteristics such as the product's safety and handling qualities, its market appeal, how efficiently it can be produced, and ways of distributing, using and maintaining it.
- Modify and refine designs, using working models, to conform with customer specifications, production limitations, or changes in design trends.
- Participate in new product planning or market research, including studying the potential need for new products.
- Prepare sketches of ideas, detailed drawings, illustrations, artwork, or blueprints, using drafting instruments, paints and brushes, or computer-aided design equipment.
- Present designs and reports to customers or design committees for approval, and discuss need for modification.
- Read publications, attend showings, and study competing products and design styles and motifs to obtain perspective and generate design concepts.
- Research production specifications, costs, production materials and manufacturing methods, and provide cost estimates and itemized production requirements.
- Supervise assistants' work throughout the design process.



- Set up prototype and test apparatus and operate test controlling equipment to observe and record prototype test results.
- Test equipment, using test devices attached to generator, voltage regulator, or other electrical parts, such as generators or spark plugs.

Detailed Tasks

Detailed Work Activities:

- analyze engineering design problems
- analyze engineering test data
- analyze technical data, designs, or preliminary specifications
- calculate engineering specifications
- communicate technical information
- conduct performance testing
- confer with engineering, technical or manufacturing personnel
- develop plans for programs or projects
- diagnose mechanical problems in machinery or equipment
- draw prototypes, plans, or maps to scale
- estimate cost for engineering projects
- evaluate engineering data
- examine engineering documents for completeness or accuracy
- fill out purchase requisitions
- follow manufacturing methods or techniques
- follow statistical process control procedures
- inspect facilities or equipment for regulatory compliance
- modify electrical or electronic equipment or products
- operate metal or plastic fabricating equipment/machinery
- operate pneumatic test equipment
- operate precision test equipment
- prepare technical reports or related documentation
- read blueprints
- read schematics
- read technical drawings
- read vehicle manufacturer's specifications
- recommend solutions to engineering problems
- record test results, test procedures, or inspection data
- set up and operate variety of machine tools
- test equipment as part of engineering projects or processes
- understand engineering data or reports
- understand service or repair manuals
- understand technical operating, service or

Detailed Tasks

Detailed Work Activities:

- analyze market conditions
- analyze project proposal to determine feasibility, cost, or time
- analyze technical data, designs, or preliminary specifications
- communicate visually or verbally
- confer with client or staff regarding theme
- confer with other departmental heads to coordinate activities
- consult with customers concerning needs
- coordinate activities of assistants
- create art from ideas
- distinguish details in graphic arts material
- draw designs, letters, or lines
- draw prototypes, plans, or maps to scale
- estimate production costs
- evaluate product design
- evaluate product quality for sales activities
- fabricate craft or art objects
- follow manufacturing methods or techniques
- identify color or balance
- identify problems or improvements
- maintain consistent production quality
- make presentations
- organize commercial artistic or design projects
- prepare artwork for camera or press
- read blueprints
- recommend improvements to work methods or procedures
- recommend solutions of administrative problems
- schedule work to meet deadlines
- sketch or draw subjects or items
- understand artistic crafts production methods
- use characteristics of graphic design materials
- use computer aided drafting or design software for design, drafting, modeling, or other engineering tasks
- use computer graphics design software
- use computers to enter, access or retrieve data
- use creativity in graphics
- use creativity in industrial artistry
- use creativity to art or design work
- use drafting or mechanical drawing techniques
- use graphic arts techniques
- use hand or power tools



- repair manuals
- use drafting or mechanical drawing techniques
- use electrical or electronic test devices or equipment
- use knowledge of metric system
- use precision measuring tools or equipment
- use robotics systems technology
- use scientific research methodology
- use technical information in manufacturing or industrial activities
- use technical regulations for engineering problems

Technology - Examples

Analytical or scientific software

- ANSYS Mechanical
- MSC Software Adams
- Spectral Dynamics STARAcoustics
- Spectral Dynamics STARModal
- The Mathworks MATLAB
- Wolfram Research Mathematica

Computer aided design CAD software

- Autodesk AutoCAD Mechanical
- Autodesk Inventor
- Bentley MicroStation
- Computer aided design CAD software
- IBM CATIA V5
- PTC Pro/ENGINEER software
- SolidWorks CAD software

Computer aided manufacturing CAM software

- CNC Mastercam
- Computer aided manufacturing CAM software
- Three-dimensional 3D solid modeling software

Development environment software

- Microsoft Visual Basic
- National Instruments LabVIEW

Industrial control software

- Computerized numerical control CNC programming software
- Robotic control software

- use marketing techniques
- use product knowledge to market goods

Technology - Examples

Computer aided design CAD software

- Ashlar-Vellum Cobalt
- Autodesk AliasStudio
- Autodesk AutoCAD software
- Autodesk Maya software
- Dassault Systemes CATIA software
- PTC Pro/ENGINEER software
- Siemens PLM Software UGS NX
- SolidWorks CAD software

Data base user interface and query software

- Microsoft Access

Desktop publishing software

- Adobe Systems Adobe InDesign
- Microsoft Publisher
- QuarkXpress

Document management software

- Adobe Systems Adobe Acrobat software

Electronic mail software

- Email software

Graphics or photo imaging software

- Adobe Systems Adobe FreeHand
- Adobe Systems Adobe Illustrator
- Adobe Systems Adobe Photoshop software
- Corel CorelDraw Graphics Suite
- Corel Painter
- McNeel Rhino software
- Xara Xtreme

Internet browser software

- Web browser software

Office suite software

- Microsoft Office

Presentation software

- Microsoft PowerPoint

Spreadsheet software



- Soft Servo Systems LadderWorks PLC

Internet browser software

- Web browser software

Office suite software

- Microsoft Office

Presentation software

- Microsoft PowerPoint

Project management software

- Microsoft Project

Spreadsheet software

- Microsoft Excel

Word processing software

- Corel WordPerfect software

- Microsoft Word

Tools - Examples

- Accelerometers

- Adjustable wrenches

- Air compressors

- Clamp-on ammeters

- High-voltage amplifiers

- Anemometers

- Optical microscopes

- C clamps

- Dial calipers

- Electronic comparators

- Compression testing machines

- Coordinate measuring machines CMM

- Dynamometers

- Extrusion machines

- Fatigue testers

- Mill files

- Fluid meters

- Rotameters

- Force sensors

- Microsoft Excel

Video creation and editing software

- Autodesk 3ds Max

- Chaos Group V-Ray

- MAXON CINEMA 4D

- Softimage XSI

Word processing software

- Microsoft Word

Tools - Examples

- Desktop computers

- Compact digital cameras

- Universal serial bus USB flash drives

- Liquid crystal display LCD video projectors

- Laptop computers

- Personal computers



- Plane-parallel gauge blocks
- Arc welding equipment
- Bore gauges
- Go/no-go gauges
- Safety goggles
- Digitizing tablets
- Surface grinders
- Polishing machines
- Claw hammers
- Durometers
- Vernier height gauges
- Hex keys
- Impact testers
- Heat treatment furnaces
- Injection molders
- Metallographs
- Computerized numerical control CNC lathes
- Spirit levels
- Granite surface plates
- Load cells
- Locking pliers
- Long nose pliers
- Metal inert gas MIG welding equipment
- Marking gauges
- Bend test fixtures
- Programmable logic controllers PLC
- Micrometers
- Microprocessors
- Combination milling machines
- Milling machines
- Digital multimeters
- Laptop computers



- Nut drivers
- Oscilloscopes
- Personal computers
- Drafting plotters
- Positioning jigs
- Power drills
- Cylindrical grinders
- Belt sanders
- Band saws
- Pressure sensors
- Safety gloves
- Protractors
- Center punches
- Hacksaws
- Offset screwdrivers
- Scribes
- Shear testing fixtures
- Power shears
- Signal conditioners
- Signal generators
- Arc-joint pliers
- Socket sets
- Soldering equipment
- Combination squares
- Steel rules
- Strain gauges
- Wire strippers
- Measuring tapes
- Dies
- Temperature sensors
- Tensile testers
- Dynamic mechanical analyzers DMA



- Snap gauges
- Screw thread gauges
- Tungsten inert gas TIG welding equipment
- Twin-screw extruders
- Twist drills
- Ultrasound inspection equipment
- Utility knives
- Vacuum molders
- Freon recovery equipment
- Vibration testers
- Spot welders
- Welding masks
- Dry rod ovens
- Wire cutters
- Drill presses

Labor Market Comparison

Description	Mechanical Engineering Technicians	Commercial and Industrial Designers	Difference
Median Wage	\$ 44,890	\$ 49,170	\$ 4,280
10th Percentile Wage	\$ 30,530	\$ 29,790	\$(740)
25th Percentile Wage	N/A	N/A	N/A
75th Percentile Wage	\$ 51,860	\$ 72,210	\$ 20,350
90th Percentile Wage	\$ 61,330	\$ 81,030	\$ 19,700
Mean Wage	\$ 45,460	\$ 53,870	\$ 8,410
Total Employment - 2007	130	140	10
Employment Base - 2006	129	153	24
Projected Employment - 2016	132	160	28
Projected Job Growth - 2006-2016	2.3 %	4.6 %	2.3 %
Projected Annual Openings - 2006-2016	3	5	2

National Job Posting Trends



Trend for Mechanical Engineering Technicians

Trend for
Commercial
and
Industrial
Designers



Data from [Indeed](http://Indeed.com)

Recommended Programs

Design and Visual Communications

Design and Visual Communications, General. A program in the applied visual arts that focuses on the general principles and techniques for effectively communicating ideas and information, and packaging products, in digital and other formats to business and consumer audiences, and that may prepare individuals in any of the applied art media.

Institution	Address	City	URL
Maine College of Art	97 Spring St	Portland	www.meca.edu
York County Community College	112 College Drive	Wells	www.yccc.edu

Commercial and Advertising Art

Commercial and Advertising Art. A program in the applied visual arts that prepares individuals to use artistic techniques to effectively communicate ideas and information to business and consumer audiences via illustrations and other forms of digital or printed media. Includes instruction in concept design, layout, paste-up, and techniques such as engraving, etching, silkscreen, lithography, offset, drawing and cartooning, painting, collage, and computer graphics.

No schools available for the program

Industrial Design

Industrial Design. A program in the applied visual arts that prepares individuals to use artistic techniques to effectively communicate ideas and information to business and consumer audiences via the creation of effective forms, shapes, and packaging for manufactured products. Includes instruction in designing in a wide variety of plastic and digital media, prototype construction, design development and refinement, principles of cost saving, and product structure and performance criteria relevant to aesthetic design parameters.

No schools available for the program

Fashion Design and Illustration



Fashion/Apparel Design. A program that prepares individuals to apply artistic principles and techniques to the professional design of commercial fashions, apparel, and accessories, and the management of fashion development projects. Includes instruction in apparel design; accessory design; the design of men's, women's, and children's wear; flat pattern design; computer-assisted design and manufacturing; concept planning; designing in specific materials; labor and cost analysis; history of fashion; fabric art and printing; and the principles of management and operations in the fashion industry.

No schools available for the program

Design and Applied Arts, Other

Design and Applied Arts, Other. Any instructional program in design and applied arts not listed above.

No schools available for the program

Technical Theater/Theater Design and Stagecraft

Technical Theatre/Theatre Design and Technology. A program that prepares individuals to apply artistic, technical and dramatic principles and techniques to the communication of dramatic information, ideas, moods, and feelings through technical theatre methods. Includes instruction in set design, lighting design, sound effects, theatre acoustics, scene painting, property management, costume design, and technical direction and production and use of computer applications to support these functions above.

No schools available for the program

Maine Statewide Promotion Opportunities for Mechanical Engineering Technicians

O* NET Code	Title	Grand TORQ	Job Zone	Employment	Median Wage	Difference	Growth	Annual Job Openings
17-3027.00	Mechanical Engineering Technicians	100	3	130	\$44,890.00	\$0.00	2%	3
17-3023.03	Electrical Engineering Technicians	91	3	430	\$45,180.00	\$290.00	-20%	9
27-1021.00	Commercial and Industrial Designers	91	4	140	\$49,170.00	\$4,280.00	5%	5
17-3013.00	Mechanical Drafters	89	3	710	\$46,630.00	\$1,740.00	2%	22
17-2141.00	Mechanical Engineers	89	4	620	\$67,210.00	\$22,320.00	-9%	14
17-2072.00	Electronics Engineers, Except Computer	88	4	210	\$76,420.00	\$31,530.00	-26%	4
17-2112.00	Industrial Engineers	87	4	580	\$68,350.00	\$23,460.00	11%	22
17-2131.00	Materials Engineers	87	4	40	\$70,250.00	\$25,360.00	-7%	1
17-2121.02	Marine Architects	86	4	60	\$75,520.00	\$30,630.00	-9%	1
51-4111.00	Tool and Die Makers	86	3	160	\$51,670.00	\$6,780.00	-11%	2
17-3026.00	Industrial Engineering Technicians	86	3	370	\$51,700.00	\$6,810.00	6%	9
17-2111.03	Product Safety Engineers	85	5	90	\$49,940.00	\$5,050.00	3%	3
17-2031.00	Biomedical Engineers	84	4	20	\$86,560.00	\$41,670.00	-10%	1



17-2071.00	Electrical Engineers	84	4	260	\$73,050.00	\$28,160.00	-10%	6
17-2121.01	Marine Engineers	84	4	60	\$75,520.00	\$30,630.00	-9%	1

Top Industries for Commercial and Industrial Designers

Industry	NAICS	% in Industry	Employment	Projected Employment	% Change
Self-employed workers, primary job	000601	25.29%	12,136	12,929	6.54%
Specialized design services	541400	8.84%	4,243	5,678	33.81%
Management of companies and enterprises	551100	5.03%	2,414	2,783	15.28%
Self-employed workers, secondary job	000602	4.50%	2,158	2,148	-0.45%
Motor vehicle parts manufacturing	336300	2.70%	1,296	1,032	-20.39%
Employment services	561300	2.16%	1,038	1,314	26.56%
Plastics product manufacturing	326100	1.90%	910	965	6.00%
Miscellaneous durable goods merchant wholesalers	423900	1.40%	674	774	14.80%
Advertising and related services	541800	1.37%	657	741	12.83%
Navigational, measuring, electromedical, and control instruments manufacturing	334500	1.13%	541	518	-4.26%
Research and development in the physical, engineering, and life sciences	541710	1.11%	533	569	6.69%
Other general purpose machinery manufacturing	333900	0.94%	452	408	-9.73%
Medical equipment and supplies manufacturing	339100	0.91%	437	447	2.29%
Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	333400	0.90%	430	396	-8.01%
Household appliance manufacturing	335200	0.86%	410	311	-24.33%

Top Industries for Mechanical Engineering Technicians

Industry	NAICS	% in Industry	Employment	Projected Employment	% Change
Research and development in the physical, engineering, and life sciences	541710	8.52%	4,072	4,344	6.69%
Navigational, measuring, electromedical, and control instruments manufacturing	334500	6.30%	3,013	2,884	-4.26%
Testing laboratories	541380	5.16%	2,467	3,037	23.12%
Other general purpose machinery manufacturing	333900	5.01%	2,393	2,376	-0.70%
Semiconductor and other electronic component manufacturing	334400	3.33%	1,593	1,392	-12.59%
Aerospace product and parts manufacturing	336400	3.02%	1,442	1,468	1.84%



Agriculture, construction, and mining machinery manufacturing	333100	2.58%	1,234	1,152	-6.63%
Employment services	561300	2.19%	1,047	1,325	26.56%
Industrial machinery manufacturing	333200	2.14%	1,022	921	-9.88%
Engine, turbine, and power transmission equipment manufacturing	333600	2.05%	980	822	-16.07%
Motor vehicle parts manufacturing	336300	2.00%	957	762	-20.39%
Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	333400	1.94%	926	852	-8.01%
Medical equipment and supplies manufacturing	339100	1.78%	851	870	2.29%
Communications equipment manufacturing	334200	1.74%	833	839	0.79%
Commercial and service industry machinery manufacturing	333300	1.63%	780	684	-12.28%