

Machinists in New Hampshire



State of New Hampshire
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Wind turbine blades.
Hydraulic brake tubes.
Alloy steel screws.
Gate latches.
Plastic chains and sprockets.
X-ray cassettes.
Landing gear supports.
Banjo fittings.



What do these items have in common? They are all made by *Machinists*.

According to the American Society of Mechanical Engineers¹, machine tools have been in use at least since the 1500s, starting with windmill-driven saws and grinding wheels with treadle and crank. Young men apprenticed as *Machinists*, learning the trade under the tutelage of working journeymen, using hand tools and basic metals. Today's *Machinists*—both men and women—engage in advanced manufacturing techniques. They use computer-controlled machinery and produce items made of space-age metals and plastics.

A *Machinist* is someone who sets up and operates different kinds of

machine tools to make parts and instruments out of metal or plastic. Some *Machinists* make, modify, or repair machine tools or maintain industrial machines. Many use CNC (computer numerically controlled) machines. *Machinists* are skilled and knowledgeable in mechanics, shop mathematics, metal properties, layout, and machining procedures.

Other job titles for *Machinists* include machine operator, machinist tool and die maintenance specialist, set-up machinist, utility operator, maintenance machinist, production machinist, maintenance technician, and mold tooling designer (MTD).

¹ *Machine Tools*, ASME History Center, American Society of Mechanical Engineering, accessed October 3, 2008, at <www.asme.org/Communities/History/Resources/Machine_Tools.cfm>

² *Occupational Outlook Handbook, 2008-09 Edition*, Bureau of Labor Statistics, U.S. Department of Labor, accessed September 30, 2008, at <www.bls.gov/oco/ocos223.htm>

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What does a *Machinist* do?

While the basic job of a machinist is to manufacture parts, that skill can be applied to an immense variety of objects created from a vast number of materials. *Machinists* frequently use high tech machinery controlled by computers that can mill an item to one-millionth of an inch precision.

Some *Machinists* make products out of exotic metals such as tungsten, vanadium, or titanium. Machine tools may use lasers, water jets, or electrified wires to cut or trim pieces. The work environment is usually clean and well-ventilated, and some equipment must be operated under carefully controlled environmental conditions.²

Core Tasks for Machinists³

- ↪ Calculate dimensions and tolerances using knowledge of mathematics and instruments such as micrometers and vernier calipers.
- ↪ Align and secure holding fixtures, cutting tools, attachments, accessories, and materials onto machines.
- ↪ Select the appropriate tools, machines, and materials to be used in preparation of machinery work.
- ↪ Monitor the feed and speed of machines during the machining process.
- ↪ Machine parts to specifications using machine tools such as lathes, milling machines, shapers, or grinders.
- ↪ Set up, adjust, and operate all of the basic machine tools and many specialized or advanced variation tools to perform precision machining operations.
- ↪ Measure, examine, and test completed units to detect defects and ensure conformance to specifications, using precision instruments such as micrometers.
- ↪ Set controls to regulate machining, or enter commands to retrieve, input, or edit computerized machine control media.
- ↪ Position and fasten work pieces.
- ↪ Maintain industrial machines, applying knowledge of mechanics, shop mathematics, metal properties, layout, and machining procedures.
- ↪ Observe and listen to operating machines or equipment to diagnose machine malfunctions and to determine need for adjustments or repairs.

³ O*Net Online, accessed September 30, 2008, at <<http://online.onetcenter.org/link/summary/51-4041.00>>

What Knowledge, Skills, and Abilities does a *Machinist* need?⁴

Below are some of the important areas of Knowledge, Skills, and Abilities for *Machinists*. These are defined by O*Net, a national source

of occupational information, and based on surveys of workers in the occupation. These areas are ranked by relative importance to performance of the occupation, on a scale of 1 to 100.

Knowledge is a learned set of facts acquired through experience and education.			
Knowledge	Mechanical	Knowledge of machines and tools, including their designs, uses, repair, and maintenance.	82
	Production and Processing	Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.	73
	Mathematics	Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.	71
	Design	Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.	60
	English Language	Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.	53
Skills are learned capabilities specific to work activities.			
Skills	Operation Monitoring	Watching gauges, dials, or other indicators to make sure a machine is working properly.	63
	Operation and Control	Controlling operations of equipment or systems.	60
	Monitoring	Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.	56
	Active Listening	Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.	53
	Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.	53
Abilities are the attributes of an individual that influence performance, and the capacity to acquire knowledge and skills for successful job performance.			
Abilities	Control Precision	The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.	69
	Arm-Hand Steadiness	The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.	66
	Reaction Time	The ability to quickly respond (with the hand, finger, or foot) to a signal (sound, light, picture) when it appears.	63
	Near Vision	The ability to see details at close range (within a few feet of the observer).	63
	Oral Comprehension	The ability to listen to and understand information and ideas presented through spoken words and sentences.	60

⁴ The O*Net Content Model, *O*Net Online*, accessed October 1, 2008, at <www.onetcenter.org/content.html>

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What is the employment outlook for *Machinists*?

Long-term growth—employment estimated for 2006 and projected to 2016—for *Machinists* in New Hampshire is considered favorable, with an average rate of growth but high average annual openings. In 2006, there were an estimated 2,460 *Machinists* in the state. That number is expected to grow to 2,715 by 2016, a gain of 10.4 percent. Nationally, employment of *Machinists* is expected to decrease from 397,000 to 384,000, a loss of three percent.

In New Hampshire, as with the rest of the nation, job openings for *Machinists* will more likely be available from replacement needs rather than from new job growth. Employment projections estimate that 256 new *Machinists* will be needed by 2016. Of those, there will be an

Even though total national employment is expected to decline, there will still be a need for new *Machinists* in the workforce. According to the Occupational Outlook Handbook, 2008-2009 edition, published by the US Bureau of Labor Statistics, the prospects for *Machinists* should continue to be good. The supply of new workers—those entering the field—is expected to be lower than the projected available openings. And while much machining work is computer-controlled or performed by robots, there is still a need for *Machinists* to monitor that activity, make repairs and maintain machines, computers, and robots, and perform related tasks in a machine shop or manufacturing plant.

average of 26 new positions each year, created because of new growth in the industries that usually employ *Machinists*. In addition to those new jobs, there will be an average need for 38 *Machinists* each year to fill openings created by those who start jobs in other occupations, retire, or leave the labor force for other reasons.

Employment Projections by Planning Region, 2006-2016

Region	Estimated Projected			Average Annual Openings		
	2006	2016	Change	Percent	Growth	Replacement
NH Statewide	2,459	2,715	256	10.4%	26	38
North Country	72	85	13	18.1%	1	1
Lakes Region	322	331	9	2.8%	1	5
Upper Valley/Lake Sunapee Region	283	324	41	14.5%	4	4
Southwest Region	114	133	19	16.7%	2	2
Rockingham	328	368	40	12.2%	4	5
Strafford Region	213	233	20	9.4%	2	3
Central NH Region	74	76	2	2.7%	0	1
Southern NH	313	348	35	11.2%	4	5
Nashua Region	699	782	83	11.9%	8	11

Regionally, the North Country has the best growth prospects, with a projected ten-year growth of just over 18 percent, though only two annual average openings are projected. The Nashua Region is projected to grow just under 12 percent between 2006 and 2016, but is expected to have the highest number of job openings, averaging 19 annually. The slowest rates of growth are predicted for the Lakes Region and the Central NH Region, both increasing just under three percent.

In what industries do *Machinists* work?

In New Hampshire, most *Machinists* work in manufacturing industries. About 44 percent of *Machinists* in New Hampshire are employed in the *Fabricated metal products manufacturing* industry, and nearly 17 percent work in *Machinery manufacturing*. Just over eight percent were employed in *Computer and electronic product manufacturing*.

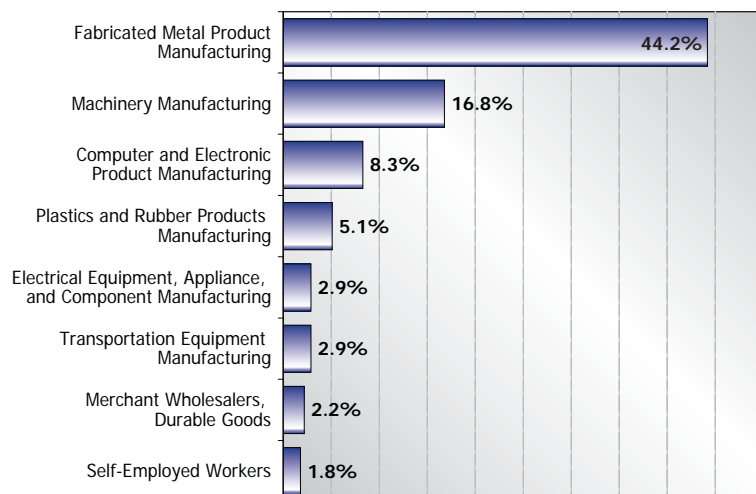
Smaller shares of *Machinists* work in a variety of other industries, including *Merchant wholesalers, durable goods, Self-employed workers, Government, Repair and maintenance services, Technical and trade schools, Utilities, and Scientific research and development services*.

How do you learn to be a *Machinist*?

Most *Machinists* enter the field either through long-term on-the-job training or by completing an apprenticeship. Workers who have experience in basic types of machine set-up, tending, or operation, can extend their knowledge, skills and abilities to those of a *Machinist* on the job. For most, an apprenticeship is the preferred method of training.

In apprenticeship training, the apprentice works almost full time under the supervision of an experienced machinist. In addition, the apprentice attends classes in math, physics, materials science, blueprint reading, mechanical drawing, quality control, and safety practices. Many also learn to use CNC machine tools.

2006 Share of Workers by Industry



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Most apprenticeships are time-based, involving a specific number hours in work activities and classroom activities. More recently, competency-based apprenticeships have been developed that specifically address the skills workers need to do their jobs well. The National Institute for Metalworking Skills (NIMS) has developed competency-based training models for Machinists, CNC programming, setup and operations in turning, CNC milling, CNC milling and turning, press setup operations, and machine maintenance, service and repair. Employers have found that this training model improves recruitment and retention, improves skill level, product quality, and customer satisfaction, and is a cost-effective method of training.⁵

The Office of Apprenticeship (OA), within the Employment and Training Administration, US Department of Labor, is responsible for approving registered apprenticeship programs. OA publishes a list of apprenticeable occupations and required training times for each.⁶ There are eleven recognized registered apprenticeship programs related to Machinists.

In addition to apprenticeship training, there are seven Regional Career and Technical Centers in New Hampshire that offer programs in Machine Shop Technology at the high school level. Centers in Keene, Rochester, Laconia, Milford, Conway, Nashua, and Claremont all offer secondary programs. At the postsecondary level, both

Apprenticeable Occupation	Program Type	Hours
Fixture Maker	Time-based	4,000
Instrument Maker	Time-based	8,000
Instrument-Maker and Repairer	Time-based	10,000
Machinist, Automotive	Time-based	8,000
Machinist, Experimental	Time-based	8,000
Machinist	Time-based	8,000
Machinist	Competency-based	5,600
Machinist, Outside (Ship)	Time-based	8,000
Maintenance Machinist	Time-based	8,000
Rocket-Motor Mechanic	Time-based	8,000
Test Technician	Time-based	10,000

Source: Office of Apprenticeship, Employment and Training Administration, US Department of Labor

⁵ *Registered Apprenticeship Trends in Advanced Manufacturing*, Employment and Training Administration, Office of Apprenticeship, accessed October 3, 2008, at <www.doleta.gov/oa/brochure/2007%20Advanced%20Manufacturing.pdf>

⁶ *US Department of Labor's List of Officially Recognized Apprenticeable Occupations*, Office of Apprenticeship, January 2007.

the River Valley Community College and Nashua Community College offer certificate programs in Machine Shop Technology. Nashua Community College also offers a certificate program in CNC Machining, and is the only institution in New Hampshire to offer an associate's degree program in Machine Technology.

Does a *Machinist* need a license or certification?

There are no licensing or certification requirements for Machinists in the state of New Hampshire, or any other state. There are, however, opportunities to obtain credentials as a qualified, trained machinist through professional association training programs. The NIMS competency-based apprenticeship model (described above) provides a standardized training curriculum used by employers as part of an apprenticeship agreement. Workers who complete the program and pass both practical and written examinations are certified with a credential. Obtaining a credential can improve career opportunities for any worker in the field.

STAR Advanced Manufacturing Training Program

On September 30, 2008, the Governor announced the start of an advanced manufacturing training program. This program will provide 150 displaced workers with an accelerated apprenticeship program and guarantee them jobs with two New Hampshire-based advanced manufacturing companies.

The STAR (Skills Through Apprenticeship and Retraining) program is being funded by a \$1.8 million grant from the US Department of Labor awarded to the New Hampshire Workforce Opportunity Council.

The program offers workers an accelerated, two-year apprenticeship while employed at Hypertherm Inc. of Hanover or Timken Inc. of Lebanon. Workers will also earn college credits from River Valley Community College in Claremont, which can be applied toward an associate's degree. Workers will have the opportunity to receive three additional nationally recognized industry certifications.

"Governor Lynch Announces \$1.8 Million Training Program in Manufacturing," Press Release, Office of the Governor, September 30, 2008. < www.governor.nh.gov/news/2008/093008.html >



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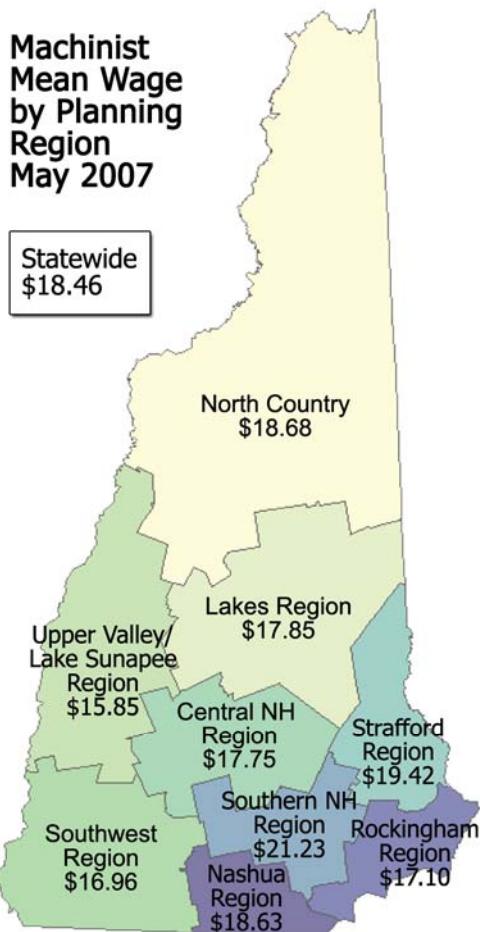
How much can *Machinists* expect to earn?

Wages earned by apprentices are based on an agreement between the employer and the apprentice. Average wages for skilled workers — those who have completed training and are in the workforce — are available from the Occupational Employment Statistics (OES) Survey.

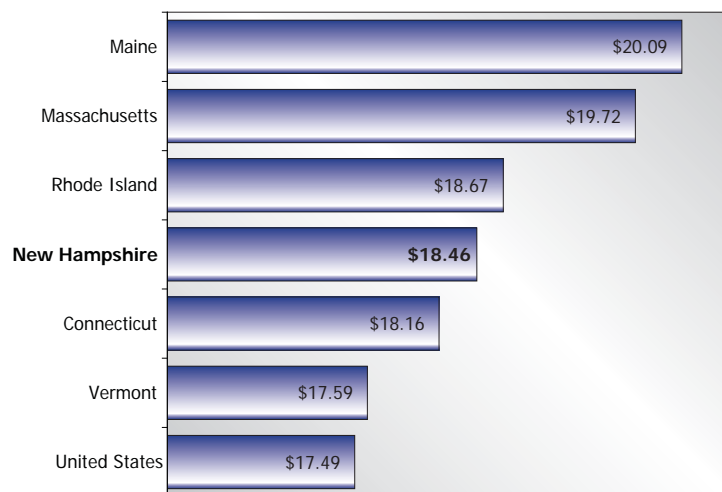
The average hourly wage for *Machinists* in New Hampshire was \$18.46, based on the May 2007 OES survey. This was a dollar per hour higher than the national average, which came in at \$17.49. Hourly wages for entry-level *Machinists* in New Hampshire averaged \$13.12, experienced workers averaged \$21.12.

Among the nine regional planning areas, *Machinists* working in the Southern NH Region earned the highest hourly wage, averaging \$21.23. Wages in the Upper Valley/Lake Sunapee Region were the lowest, averaging \$15.85 hourly.

When comparing the New England states, all six have average hourly wages for *Machinists* that are higher than the national average. New Hampshire falls about in the middle of the pack. Maine had the highest hourly wage, averaging \$20.09, and Massachusetts was not far behind, averaging \$19.72. Vermont brought up the rear, averaging just 10 cents above the national average.



Machinist Mean Wage, New England States and U.S., May 2007



Where can I find more information?

Training and Apprenticeship

↳ Office of Apprenticeship, Employment and Training Administration
www.doleta.gov/oa/

↳ STAR Program, New Hampshire Workforce Opportunity Council
www.nhworks.org

↳ National Institute for Metalworking Skills (NIMS)
www.nims-skills.org

Professional Associations

↳ National Tooling and Metalworking Association
www.ntma.org

↳ New Hampshire Machining Association
www.nhmachine.org

↳ Precision Machined Products Association
www.pmpa.org

↳ Precision Metalforming Association Educational Foundation
www.metalforming.com/edufound/

Sources are listed to provide additional information. Links are provided for your convenience and do not constitute an endorsement. This information is subject to change.