Getting to ISO

Print:

Reading and following technical documents to ensure adherence to ISO standards in manufacturing

Industry Sector: Advanced Manufacturing
Content Area: Literacy
Core Topic: Reading technical information

Expand All | Collapse All

Common Core State Standards

RST.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.

RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Adult Basic Education Standards

Reading Standard 1: Learners will comprehend and analyze a variety of texts for various purposes.

R1.4a Distinguish between fact and opinion, fact and fiction, relevant and irrelevant information.

R1.4d Summarize ideas and information from texts of increasing length and complexity of content.

R1.4f Draw conclusions and make predictions and inferences from information or ideas presented in texts of various genres (e.g. historical documents, newspaper and magazine articles, fiction and non-fiction, job-related materials).

Reading Standard 3: Learners will use a variety of strategies to comprehend written English.

R3.4e Use a graphic organizer to organize information, ideas, words (e.g. web, Venn diagram, timeline, k-w-l chart.

Industry Overview

Today's Manufacturing Workplace

A manufacturing renaissance is occurring in the United States. The United States is the largest manufacturing economy in the world, producing 21 percent of the goods manufactured across the globe. In addition to the 12 million Americans working directly in the manufacturing industry, manufacturing supports more than 6.5 million other jobs, thus accounting for nearly 17 percent of all private sector jobs in the United States. In 2010, the average U.S. manufacturing worker earned $77,186, including pay and benefits (the average in all industries was $56,436).[1]

While manufacturing jobs in Massachusetts have declined, as they have nationally, manufacturing is still a critical industry in this state and provides opportunities for good, high-paying jobs. In the Greater Boston area, most of the manufacturing jobs are in computer and electronics companies, and much of the state relies on manufacturing positions in these and other very high-tech areas, such as aerospace and biotechnology.[2]

Advanced manufacturing involves the use of computers and technology in the manufacture of products. While not all manufacturing companies use technological innovations in developing their products or processes, the competitive advantage of the United States in the manufacture of goods relies on technological innovations. This means that today's manufacturing workplace is usually highly technical, which accounts for the high-paying positions many workers in this field receive in compensation for their work. It also means that today's advanced manufacturing workplace is very different from many people's conceptions of factories and mills as dark, dirty, and unsafe. Today's advanced manufacturing facilities are usually bright, clean, and very safe, and the emphasis is on working efficiently—with as little waste as possible.

In the advanced manufacturing industry, there has been a marked shift from the traditional role of line workers to workers who demonstrate creativity and innovation. Innovation is a hallmark of the U.S. manufacturing industry, and key to maintaining its position in the global market since products can often be produced at a lower cost in developing countries. Critical-thinking, problem solving and reasoning are important components of the innovation process. Today's manufacturing workers are expected to formulate solutions to problems using critical thinking and reasoning skills while working independently and/or in teams.

1. http://www.nam.org/~/media/AF4039988F9241C09218152A709CD06D.ashx
2. http://www.bostonglobe.com/business/2012/05/08/high-end-factory-jobs-boston-paying-high-wages/3gZuNc6GywDGKoYNP2hnaO/story.html?camp=pm

Careers in Advanced Manufacturing

The manufacturing sector includes jobs related to planning, managing, and performing the processing of materials into intermediate or final products and related activities such as production planning and control, maintenance, and engineering. Thus, this industry includes not only those people who actually produce the manufactured goods, but also managers, maintenance staff, scientists and researchers, analysts, administrative personnel, and IT personnel.

Career Pathways

The manufacturing industry includes six career pathways:

- Production is the construction and assembly of parts and final products. People in these positions work in factories and mills, with machines, to make or assemble parts, construct components of parts (such as plastics), and print materials. Occupations in this pathway range from production

helpers who move parts and materials around the factory, to numerical control machine operators who run the computer-controlled machines that modify metal and plastic to create products, to manufacturing production technicians who oversee production.

- Manufacturing production process development occupations are involved in designing products and manufacturing processes. People in these occupations work with production workers to set up the machines and processes to develop new products. These occupations include engineers and production managers.

- Maintenance, installation and repair workers take care of products after they've been sold and delivered to customers—they install the products, perform maintenance on machines, tools, and equipment so that they work properly, and repair systems that are not performing adequately. Workers in this pathway include automotive technicians, automotive electronics installers, building maintenance workers, industrial electronics repairers, industrial machinery mechanics, millwrights, and small engine mechanics.

- Quality assurance is provided by quality control inspectors and technicians, who ensure that products both meet design standards and are of high quality.

- Logistics and inventory control workers ensure that those working in Production have the materials they need to complete their work. Workers in these occupations inventory materials and products, move materials to the line, and pack and ship finished products. Thus, they include production and planning clerks, and operators of moving machinery such as cranes and forklifts, and packers.

- Health, safety and environmental assurance occupations are focused on keeping the workplace safe by ensuring that workers are using equipment safely and that manufacturing processes are as safe as they can be. The also conduct investigations and conduct inspections.

Mathematics and Communication Skills Needed in Advanced Manufacturing

Mathematics and communication are key skills needed for success in today's high-performance advanced manufacturing workplaces. Mathematics is used in the advanced manufacturing industry to measure the amounts and sizes of materials and parts, create "recipes" used to manufacture man-made materials, and analyze data. Data analysis is critical at many levels of a manufacturing organization in order to ensure quality and to continuously improve both quality and processes. Today's manufacturing industry must operate extremely efficiently and produce very high-quality products in order to maintain competitiveness. Many front-line workers are involved in collecting data and working to improve quality and efficiency. Thus, in addition to basic mathematical calculations (which rarely involve simple whole numbers), workers are engaged in mathematical reasoning and solving problems using a variety of mathematical tools.

To succeed and move up the ladder in today's advanced manufacturing workplace, workers need reading skills to understand technical concepts, vocabulary, and to bring together information needed for a particular situation; to locate, organize, and document written information from various sources needed by co-workers and customers; and to locate written information needed by co-workers and customers. They need to use correct grammar, punctuation and terminology to write and edit documents and to develop and deliver formal and informal presentations using appropriate media to engage and inform audiences. In addition, they need to interpret verbal and nonverbal behaviors to enhance communication with co-workers and clients/participants; apply active listening skills to obtain and clarify information; and interpret and use information in tables, charts, and figures to support written and oral communications. They also must communicate with co-workers and customers using technology tools. As they move up the corporate ladder they will need to explain written organizational policies, rules and procedures to help employees perform their jobs.

Career Opportunities in Advanced Manufacturing with Education from Community Colleges

Massachusetts Community Colleges play an important role in preparing the state's citizens to take advantage of the career opportunities available in advanced manufacturing. Degree and certificate programs prepare students to enter advanced manufacturing occupations, including:

- production occupations, including people who work as assemblers (such as airplane assemblers), machine operators, machinists, systems operators, CNC machine tool operators, machine setters, laminators/fabricators, metal and plastic workers, packers, molders, semiconductor processing operators, welders and solderers, tool and die makers, and other production workers;

- manufacturing production process development occupations, including numerical control tool programmers who write the programs that control machine tools and industrial production managers who plan and oversee production;

- maintenance, installation and repair occupations include automotive, electronics, and biotechnology technicians, industrial machinery mechanics, and millwrights (who install and maintain heavy equipment);

- quality assurance occupations including quality control technicians and inspectors.

Recent Career Opportunities in Massachusetts

The following is a sample of advanced manufacturing job listings in Massachusetts that require associate's degree or certificate:

- Manufacturing Engineering Technician, Randstad Corporation, Framingham, MA, [show]
- Quality Control Technician, QD Vision, Lexington, MA [show]
- Manufacturing Technican, Hologic, Marlborough, MA [show]

Employment Outlook for Advanced Manufacturing

Advanced manufacturing continues to be a high-growth industry, given the knowledge capital in the United States. However, the work in this industry is increasingly technical and requires far fewer workers as more tasks are automated. Entry-level positions in this industry require the same skills that only a select group of highly-experienced and well-paid workers once had. Unfortunately manufacturers find it difficult to fill these high-skill positions. A 2011 survey found that there is a persistent skills gap between the skills that are needed in the today's manufacturing workplace and the skills that candidates bring to the workforce.

Most of the advanced manufacturing companies in Massachusetts are small to mid-sized operations that employ smaller numbers of workers and rely on computer-operated machinery for production. While the numbers of workers are smaller than in the past, the more highly-skilled nature of the work means that these are high-paying jobs and provide workers with opportunities to grow through training and education and to be part of the effort to innovate.

Resources:

Advanced Manufacturing Industry

- National Council for Advanced Manufacturing
- Advanced Manufacturing
- Brookings: "Why Does Manufacturing Matter? Which Manufacturing Matters?" (2012)
- National Association of Manufacturers: "A Manufacturing Renaissance: Four Goals for Economic Growth" (2012)

Advanced Manufacturing Industry Outlook Information

- Bureau of Labor Statistics: Manufacturing Industry at a Glance
- Massachusetts Labor Market Data
- Massachusetts Career Information System

Careers in Advanced Manufacturing

- Massachusetts Career Information System
- Manufacturing Career Opportunities
- Manufacturing Career Pathways

- Industry Competency Model for Advanced Manufacturing shows the skills and knowledge needed to work in this industry
- National Association of State Directors of Career Technical Education Consortium's Common Career Technical Core
- National Association of State Directors of Career Technical Education Consortium's Knowledge and Skills: Manufacturing
- O*NET
- WorkKeys Occupational Profiles
- Manufacturing's Missing Generation
- A Career in Toolmaking or Machining Technologies: The Right Choice for Students, Community, & Country

Workplace Scenario (8th Grade Level)

This scenario is based on the work of a machine operator. For more information, view this video.

The International Organization for Standardization sets ISO standards for each industry. The standards help to make sure products and services are safe and of high quality. Your company has introduced a new ISO standard for machinery. The standard is designed to help you know about risks when using of machinery.

You are a machine operator at your company. You are expected to read the new ISO guidelines for your machine. The guidelines provide a series of steps. By following these steps, you will understand the limits of your machinery. You'll also be able to identify risks of hazards such as crushing or cutting. You'll be able to reduce dangers caused by machine failure or human error.

ISO auditors are scheduled to visit your company during the year. Auditors will watch you and other machine operators at work. They also ask questions about the guidelines to make sure you understand them. You must be able to follow correct procedures and answer the questions correctly. If you don't, the company may lose its ISO certification. Losing certification will affect your company's brand name and reputation.

Your company will likely provide training to help you understand the ISO standards. You will be expected to apply them to your job. The standards include technical language used in manufacturing. You need to be able to transfer the information to the operation of your specific machine. You must be able to think clearly and follow steps in a process.

You need to use many skills to carry out tasks effectively and efficiently. The skills include reading and understanding work materials. You also need to use reason and problem solving skills to understand new information and materials. You also need to be able to follow guidelines to arrange objects or actions in a certain order. You need to listen to others with understanding and ask questions. You need to be able to write clearly so others can understand.

Workplace Scenario (High School Level)

This scenario is based on the work of a machine operator. For more information, view this video.

Your manufacturing company uses ISO International Standards published by the International Organization for Standardization. ISO International Standards provide specifications for products, services and good practice. ISO Standards helps to make the company more efficient and effective. ISO standards are set for each industry to make sure that companies meet the needs of their customers. A new ISO standard for machinery was recently introduced into your company. The standard is designed to help you be aware of and reduce risks related to the use of machinery. This standard can help protect you from on-the-job injury and fatal accidents.

As a machine operator, you are expected to read and understand the new ISO guideline documents about your machine. The guidelines provided in the ISO standards are presented as a series of logical steps. By reading and following these steps, you will be better able to determine the limits of the

machinery. You'll also be able to identify risks of hazards such as crushing, cutting, electric shock, or fatigue. And finally, you'll be able to reduce possible dangers ranging from machine failure to human error. In addition, as part of the quality management process, ISO auditors will visit the company during the year to make sure you and other machine operators are meeting the standards. During these visits, ISO auditors observe you and other machine operators and ask questions about the guidelines to make sure you are following them correctly. If you are not following correct procedures or you are unable to answer the auditors' questions, the company may lose its ISO certification. This will affect its brand name and reputation.

As part of your company's required training, you need to be able to read and understand the ISO standards and apply them to your job. The standards include technical language about the equipment, tools and processes used in manufacturing. You need to be able to translate those to the operation of your specific machine. You must be able to think logically and follow sequential steps in a process.

You need to use many skills to carry out tasks effectively and efficiently. The skills include reading and understanding work-related materials and using reason and problem solving skills to understand new information and materials. You also need to be able to follow guidelines to arrange objects or actions in a certain order, to listen to others with understanding, and to ask questions. You need to be able to write clearly so others can understand.

Core instructional context

Lack of reading skills presents significant challenges to students' career and college readiness. While the majority of the adults in this country are functionally literate, a high number of adults in this country are poor readers and this has major implications for employers. Adults with low literacy levels are more likely to be unemployed or hold very low paying jobs. According to the National Center for Educational Statistics "…about 22% of American adults have minimal literacy skills. Some are functionally illiterate in that they can read some words but not enough to understand simple forms or instructions."

In order to help students to become good readers, teachers may want to focus on skills to help build overall literacy, including vocabulary, fluency, and comprehension development.

A good reader

- confidently approaches reading tasks.
- activates their background knowledge before reading.
- knows the purpose for reading.
- can make predictions and choose appropriate strategies for the passage.
- summarizes major ideas and recalls supporting details, makes inferences, and paraphrases.
- can focus their complete attention on reading.
- uses appropriate word decoding skills.
- can monitor his or her comprehension during and after reading.
- can anticipate and predict meaning of words by using context clues and other strategies.
- can create visual and sensory images from text.
- has a large repertoire of strategies to help them attack an unfamiliar passage.

The following tactics are ideas to help build student vocabulary and background knowledge, fluency, and comprehension skills.

Building Vocabulary and Background Knowledge

In order for students to raise their reading proficiency, they need repeated exposure to new words. Encourage students to skim the assigned text and identify unknown words prior to reading and provide descriptions or an explanation of a new term or word for students. One helpful resource to support this is Innovativocab. Students should make notes of unknown words to review and learn by reusing the word in an original sentence and practicing the word orally. They can also provide their own description for the word and attempt to connect the word to a picture or make a personal anecdotal connection to the word.

Another way to help students build vocabulary is to help them build semantic maps, placing the word to be defined in the center and brainstorming ideas about the word. As students identify words that define the main word or mean the same, draw the semantic map to show relationships. The website Visuwords is an online thesaurus that provides semantic maps for words. Once a word is entered, rolling over the word in the semantic map provides the definition. Using this website is one way for students to build knowledge about families of words.

Students can also be encouraged to learn Greek and Latin prefixes, suffixes and common root words. Point out to students that they can unlock the meaning of a significant number of new words by knowing these word forms. One resource students might use is "Root Words, Roots and Affixes" or the list "English Language Roots". One strategy the instructor can use is to identify roots and affixes of word that may be unknown to students during a vocabulary lesson. For example, the word "auditor," contains the root *aud-* meaning "to hear or listen" and the suffix *-tor* meaning "one who" or "one who hears or listens" and is used with this meaning in the scenario for this module.

Finally, have students keep their own vocabulary journal to record unknown words, especially academic words. The Academic Word List is a resource to help with identifying academic words, Have students record graphics and definitions in their own words as this can help students to better retain words over time.

Building Fluency

Fluency—the ability to read with accuracy, speed and expression—is important because it allows the reader to avoid the process of decoding each word along the way. One effective strategy to build fluency is repeated reading or the strategy of reading short passages several times and attempting to read a little faster each time. It will be more difficult for instructors to understand the students' reading issues if they are only asked to read silently. According to Guglielmino (2005), "finding a balance of activities (such as explicit instruction, guided reading, echoing the teacher's reading, reading in pairs, and silent reading) every day within a safe and non-threatening environment is most likely to produce positive results."

One specific strategy to build fluency is **WARF**, which encourages students to:

- **W**iden your eye span. Read groups of words or phrases rather than one word at the time.
- **A**void skip backs. Keep reading even if you are not sure you understand.
- **R**ead silently. Even if you have to place a finger on your lips to remind you.
- **F**lex your reading rate. When reading important information, read more slowly than when you are reading less important, less detailed information.

Other strategies to improve fluency include timed reading, repeated and monitored oral reading, teacher modeling, paired (partner) reading, tape-assisted reading, and chunking. For more information on these strategies, see Florida GED PLUS College Preparation Program Curriculum and Resource Guide.

Improving Comprehension

It is important to teach students that, with practice, reading can become easier. Instructors should consider their approach to teaching comprehension in terms of where particular students' confidence levels are in regards to reading.

Useful strategies for comprehension include retelling or summarizing the passage, discussing the reading and evaluating what was read. Writing a summary of what was read also reinforces the reading-writing connection. Encourage students to take notes as they read using a system such as Cornell Notes or Thinking Notes. Using graphic organizers to help students before, during, and after reading are also great tools, such as these graphic organizers from Scholastic.

Help students learn pre-reading strategies such as TIPP?. This strategy uses skimming to preview the text and develop questions students think the text may answer as they read. Point out that scanning is a different strategy used to locate specific information, such as the answer to a question. This is also a good time to activate prior knowledge with the use of a KWL chart or other strategy to help students recall what they already know about the topic.

Finally, writing for understanding is a way for students to show and for instructors to check for comprehension. Students can keep a journal to predict what a reading will be about and then summarize the entire text after they read sections or individual passages, making note of any questions they have about the text. This is an easy way to model comprehension strategies in the classroom as well.

Reading Technical Texts

Technical texts such as the ISO standards discussed in the scenario are especially challenging to read and comprehend. Reading experts (Fry, 2012, p. 74) suggest five kinds of information to look for in technical text: definitions and terms, examples, classifications and listings, comparison and contrast, and cause and effect. Fry also suggests a seven-step plan for students as they attack technical material.

1. Learn the technical terms.
2. Analyze the structure and understand it.
3. Skim the text, identifying questions you have.
4. Be sure you have a full understanding of each section before moving on.
5. Read slowly.
6. Pay attention to examples
7. Summarize after reading.

Example

Ask students to practice the seven-step plan as they read technical information. Assign an excerpt from the Occupational Safety and Health Administration (OSHA) Technical Manual Section IV: Chapter 4 or any of the sections or chapters of the OSHA Technical Manual for students to read using the seven-step plan. Students will complete reading notes using a template such as the one below.

Seven-Step Plan Template for Technical Material	
Step	**Notes**
1. Technical terms: Identify technical vocabulary and definitions	
2. Structure: How is the material organized?	
3. Skim: What questions do you have about the material?	
4. Understanding of each section: What are the key ideas of each section?	
5. Read slowly: Write your notes on the document or in this space.	
6. Examples: What examples are used?	

7. Summary: Write a summary of the text.	

Assessment

Review the chart that students created to guide their reading or assess students' written summaries of technical text they have read by using a classroom rubric. Also, use vocabulary quizzes or content quizzes to assess students' knowledge and understanding of the content they've read.

Sample rubrics to use or adapt include these:

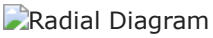
- Assessing Critical Reading Competencies from a Student-Produced Text: Rubrics
- Rubric for Reading Technical Information

Contextualized learning activities

Reading Technical Material Text
To demonstrate some of the challenges of reading technical information, have students read page 3 of the Pedersen Universal Tool and Cutter Grinder Manual. Tell students to identify words or phrases they don't understand. Point out the three sentences below taken from page 3 of the manual. Ask students what they think each of these sentences means. Students may need to refer to the page for help. Ask students to indicate what other information they would need to know to fully understand these sentences (for example, the meaning of ASA 50 and MORSE 5):

- The pushbuttons and the speed regulation switch of this machine type are placed in a swivable pendant station.
- The grinding spindle and the main motor are balanced statically and dynamically to ensure a correct grinding.
- The spindle is hardened, ground and provided with ASA 50 at one end and MORSE 5 at the other.

Discuss the meaning of one or more of the sentences and demonstrate strategies for understanding each of the sentences. One strategy students should use is to identify vocabulary they need to know and ways to understand what the terms mean in the context of these sentences. Lead students in a vocabulary-building activity using words from the three sentences above. Select one or two words to create semantic maps that will help students build word associations for these terms. For example, a semantic map for the word *swivable* might look like the figure below.



Follow this activity with an assignment that students can accomplish on their own. Have students preview the manual *Operation and Maintenance Manual Mrl Series Roll Laminators/Mounters* and identify the topic and the structure of the document. Ask students to identify any symbols in the manual and what they mean. (There are none in this manual.)

Assign other questions for students to answer individually or in small groups using the section on Safety Precautions on page 5.

- Why should the work space be kept clear?
- What should you know about the heat shoes?
- What is the purpose of the panel guards?
- What process should you follow to move the laminator?

Check correctness of response against this key (the idea is important not the exact words):

- Accidents can happen if the work space is cluttered.
- Heat shoes are very hot. To clear a jam or near the heat shoes, turn the heat switch off and allow the laminator to cool.
- The panel guards protect the person operating the machine from the moving parts.

- Turn the laminator off, unplug it and allow it to cool. Remove the film rolls before lifting or moving the machine.

Also assess students' responses for their use of standard English, correct capitalization and punctuation.

Understanding Safety Symbols
ISO agrees on standards, and companies articulate or write work processes and procedures they follow to meet those standards. There are four levels of ISO: quality manual, standard operating procedures, work instructions specific to a machine, and related required forms and records.

ISO auditors monitor the degree to which companies are following the work processes identified. Workers often help to write the work processes. They document how they are following the processes and how they address problems that arise.

Procedures developed by companies to address ISO standards often focus on safety in the workplace. Safety in the manufacturing workplace is communicated through words and symbols. Therefore, reading in manufacturing includes reading and understanding symbols. For a list of symbols students need to be aware of, the SafetySign website has a large selection including ISO warning labels. SafetySign's website also shows ISO safety and warning symbols with explanations of how ISO symbols differ from other systems. Consider showing "The international language of ISO graphical symbols," a resource which show many of the international symbols in humorous situations.

After students review these resources, ask students to work in groups to develop a poster or Glog of the most common safety and warning symbols and their meanings.

Class Discussion
Reading in the manufacturing workplace requires workers to read manuals and procedures, as well as graphs and charts that communicate progress towards meeting company goals related to the ISO standards is an important skill in manufacturing.

- Discuss: What are the consequences of not following safety procedures in the workplace? Provide an example: There was a crane in Boston that fell over because it was not secured properly. Ask students: Why did this accident happen? What do you think went wrong? What could be done to prevent these accidents from occurring? What is the role of quality management? Then, introduce the concept of ISO standards and the procedures that are developed in each company for workers to follow in order to meet the standards. Discuss safety in the workplace.

Read Selections from the Studs Terkel Book, Working
This document includes a brief biography of Terkel and an overview of the book. Read the excerpt from the "Who Built the Pryamids?" (Mike LeFevre) selection and discuss the themes, such as pride in a job, working without seeing the end product. (For the full chapter "Who Built the Pyramids" see this website. Use the scroll bar next to the first book to get to the reading selection.)

Other possible activities are:

- Have students compare and contrast LeFevre's job as a truck driver and his job in the steel mill.
- Have students read the quotes from the play. Assign groups of students a quote to discuss and report their ideas of what the person means and why he or she might have said it. For example, what do they think the quote from Roberto means: "If I had enough money, I would take busloads of people out to the fields and into the labor camps. Then they would know how that fine salad got on their table."
- Have students listen to some of Terkle's original interviews that are a part of the NPR story, Revisiting Studs Terkle's 'Working' Have a class discussion about these interviews.

Research Activity
Have students to locate news or company reports on what happens when standards are not met or procedures not followed? What went wrong? Was it machine failure or human error? Have a class discussion focusing on these questions: What is the role of the worker in quality management? Have you been part of any job or situation where you have been involved in quality of work on the job? Describe the situation and how you were responsible for the quality of the product or service. For example, if you worked an after-school job at McDonald's what quality controls were in place that you were expected to follow?

Reading a Flow Chart
To be able to read and understand a flow chart as they will do in this activity, students may need to learn the meaning of symbols used in flow charts as described in this resource, All About Flowcharts. After reviewing the meaning of flow chart symbols, ask students to review Computer Numerical Control (CNC), which is used to manufacture small everyday items that cannot be made profitably by hand, and complete the following steps. (*Note: This website also provides printable worksheets*.)

- Have students read the introduction and review the parts of the machine and the technical terms defined on this page.
- Next have students, read the stages involved in the manufacture of a CNC project on this page.
- Have students review the flow chart of the manufacturing process of a small item, in this situation a trophy, on this page.

Have students translate the flow chart into written directions on this page. Alternately, ask students to create a flow chart from written directions, for example a macaroni and cheese recipe or replacing the spark plugs in a car.

Contextualized test items

1. After reading Section Two on pages 2-5 through 2-7, from the Manitowoc Ice Machine Q-Model service manual, students will demonstrate understanding of vocabulary and comprehension of the material by answering these comprehension questions:

- What symbols are used in the excerpt and what do they mean?
- What information is important to know about heat in relationship to the ice machines?
- What is the purpose of the air-cooled baffle?
- On page 2-7, the document states, "The ice machine must be grounded in accordance with national and local electrical codes." What does the word *grounded* mean in this context?

Create a matching exercise with the warning and safety symbols and their meanings. (Images from http://www.safetysign.com/Safety+Labels/ISO+Hazard+Alert+Symbol+Labels.html)

Contextualized project

1. *Comparing/Contrasting Information.*
   Exploring Careers in Manufacturing for information about salaries, required training, jobs available in a nearby area. Have students fill in a chart as they look for information. Chart categories can include: average salary, qualifications, degree/certification, growth percentage or potential. Connect their research to manufacturing programs offered in their college or other nearby colleges. After students have researched the information, have them work in pairs to compare and contrast the information they are gathering on the jobs they are researching. Suggest that they use a Venn diagram as a strategy to compare and contrast the careers they have researched.

Additional or extension activities, multimedia, readings and/or resources

Guglielmino, L.M. (2005), Florida GED PLUS college preparation program curriculum and resource guide. Retrieved from http://bit.ly/Nb0OOa.

Fry, R. W. (2012). *Improve Your Reading* (6th ed.). Career Press.

Research Based Principles for Adult Basic Education Reading Instruction, The Partnership for Reading

Teach Students the All-Purpose Academic Word List by Alice Thomas

The Effectiveness of Strategic Reading Instruction for College Developmental Readers, Journal of College Reading and Learning

Comprehension of Technical Texts, Roane State Community College

Decoding and Fluency Problems of Poor College Readers, National College Transition Network

Strategies to Facilitate Reading Comprehension among College Transition Students, National College Transition Network

Please contact ETLO to report any broken links or other problems with this page.

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