

Assessment/Certificate Options Industrial Manufacturing

CIP No. 15.0600

NATIONAL SKILL STANDARDS, CERTIFICATIONS AND ASSESSMENTS

Contents:

National Skill Standards

National Certifications

National Assessments

NATIONAL SKILL STANDARDS

Manufacturing Skills Standards Council (MSSC)

C/O National Coalition for Advanced Manufacturing
1201 New York Ave. NW, Suite 725
Washington, DC 20005-3917
Phone (202) 216-2740
Fax (202) 289-7618

<http://www.msscusa.org/index.cfm>

Founded in 1998, the Manufacturing Skills Standards Council (MSSC) is comprised of leading companies, international unions, educational and training organizations and national, state and regional governmental organizations. MSSC Members must have an extensive network into their respective stakeholder communities (companies, labor unions, employees, teachers, students, parents, and others) within which they can communicate about the MSSC efforts. The MSSC is staffed and managed by the National Council for Advanced Manufacturing (NACFAM)¹ and the AFL-CIO Working for America Institute.

The primary purpose of the MSSC is to improve the U.S.-based manufacturing industry by ensuring a skilled and mobile workforce in the 21st century. Therefore, in partnership with the National Skill Standards Board (NSSB), MSSC is developing a nationwide system of skill standards, assessments and certifications. The MSSC Skill Standards System was released in 2001 and is the product of more than two years of intensive field research involving more than 700 companies, 3800 workers, 300 subject matter experts, 30 facilitating organizations and a large number of volunteers who serve on MSSC committees. The Standards were developed using a DACUM process, which defines duties, tasks and activities, followed by worker knowledge and skills needed to accomplish those tasks. Skills are categorized by level of complexity and performance indicators are also identified. Completion of these standards marked the first major step towards developing a nationwide system of skill standards, assessments and certification, as envisioned in the National Skill Standards Act of 1994.

The MSSC Skill Standards

As MSSC's goal was to promote a set of skill standards that applies to *every* sector of the manufacturing industry, it developed standards for six concentration areas as well as a set of core standards that are common to all six concentrations.

The six concentration areas in the MSSC skill standards are (for complete lists of the skills standards, see <http://www.msscusa.org/gotostandards.cfm>—the site requires a sign-in, but the standards may be viewed and downloaded for free with sign-in):

- **Production** (*Examples: set up, operate, monitor*)
- **Health, Safety & Environment** (*Examples: determine priorities for training needs, prepare training materials*)
- **Logistics & Inventory Control** (*Examples: station materials for production flow, conduct on-site inventory*)
- **Maintenance, Installation & Repair** (*Examples: develop maintenance schedule, identify special maintenance and repair needs*)
- **Production Process Development** (*Examples: review production performance data, develop production improvement goals*)
- **Quality Assurance** (*Examples: inspect materials, report material quality deviation.*)

Within each of these six concentration areas, the MSSC identified 3 levels of skills:

- **Core skills** are the knowledge, skills and performance that are common and critical to all frontline jobs within manufacturing-related sectors and concentrations.
- **Concentration skills** are the knowledge, skills and performance that are needed for major areas of frontline responsibility, covering families of related jobs and occupations.
- **Specialty skills** are the knowledge, skills and performance that are unique to a particular job or occupation, to an individual industry, or to a specific company. Although the MSSC will not develop specialty skill standards, they will work with existing specialty providers to “align” their skill standards with the MSSC skill standards, and will provide guidance to organizations/sub-industries (such as furniture) that do not currently have specialty standards

The MSSC Skill Assessments

With the Skills Standards in place, the MSSC has contracted with the NOCTI-Raytheon Partnership (NRP) to develop assessments that are designed to help manufacturing workers receive an MSSC certification, document their skills, and provide them with feedback on their performance. The first project undertaken by the NRP is to develop four assessments to align with the Manufacturing Production concentration area Skill Standards. Each of the assessments includes a multiple-choice assessment as well as an integrated simulation for each of the four modules (Quality and Continuous Improvement; Safety; Manufacturing Processes & Production; and Maintenance.) The assessment was piloted during the fall and winter of 2004-2005. It is anticipated that the assessment/certification program will roll-out in the summer/fall of 2005. At present, it is anticipated that the target worker for these assessments will have an education/experience level above that of the typical high school graduate. However, a graduate of a well-developed program with some work experience in a manufacturing setting could probably pass the assessments. That remains for future research. At present NOCTI has a Work Readiness assessment for Manufacturing (see below). It will be evaluated relative to the new certification assessments in the near future.

National Coalition for Advanced Manufacturing (NACFAM)

1331 Pennsylvania Avenue, NW, Suite 1410 - North Tower

Washington, DC 20004-1703

Telephone: 202-662-8960

Fax: 202-662-8964

<http://www.nacfam.org/>

E-mail: nacfam@explorer.clark.net

See also:

Foundation for Industrial Modernization (FIM)

1331 Pennsylvania Ave NW, Suite 1410 North

Washington, DC 20004

The NACFAM Skills Standards

The NACFAM **Voluntary Skill Standards for Advanced Manufacturing** (1997) preceded the MSSC Skill Standards and were used as guidelines in developing the Career Cluster Resources for Manufacturing (<http://www.careerclusters.org>). They are available for download at <http://www.mfglinks.org/nacfam2.pdf>. As the MSSC Skill Standards are being taken to the next level for assessment and certification development, the earlier NACFAM standards will probably receive less attention in the future.

NACFAM also is responsible for developing the **Computer Aided Drafting and Design (CADD) Skill Standards** under a grant from the U.S. Department of Education in 1996 (revised in 1999). For assessment NACFAM recommends both the performance tests offered by CADD software vendors and the drafting concepts tests offered for Drafter Certification by the American Design Drafting Association (ADDA).

National Institute for Metalworking Skills (NIMS)

3251 Old Lee Highway, Suite 205

Fairfax, VA 22030

Telephone: 703-352-4971

Fax: 703-352-4991

<http://www.nims-skills.org/home/index.htm>

The National Institute for Metalworking Skills (NIMS) is a nonprofit organization formed by metalworking trade associations (led by the National Tooling and Machining Association (NATMA), national labor organizations, a council of state governors, companies, and educators to support the development of a skilled workforce for the metalworking industry. NIMS originated as one of 20 industry skill standards initiative, pilot projects funded by the U.S. Department of Labor and U.S. Department of Education in the early 1990's, and is one of four on-going initiatives remaining from that effort. NIMS is accredited by the American National Standards Institute (ANSI) as a developer of American National Standards.

The NIMS Skill Standards

Through NIMS, Skill Standards are being written and maintained for four clusters of metalworking occupations and up to three Levels of Skill:

MACHINING

- Machining Levels I, II and III
- Screw Machining Levels II and III

MACHINE BUILDING AND MAINTENANCE

- Machine Building Levels II and III
- Machine Maintenance, Repair, and Service Level II and III

METALFORMING

- CNC/NC Punch Press Level II
- Laser Cutting Level II
- Metalforming Level I
- Press Brake Levels II and III
- Roll Forming Level II
- Slide Forming Levels II and III
- Spinning Level II
- Stamping Levels II and III

TOOL, DIE, AND MOLDMAKING

- Moldmaking Levels II and III
- Tool and Die Making Levels II and III

The NIMS Skill Assessments

Skills in the metalworking industry are certified through the earning of NIMS credentials. The credentials are awarded on satisfactory completion of both standards-based performance tests and related theory exams. Both performance and theory assessments are developed by the industry and piloted in the industry. On-line test fees are \$35.00 for Level I modules.

NIMS has developed skill standards and individual certification programs for *entry-level machinists* under its **Machining Skills Level I** Program. In addition to benchmarking an individual's basic machine skill knowledge and practical abilities, the Machining Skills Level I certification also is a prerequisite for the other mid-level and advanced NIMS machining certifications. NIMS also has developed skill standards and individual certification programs for *entry-level metalformers* under its **Metalforming Skills Level I** Program. Because the national NIMS standards are modular, credentials may be based on specific metalworking competencies. For example, there are eight distinct credentials in Machining Level I. These credentials currently are recommended by the ADE CTE as an end-of-program assessment/credentialing for programs in Precision Metal Workers Machining Technology (C.I.P. 40.0500). NIMS estimates that the standards covered in Machining Level I could be accomplished in 6 months to one year, depending on the manufacturing experience, basic academic skills, and mechanical aptitude of the learner, and availability of laboratory-based learning.

American Chemical Society (ACS)

<http://www.chemistry.org/portal/a/c/s/1/home.html>

The American Chemical Society is a self-governed individual membership organization that consists of more than 159,000 members at all degree levels and in all fields of chemistry. One of the ACS's many Divisions is the Chemistry Technicians Division. It also has committees on Technician Affairs and Education. Through these committees, ACS has developed The Voluntary Industry Standards (VIS) Database for Chemical Process Technicians. The database was designed for use by two-year colleges and local area chemical industries in developing alliances. It is a collection of industrial workplace

competencies and skills for chemistry based technicians. It originated in the publication, “Foundations for Excellence in the Chemical Processing Industry,” which was initially prepared by the ACS under a grant from the US Department of Education in 1996.

To review the ACS Voluntary Standards for Chemical Process Technician see <http://acswebapplications.acs.org/applications/volindstandards/home.cfm>. These standards are used by the ACS Chemical Technology Program Approval Service (CTPAS) to review, nurture, and approve two-year AAS chemistry-based technology programs. They also have been used as guidelines for the ACS High School program called *Science in a Technical World*. To date, the Skill Standards have not been carried into the development of associated assessment and credentialing of Chemical Process Technicians.

NATIONAL CERTIFICATIONS

Manufacturing Skills Standards Council (MSSC)

<http://www.msscusa.org/index.cfm>

Manufacturing Production Certification

As noted above, the MSSC is currently working with NOCTI/Raytheon Partnership to create assessments for the four modules (Quality and Continuous Improvement; Safety; Manufacturing Processes & Production; and Maintenance) in the Manufacturing Production concentration area of the MSSC Skill Standards. Successful completion of all four assessments will entitle the candidate to certification in Manufacturing Production.

National Institute for Metalworking Skills (NIMS)

<http://www.nims-skills.org/cred/cred.htm>

Machining Level I Certification

Metalforming Level I Certification

As noted above, workers, trainees, and students can earn a NIMS Machining or Metalforming certification when their specific knowledge and skills have been validated against the appropriate set of industry-based skill standards. Each such NIMS *skill validation* involves passing *both* a written, knowledge-based skills examination *and* a hands-on, performance-based test. A candidate may attempt to gain credentials in one or several modules of their defined skill areas. Altogether, NIMS presently has developed skill standards certification programs for individuals in 24 occupational areas and proficiency levels. It should be noted that NIMS uses the term *credential* in its materials to apply to the earned recognition that an individual receives when he or she successfully completes all the skill standards requirements necessary to receive a particular skill standards designation. NIMS uses the term *certification* to apply to a machining or metalworking training program – offered by an educational institution, training consortium, or company – that has met all NIMS criteria for program content: equipment, tooling, and measuring device inventory; instructor qualifications; and participation by advisory bodies.

Society of Manufacturing Engineers

http://www.sme.org/cgi-bin/certhtml.pl?cert/schools_students.htm&&&SME&

Certified Manufacturing Technologist (CMfgT)

Earning the CMfgT demonstrates the candidate's competence in the fundamentals of manufacturing. It requires a minimum of 4 years combined manufacturing-related education and/or work experience. It is designed as an end-of-program certification assessment for students graduating from two-year college and four-year university students in manufacturing-related programs.

National Association of Industrial Technology

<http://www.nait.org/certif/certif.html#cert>

Certified Industrial Technologist (CIT)

Certified Senior Industrial Technologist (CSIT)

NAIT is responsible for the accreditation of industrial technology programs in colleges, universities, and technical institutes, and the certification of industrial technologists and the recognition of their continued professional development. To be certified by the NAIT, a candidate must have an industrial technology-related degree (AS, BS, MS or Doctorate) or an equivalent degree, teach or serve as an administrator in an industrial technology-related degree program, or be professionally employed in a capacity related to the discipline of Industrial Technology. In addition, the candidate must pass the NAIT Certification Examination.

National Institute for Certification in Engineering Technologies (NICET)

<http://www.nicet.org/index.cfm>

***Certified Engineering Technician
Industrial Instrumentation
General Knowledge:***

- ***Electrical/Electronic***
- ***Industrial***
- ***Mechanical***

NICET's nationally recognized certification programs are designed by industry experts to provide engineering technology fields with a qualified workforce by assessing the candidate's job skills and knowledge. NICET certifications are very specific within certain fields (e.g. fire alarm systems). However, some certification programs are more general. Relevant Technician certifications are noted above.

Technician certification requires testing (written, multiple choice) and documentation including a work history, recommendations, and for most programs, supervisor verification of specific experience.

Technologist certification requires a 4-year engineering technology degree (no testing required), and at the advanced level, documentation including a work history and endorsements.

American Society for Quality (ASQ)

<http://www.asq.org/cert/types/cqt/index.html>

Quality Technician Certification (CQT)

The American Society for Quality (ASQ) creates better workplaces and communities worldwide by advancing learning, quality improvement, and knowledge exchange to improve business results. For Quality Technician Certification, the candidate must have at least four years of higher education and/or work experience in one or more of the areas of the Certified Quality Technician Body of Knowledge. With certification through the Quality Technology program of a community college or vocational school, one year will be waived. With an Associate degree, two years are waived.

International Society of Certified Electronics Technicians (ISCET)

<http://www.iscetstore.org/index.html>

Certified Electronics Technician

A technician or student in electronics with less than four years of experience may take the associate level exam. The exam is the basic electronics portion of the full credit CET exam and must be passed with a score of 75% or better. This multiple-choice test covers basic electronics, math, DC and AC circuits, transistors and troubleshooting. A successful associate CET will receive a wall certificate valid for four years and is eligible to join ISCET.

NATIONAL ASSESSMENTS

National Occupational Competency Testing Institute (NOCTI)

<http://www.nocti.org/index.htm>

NOCTI's Job Ready tests are designed to measure an individual's knowledge of basic processes including the identification and use of terminology and tools. Job Ready tests can be used for both secondary and post-secondary education. At present, there is one NOCTI assessment that could be used to test student attainment of manufacturing knowledge. It is not clear how this job readiness assessment will relate to the modular assessments recently developed for the MSSC Skill Standards (see above). In addition, NOCTI has recently released a pre-engineering assessment that could be of interest in some programs.

Job Ready: MANUFACTURING TECHNOLOGY Test Code: 1084 Version: 01 **Written**

Assessment: Administration Time: 3 hours

Number of Questions: 175

Areas Covered:

11% Math, Science, Measurement and Communication Skills

11% Workplace Safety, Health and Job Skills

8% Quality Assurance (Maintenance)

8% Blueprint Reading

17% Manufacturing Fundamentals/Processes and Materials

3% Planning and Scheduling Production Processing and Material Utilization

5% Computer Use

5% Process Control and Improvement/Time Motion and Cost

2% Purchasing & Resource Identification Activities

5% Computer Control Functions, PLC's and Automated Manufacturing

3% Communication Processes

15% Electrical/Electromechanical Components

7% Design Processes

Specific Competencies and Skills Tested in this Assessment:

Math, Science, Measurement and Communication Skills

- Apply basic math function to solve problems
- Create and interpret basic graphs and charts commonly used in manufacturing
- Match measurement activities to manufacturing processes
- Distinguish between direct and calculated measurements
- Demonstrate proper general measurement techniques
- Demonstrate proper precision measurement techniques
- Illustrate measurement differences when taken with calibrated and non-calibrated instruments
- Match appropriate measurement tools with various types of measurement requirements
- Convert between US and metric measurement systems
- Convert fractional measurements to decimal measurements
- Compute within measurement systems
- Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares and cylinders.
- Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches

- Add, subtract, multiply and divide using fractions, decimals and whole numbers
- Understand molecular action as a result of temperature extremes, chemical reaction, and moisture content
- Draw conclusions or make inferences from data
- Understand pressure measurement in terms of P.S.I., inches of mercury and K.P.A.

Workplace Safety, Health and Job Skills

- Complete forms and paperwork as required
- Maintain and use protective guards on equipment and machinery
- Use electrical devices correctly and safely
- Prevent spontaneous ignition by practicing proper waste disposal habits
- Keep marked aisles clear of equipment and materials
- Identify fire exits, fire-fighting equipment and procedures
- Report unsafe practices to appropriate personnel
- Locate power shutoff controls for all machinery/equipment
- Report malfunctions to appropriate personnel
- Determine weight/operating limits of equipment
- Perform periodic checks during operation to assure proper function
- Define different types of chemical, biological and physical hazards
- Describe ergonomics and its importance to the manufacturing process
- Identify health related problems that may result from exposures to work related chemicals and hazardous materials and know the proper precautions required for handling such materials
- Follow established safety procedures when around machinery/equipment
- Demonstrates safe operation of all power tools, hand tools and machines
- Demonstrates discipline by wearing all required personal safety equipment (glasses, shields, gloves, etc.)
- Demonstrates discipline of working in a safe, efficient manner without the threat of injury to self or others

Quality Assurance (Maintenance)

- Contrast quality manufacturing system with other manufacturing systems
- Identify effects of quality systems on specific manufacturing processes
- Explain the effect of quality on profit
- Identify the effects of continuous quality improvement
- Demonstrate the ability to apply continuous quality improvement to the manufacturing process
- Define SPC (Statistical Process Control)
- Identify and apply SPC to specific production processes
- Analyze production specific processes
- Analyze and interpret test data for compliance to specifications
- Maintain production according to instructions
- Identify customer problems
- Develop a plan utilizing a selected quality control system
- Investigate equipment failures
- Perform inspections
- Performs basic measurements using rules, tapes, micrometers, calipers and indicators in both Metric and English units
- Establish operating maintenance schedule
- Performs measurements using a digital gauge interfaced with a CPU

Blueprint Reading

- Identify different dimension methodologies
- Identify general note symbols
- Interpret commonly used abbreviations and terminology
- Determine tolerances associated with dimensions on a drawing
- Identify types of lines within a drawing
- List the essential components found in the title block
- Identify orthographic views
- Identify isometric views
- Identify positions of views: top, front, side, auxiliary, section
- Extract information from prints

Manufacturing Fundamentals, Processes, and Materials

- Use measuring instruments
- Calculate with percents, rate, ratio and proportion with the use of a calculator
- Make reasonable estimates of arithmetic results without the use of a calculator
- Demonstrate basic mechanical skills
- Identify and report equipment malfunctions
- Describe the importance of correct fixturing and work holding devices
- Describe the function of specific machine tools
- Inspect machine tools for defects
- Locate and retrieve production materials specific to process flow and delivery schedule
- Interpret prints to determine appropriate tool usage
- Follow electrical troubleshooting procedures
- Understand different metal stock shapes (sheet, flat, round, etc.)
- Demonstrates proper vertical band saw, drill press, hydraulic shear and pedestal grinder use
- Demonstrates proper use of various hand tools
- Demonstrates proper counter boring, sinking, reaming, tapping and threading on metal stock
- Performs basic layout techniques to mark center points of holes and lines to cut on a workpiece
- Enter and edit a program in a Computer Numerical Control machine (CNC Mill)
- Design a Computer Numerical Control program using both linear and circular interpolation
- Convert coordinates between absolute and incremental positioning
- Locate Point Reference to Zero (PRZ) and offsets in a Computer Numerical Control Mill
- Operate a Computer Numerical Control machine (mill)
- Demonstrate basic operation of a manual lathe
- Demonstrate basic operation of a manual mill
- Mill Setup and Tooling
- Material characteristics

Planning and Scheduling Production Processing and Material Utilization

- Schedule jobs
- Requisition materials
- Organize assembly lines
- Assign personnel to equipment and positions
- Control shop flow of jobs
- Conduct in-process inspections
- Direct assembly of components into final products
- Conduct final test and inspection
- Direct packaging
- Direct shipping or transfer to customer or warehouse

- Establish system for handling and storing material in process
- Establish a system for handling and storing finished material
- Use a teach pendant to teach/edit robot position points
- Design a program to perform a basic material handling task
- Use PC software to enter and edit a program that will unload an automatic machine using an operator station
- Design a robot program that uses input and output devices (conveyor, push button, buzzer, go-no-go gauge, limit switches, lights)

Computer Use

- List possible computer applications in manufacturing processes
- Identify possible effects of introducing automations into manufacturing processes
- List various methods of tracking inventory quantities
- Demonstrate use of industry-accepted word processing software package
- Demonstrate use of industry-accepted spreadsheet software package
- Demonstrate use of industry-accepted database software package
- Demonstrate use of industry-accepted statistical processing software package
- Demonstrate use of industry-accepted graphic software package
- Demonstrate use of computers involving distance learning
- Demonstrate use of computers to interface with machines
- Basic computer knowledge

Communication Processes

- Write production reports
- Write technical reports
- Illustrate report with charts, diagrams and graphs
- Plan technical training for employees

Process Control and Improvement/Time Motion and Cost

- List a variety of process control applications
- Collect and analyze information to determine and improve work processes
- Explain the advantages and disadvantages of just-in-time inventory
- Create a project plan
- Conduct time and motion studies
- Establish and write employee job standards
- Develop and analyze cost central data
- Write job descriptions
- Complete job status reports
- Analyze job evaluation

Purchasing and Resource Identification Activities

- Advise on “make or buy” decisions
- Identify services of supply
- Obtain bids or quotations
- Select vendor
- Prepare and issue purchase requisition
- Receive and inspect incoming materials

Computer Control Functions, PLC’s and Automated Mfg

- Use CAD/CAM program
- Program microprocessors
- Make adjustments to programs

- Evaluate robotic applications to improve programs
- Connect digital input and output devices to a robot controller (PLC) Programmable Logic Controller
- Program PLC
- Connect output and inputs
- Understands/interprets basic ladder diagrams

Electrical/Electromechanical Fluid Components

- Interpret blueprints, schematics and technical manuals
- Analyze system failures
- Use various devices to gather electrical measurements (analog voltmeter, DMM)
- Circuit Analysis (calculate voltage, current and resistance in a series circuit)
- Inductance and Capacitance
- Transformers
- Control Logic
- Electrical Wiring Techniques
- Understand fluidics systems/fluid power
- Electrical/electronics terminology and symbols

Design Processes

- Construct drawings using various commands in a Computer Aided Design program
- Perform a sketch of a multiview drawing given an isometric drawing
- Use Computer Aided Manufacturing software to produce and print a Computer Numerical Control program (CNC)
- Design process procedure
- Understand research development
- Use Computer Aided Manufacturing software to create CNC programs

Job Ready: PRE-ENGINEERING/ENGINEERING TECHNOLOGY

Test Code: 1475 Version: 01

Written Assessment: Administration Time: 3 hours

Number of Questions: 179

Areas Covered:

8% Overview of Engineering

46% Engineering Systems

9% Design Process/Problem Solving

22% Manufacturing

9% Materials

3% Safety

3% Communication and Teamwork

Performance Assessment: Administration Time: 3 hours

Number of Jobs: 2

Areas Covered:

60% **Technical Writing** *Identify the problem, evaluate alternatives, design solution, test solution, analyze results, draw conclusions, format report*

40% **Oral Presentation** *Presentation time, headings, number of slides, appropriate slides, question and answer period, overall presentation.*

Specific Competencies and Skills Tested in this Assessment:

Overview of Engineering

- Describe major engineering fields
- Understand functions an engineer performs
- Describe education required to be an engineer
- Understand ethics related to engineering situations
- Understand complex system inter-relationships

Design Process/Problem Solving

- Identify principles of a problem
- Outline the steps in the design process
- Translate word problems into mathematical statements
- Determine known, relevant information and analyze solutions
- Choose between alternate solutions
- Develop details of a solution
- Build a prototype from plans
- Test a prototype
- Redesign prototypes

Manufacturing

- Explain the major manufacturing processes
- Identify and use common hand tools/fasteners
- Estimate and measure the size of objects using SI and US units
- Explain quality control in manufacturing
- Measure with precision measurement tools and instruments

Materials

- Identify common materials
- Compare and contrast physical properties of materials
- Select correct materials for specific functions
- Test materials for specific characteristics

Communication and Teamwork

- Determine what known information is relevant
- Read and understand design documentation and technical manuals
- Write technical reports
- Make an oral presentation
- Express data in tables, graphs, and charts
- Contribute to a team project

Safety

- Understand personal safety
- Describe and use safety equipment
- Describe the function of a safety device

Engineering Systems

- Solve problems using vectoring, predict resultant forces
- Demonstrate the effect of resistance
- Apply ohm's and watt's laws
- Identify series, parallel, and combination circuits
- Understand AC and DC systems

~~· Identify what causes resistance in a fluid system~~

- Give examples of hydraulic and pneumatic systems
- Identify the three ways heat is transferred
- Explain the difference between Celsius and Fahrenheit scales
- Describe heat conductors and insulators
- Solve thermal problems using appropriate units
- Identify the six simple machines and their applications
- Solve problems using appropriate units in engineering systems
- Understand/identify inductors and capacitors
- Use appropriate electrical units to solve problems
- Draw a circuit diagram and lay out the circuit
- Identify the difference between analog and digital signals
- Identify direction of heat flow given differences in temperature
- Understand the use of insulation to minimize heat flow

Brainbench

<http://www.brainbench.com>

Headquartered in Chantilly, Virginia, Brainbench provides online assessment and certification of over 400 different work skills. Although Brainbench offers many certification assessments that involve both knowledge and performance assessments, they offer only a knowledge assessment for **Manufacturing Industry Knowledge**.

The Manufacturing Industry Knowledge test measures one's knowledge of the manufacturing industry within the United States of America. Designed for individuals with broad knowledge of the industry and related trends, this test covers the following topics:

Sample of Results Reporting

- Computer-Aided Manufacturing

Mike Russiello
(mike@brainbench.com)

Test: .NET Framework
Date: 25-May-2004
Score: 1.25
Weights: 100% .NET Framework
Elapsed time: 3 min 13 sec

.NET Framework

Score 1.25
Percentile Scored higher than 4% of previous examinees

Demonstrates an understanding of only the most basic concepts contained within this topic. Employers will most likely require formal training or self study before making any assignments in this area.



Conceptual Score 1
 Problem Solving Score 1

Strong Areas

- None noted

Weak Areas

- .NET Architectural Overview
- .NET Framework Class Library
- .NET Programming
- Assemblies
- Common Language Runtime (CLR)

 One Page Report
  See Questions
  Score Histogram
 Geo. Rankings
  Topic Report
  Benchmark

[View detailed topic results](#)

Facilities Planning

- First-line Supervision
- Fundamentals of Manufacturing Processes
- Industrial Safety
- Maintenance
- Production and Inventory Control
- Purchasing
- Quality Assurance

Brainbench tests use a proprietary Computer Adaptive Testing (CAT) technology. This technology selects the next question based on previous answers. In this way, no two tests are ever the same. Brainbench assessments are developed by qualified professionals in accordance with recognized guidelines published by the American Psychological Association (APA), the Society for Industrial and Organizational Psychology (SIOP), and the US. Department of Labor. Each test is developed by qualified subject-matter experts according to a carefully defined process.

(Footnotes)

¹ NACFAM an industry-led, non-profit education, research and services organization consisting of over 1500 corporations, 20 national trade associations and 350 non-profits (federal labs, university research centers, industrial research consortia, technical and community colleges, and manufacturing extension partnerships) that offer productivity-enhancing services to manufacturers. Since its founding in 1989, NACFAM has helped build national policies and programs designed to accelerate the development and deployment of advanced technologies and related workforce skills. Some examples include the National Skill Standards for Computer-aided Drafting & Design and the National Skill Standards for Advanced Manufacturing.