ACT® WorkKeys®

Curriculum Analysis Report

Manufacturing Skill Standards Council's
Curriculum for

CERTIFIED FORKLIFT TECHNICIAN (CFT)

February 2020

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Executive Summary

The Manufacturing Skill Standards Council (MSSC) and ACT recognize the benefits to relative stake-holders of "stacking" MSSC certification credentials upon ACT's WorkKeys Assessments, specifically the National Career Readiness Certificate (NCRC), as the "foundation" for MSSC's Certified Forklift Technician (CFT), Certified Production Technician (CPT), Certified Logistics Associate (CLA), and Certified Logistics Technician (CLT) credentialing programs. The results of this project and review of its findings can help guide the selection of students into the Certified Forklift Technician program and encourage skill development for those applicants whose skills currently do not match the recommendations for entry.

The WorkKeys curriculum profiling procedure is designed to identify the skills and the skill levels needed to enter into and successfully complete a training program. When combined with the remaining components of the WorkKeys system, (i.e., the assessments, instructional support, and reporting), curriculum profiles provide educators with information regarding an individual's readiness for training and provide individuals with the information they need to recognize the areas they may need to strengthen as they pursue their education and career goals.

The profile was conducted by ACT's Industrial/Organizational Psychologist and profiler Cindy Hill, Ph.D. (Dr. Hill). The curriculum profiling procedure includes the following:

- A review of the curriculum materials available in the E-learning portal
- A skill analysis to 1) identify the WorkKeys skills required to accomplish each learning objective/standard, and 2) identify how the skills are used during the training program
- A skill level-setting to determine the skill levels recommended for entry into and for successful completion of the CFT online certificate modules

Skill Level Recommendations for Entry into and Exit from the CFT curriculum

WorkKeys Skill	Skill Level Range	Entry	Exit
Workplace Documents	3-7	4	5
Graphic Literacy	3-7	4	4
Applied Math	3-7	4	4

Section 1

Curriculum Review

The first step in conducting the profile was to obtain background information on the program from the Manufacturing Skill Standards Council's (MSSC) representatives. This included obtaining the learning objectives/standards of the program which indicate the parameters and expectations of the program and its requirements.

The Certified Forklift Technician (CFT) is a nationally portable, industry-led, hands-on training and assessment certification program developed through a partnership between the Manufacturing Skill Standards Council (MSSC) and the Material Handling Equipment Distributors Association (MHEDA). The goal of the CFT certification program is to raise performance of forklift technicians, both to assist individuals in *finding higher paying jobs* and to help employers ensure their workforce is skilled. This combination increases the company's productivity and competitiveness. The CFT credential will give technical and community college students the tools to enter career pathways within the material handling industry.

Individuals demonstrate their understanding of the core skills and knowledge through one assessment based upon MSSC's industry-defined, nationally validated skill standards. Delivered online, this Pre-Qualification assessment contains 92 multiple-choice questions. Once the candidate has passed, they earn a CFT Pre-Qualification Award and can then move on to the hands-on assessment to earn the Full CFT certification. This performance-based hands-on assessment is given at an authorized Forklift Dealership. Candidates will be required to demonstrate their understanding of the 20 key activities listed on the CFT Standards. Currently, MSSC strongly recommends that individuals be at an 8th-grade math and 10th-grade reading level.

Schools may choose to combine CFT with the Certified Logistics Technician certification program as part of a larger program of study. Since the demand for higher skilled technicians permeates the entire transportation, distribution, and logistics (TDL) industry, schools may also wish to offer CFT as part of a suite of "stackable" industry certifications within the framework of an innovative "supply chain logistics" or industrial maintenance curriculum.

MSSC Courses were developed in strict adherence to the industry-recognized, nationally-validated standards upon which the CFT is based. These MSSC Courses, developed and delivered by Amatrol, have a proven track record of success in teaching the knowledge and skills identified in the national standards. The success rates for students taking MSSC Courses are nine points higher than those who do not (81% vs. 72%, respectively). MSSC Courses are highly interactive and utilize state-of-the-art, computer-based and simulation e-learning technologies. MSSC does not require that individuals take MSSC Courses or any other MSSC-related courses before taking an MSSC Assessment.

Section 2

Skill Analysis

The skill analysis was conducted by ACT's Industrial/Organizational Psychologist and profiler Cindy Hill, Ph.D. (Dr. Hill). Dr. Cindy Hill has been an Industrial/Organizational Psychologist in the Research Division at ACT, a mission-driven, non-profit organization dedicated to helping people achieve education and workplace success, since 1996. Her work has included the recent refresh of the National Career Readiness Credential, a portable, evidence-based credential that certifies the essential skills for workplace success. Dr. Hill has been a major contributor to the design and presentation of the WorkKeys Profiling Training Program. She managed the development and implementation of the WorkKeys 7-week profiling training program, which includes paper-based and web-delivered distance learning activities and a face-to-face on-site workshop. Dr. Hill has trained hundreds of people to conduct ACT WorkKeys profiles and provides coaching and support for all profilers. She has worked directly with many different types of service and manufacturing industries including medical, food processing, utilities, music distribution, telecommunications, chemical processing, and oil. For example, her projects have included working with the plastics molding division of a Fortune 200 company with revenue exceeding $3 billion annually, an agribusiness Fortune 100 company, two chemical processing Fortune 100 companies, and with an international corporation that is one of the largest producers of beverage products. Her recent research has explored the alignment and "stacking" of credentials through standardized frameworks and the use of technology. Dr. Hill has also spent many years developing and reviewing licensure and certification programs. This includes job analysis, the development of test content outlines, national surveys, data analysis, item writing and review, standard setting, and validating the test scores of off-the-shelf and company-specific tests. As part of ACT's partnership with the Association for Talent Development, she developed and facilitates their Test Design and Delivery Certificate Program. This program assists learning professionals to develop valid tests for training, certification, and management decision-making.

The curriculum profiling procedure includes the following:

- A review of the curriculum materials available in the E-learning portal
- A skill analysis to 1) identify the WorkKeys skills required to accomplish each learning objective/standard, and 2) identify how the skills are used during the training program
- A skill level-setting to determine the skill levels recommended for entry into and for successful completion of the CFT certificate modules.

Applied Math

WorkKeys Applied Math is the skill people use when they use mathematical reasoning and problem-solving techniques to solve work-related problems. Students may use calculators and conversion tables to help with the problems, but they still need to use math skills to think them through. Dr. Hill identified 10% of the learning objectives/standards as requiring the WorkKeys Applied Math skill.

In evaluating the level of Applied Math skill necessary for the student to master the learning objectives/standards of the curriculum, the types of mathematical operations (including single-step or multiple-step mathematical operations and conversions either within or between systems of measurement); how the information in the problem is presented (i.e., the information is presented in the order in which it is needed or it must be reordered); and whether all the information students need for solving problems is provided or if they must derive some necessary information must be considered.

Dr. Hill evaluated the curriculum in comparison to WorkKeys Applied Math skill levels 3 through 6 and decided that Level 4 skills are required for entry into the curriculum and for effective performance. Students are expected to apply their math skills to specific situations during the training program, so they need to begin the program with Level 4 Applied Math skills. By the end of the program, students may have learned some Level 5 Applied Math skills.

At Applied Math Level 4, learning objectives/standards may present information out of order and may include extra, unnecessary information. One or two operations may be needed to solve the problem. A chart, diagram, or graph may be included. When students use Level 4 Applied Math skills, they can solve problems that require one or two operations. They may add, subtract, or multiply using positive or negative numbers, and they may divide positive numbers. They can figure out an average or mean of a set of numbers using whole numbers and decimals. They can figure out simple ratios, simple proportions, or rates. At Level 4 students can add commonly known fractions, decimals, or percentages and add or subtract fractions that share a common denominator. They can multiply a mixed number by a whole number or decimal and they can put the information in the right order before they perform calculations.

Students use the Applied Math Level 4 skills when they calculate amp hour capacity (AHC). AHC represents a battery's ability to deliver a certain number of amps per hour for a certain number of hours. AHC is determined using battery ratings which are expressed as, for example, 18-100-21, where 18 is the number of cells, 100 is the amps-per-positive-plate, and 21 is the number of plates per cell. This information is on the vehicle's capacity plate and on the battery information label (e.g., AMP HOUR CAPACITY (6 hour rate): 1400/1100). The equation to calculate amp hour capacity is AHC = number of positive plates x amps-per-positive-plate. The student learns to start with the number of plates minus 1, since every cell has an extra negative plate. In this example, this number is 20. Divide 20 by 2 because only half the plates are positive. Therefore, this battery has 10 positive plates. The student would typically want to

discharge a battery to its 80% capacity level. This means that for a battery with a full AHC potential of 1000, the student would want to calculate the AHC for its 80% discharge level. To find this out, the student would multiply 100 (APP) by 10 (the number of positive plates per cell) to calculate the AHC (1000). The battery in this example has an AHC of 1000, so the 80% discharge level is 800. It could deliver 133 amps per hour for six hours before it is 80% discharged (800/6=133 amps). Students need at least Level 4 Applied Math skills to determine the AHC for a particular discharge level.

When students calculate the kilowatt hour ratings (kWh), they use the Applied Math skill. They need to understand the amount of power a battery can have for a given amount of time. To calculate the kWh of a battery, students will multiply the number of volts in a battery by its AHC. Divide the result by 1000. To determine the kWh for the example above, students will multiply the battery voltage, in this case 36, by the AHC of 1000, which equals 36,000 watts. Then divide this figure by 1000 which equals 36.0 kWh. Students will need Level 4 Applied Math skills to complete the two steps required to set-up and calculate the kWh of a battery (e.g., 36 x 1000 = 36,000 watts/1000 = 36.0 kWh).

Students will need to be able to use the kWh to determine the depth of discharge. When a battery is properly specified, it should include the amount of kWh to perform the duty cycle; plus 25% as a safety factor. For example, if it is determined that the battery kWh should be 30, you would add another 25% as a safety factor. So, the kWh can be 37.5 kWh in two steps: (1) 30 x .25 = 7.5. and (2) 30 + 7.5 = 37.5. Students need Applied Math Level 4 skills to calculate the kWh of a battery because two operations are required: (1) multiply the number of volts in a battery by its AHC and (2) divide the result by 1000. They will also need Level 4 skills to determine the depth of discharge by adding 25% of the kWh as a safety factor. First, they will need to determine what 25% of the kWh is and then they will need to add it to the kWh.

Students use Applied Math skills to understand the compression ratio of an engine. It is expressed as the ratio of the maximum volume of uncompressed air in the cylinder to the minimum volume of uncompressed air in the cylinder. For example, an engine has 40 cubic inches at bottom dead center and 2 cubic inches at top dead center for a ratio of 40:2 or reduced down to 20:1. This requires Applied Math Level 4 math skills because the student must figure out a simple ratio. Students will also use Level 4 Applied Math skills when determining which basic attachments can be used with a specific lift truck. To determine clamp force needed to pick up a paper roll, the student will multiply the paper roll weight by the clamp force ratio found in a table (e.g., 7,600 lbs. = 3,800 lbs. x 2.0). Hose diameters are described by a numerical value such as a No. 6 hose. An easy way to determine the hose diameter is to divide the hose number by 16. For example, a No.6 hose is 6/16 or 3/8 inch in diameter. The student uses Level 4 Applied Math skills when figuring out the ratio and working with unusual fractions.

At Applied Math Level 5, the information may not be presented in logical order; the item may contain extraneous information; it may contain a chart, graph, or diagram; and the mathematical set-up may be complicated. In solving the problem, the student may need to perform multiple operations. When students use Level 5 Applied Math skills, they must decide what information, calculations, or unit conversions to use to find the answer to a problem. As part of a multiple step problem, the student may have to find one value and use it to find another value that answers the question. They can add and subtract fractions with unlike denominators. Students can convert units within or between systems of measurement where the formula is provided such as converting from ounces to pounds or from centimeters to inches. They can solve problems that require mathematical operations using mixed units. They can identify the best deal by doing one- and two-step calculations and then comparing the results to determine the solution that meets the stated conditions. At Level 5 students can calculate perimeters, circumference, and areas of basic shapes like rectangles and circles. They can calculate a given percentage of a given number and then use that percentage to determine the solution. They can identify where a mistake occurred in a calculation.

When the course material for basic engines refers to an intake stroke being between 0 and 180 degrees, the student must understand that there are 360 degrees in a circle and that it is not referring to temperature. Same for power stroke (361 to 540 degrees), exhaust stroke (541-720 degrees), and compression stroke (181-360 degrees). However, they aren't actually required to perform any Level 5 Applied Math skill calculations.

Students will also need to have a working knowledge of Ohm's Law in order to select the correct battery for a customer's application. The most important consideration is the amount of voltage required. The formula is Voltage/Amps x Resistance. As long as the student knows two of the variables, they should be able to calculate the third. Students will need to be able to determine the rate at which energy is spent and, as a result, work accomplished. They learn to do this by using the formula for finding watts: Watts=Amps x Volts. For example, if a battery delivers 1000 amps at 24 volts it produces 24,000 watts (1000 amps x 24 Volts = 24,000 watts). To keep it simple, watt-hours are usually expressed as kilo, or 1000-hour units. Therefore, a kilowatt=1000 watts. So, 24,000 watts are expressed as 24 kilowatts (24,000 watt-hours/1000 = 24 kWh). Students will need to learn Level 5 Applied Math skills to perform these calculations. However, students with Level 4 Applied Math skills should be well prepared to quickly learn how to perform the specific learning objectives/standards that require Level 5 skills.

GRAPHIC LITERACY

The WorkKeys Graphic Literacy skill is the skill people use when they work with workplace graphics such as tables, graphs, charts, digital dashboards, flow charts, timelines, forms, maps, and blueprints. Students use this skill when they find, summarize, compare, and analyze information to make decisions using workplace graphics to solve work-related problems.

Dr. Hill identified 69% of the learning objectives as requiring the WorkKeys Graphic Literacy skill for entry into and successful completion of the training program. Students need the Graphic Literacy skill when they complete the following modules.

Some examples include:

Basic Engines

- An animated diagram of an internal combustion engine specifically showing how the piston goes up and down and the intake and exhaust valves close and open.
- Line graph of low moderate difficulty to show a typical lug curve running from the peak torque point to the balance point. Torque output is plotted against engine speed to show the lugging ability of an engine.
- Diagrams to identify similarities and differences in different fuel systems, their components, and how they function.
- Diagram including ignition coil, spark plugs, ignition switch, distributor, breaker points, battery, and distributor cap used to describe the purpose and function of a typical IC engine ignition system and the differences between ignition system types including the identification of specific parts of an ignition system.
- Diagrams to identify the specific parts of fuel injector systems and valve configurations and how they operate.
- Troubleshooting tables showing the complaint, the possible cause, and correction for basic engines.
- Diagrams identifying and describing the function of the cooling system, engine air filter, and PCV valve.
- Diagram of an engine explaining the concept of compression ratio.

Batteries and Industrial Batteries

- A simple table showing the differences between two types of batteries.
- A simple table showing common battery hazards and dos and don'ts.
- Identifying minimum weight specified and amp hour capacity on vehicle's capacity plate on the battery information label (simple table).

Brake Systems

- Diagrams of brake systems comparing different models and identifying different

parts such as the control valve, fluid reservoir, air master, air compressor, wheel cylinder, safety valve, air tank, air governor, and air dryer.
- Diagrams showing how to inspect brake shoes and linings for wear or damage.
- Diagrams of different brake systems on specific powered industrial vehicles.

Fuel Systems
- Diagrams of typical fuel systems and their components including fuel tank, fuel lines, fuel pump, fuel filter, engine control module, air-fuel mixer-and-metering system, and fuel system sensors.
- Fuel comparison chart showing the properties and characteristics, of LPG vs Gasoline systems.

IC Electrical Systems
- Diagrams of internal combustion engines showing the 4-stroke process, breaker points assembly, and components of the starting system.
- Diagrams and tables are provided and shows the differences between traditional and electronic ignition systems including traditional, multiple coil distributorless and direct ignition system.
- A sample maintenance service table is provided and shows the item, service, and page number and includes what needs to be done every 10 service hours, 50 service hours, and one month after delivery of a new truck.

Engine Cooling Systems
- Diagrams of cooling systems for internal combustion engine and radiators.
- Periodic maintenance table for a cooling system.

Front Drive Axle and Differential
- Basic troubleshooting table including complaints, possible causes, and correction.

Masts
- Diagrams showing mast sections, piston cylinders.
- Diagrams showing how to measure maximum fork height, effective fork height, and liftoff.
- Troubleshooting table including condition, possible cause and remedy.

Motors & Magnetism
- Diagrams showing the parts of a motor, torque and speed, and types of motors.
- Diagrams showing how an electromagnet is a contactor, how inductance works, and how current can be induced from another winding.

Oil Cooled Wet Disc Brakes
- Diagrams of brake oil lines, how they are bleed, and how the gear pump pumps hydraulic fluid from the main tank.
- Tables showing fluid change intervals and recommended fluid.

Transmissions

- Diagram of transmissions including call outs and exploded parts.
- Line chart showing how the smaller the swash plate angle, the lesser the pump displacement.
- Troubleshooting chart showing complaint, possible cause and correction.

Steering Systems

- Diagrams showing drag link and hydrostatic steering systems and their mechanical and hydraulic components.
- Side-by-side table comparing the two steering systems.
- Maintenance and troubleshooting checklist for a hydrostatic steering system.

How to use Meters for Testing Electrical Circuits and Components

- Diagram of analog meters with needle moving along a scale.
- Multimeters that include ammeter, voltmeter, and ohmmeter.

Circuits & Components

- Use truck's electric schematic's and wiring diagrams to perform basic checks for troubleshooting error codes by performing pin-to-pin and wire-to-wire checks for continuity, voltage and resistance.

AC Motors

- Animated diagram to show sine waves created by a single wave and a controller flowing in the three phases.
- Animated diagram showing how an AC motor regenerates the battery.
- Diagram showing a motor control circuit with a DC controller and a potentiometer.
- Graph and diagram of a direct current vs an alternating current.

Basic Attachments for Lift Trucks

- Capacity Plate Change Request form.
- Table showing typical attachment hydraulic functions for specific attachments including attachment, single function, double function, and triple function.
- Reference table of primary attachment types, the functions they perform, and within what industries they are used.
- Table showing measurements for each carriage class.
- Diagram showing set-ups for single, double, and multi-function hose setups.
- Reference table to using when calculating the clamp force/load weight ratio.
- Finding the amount of oil flow and the hydraulic pressure to an attachment in manufacturer's price pages.

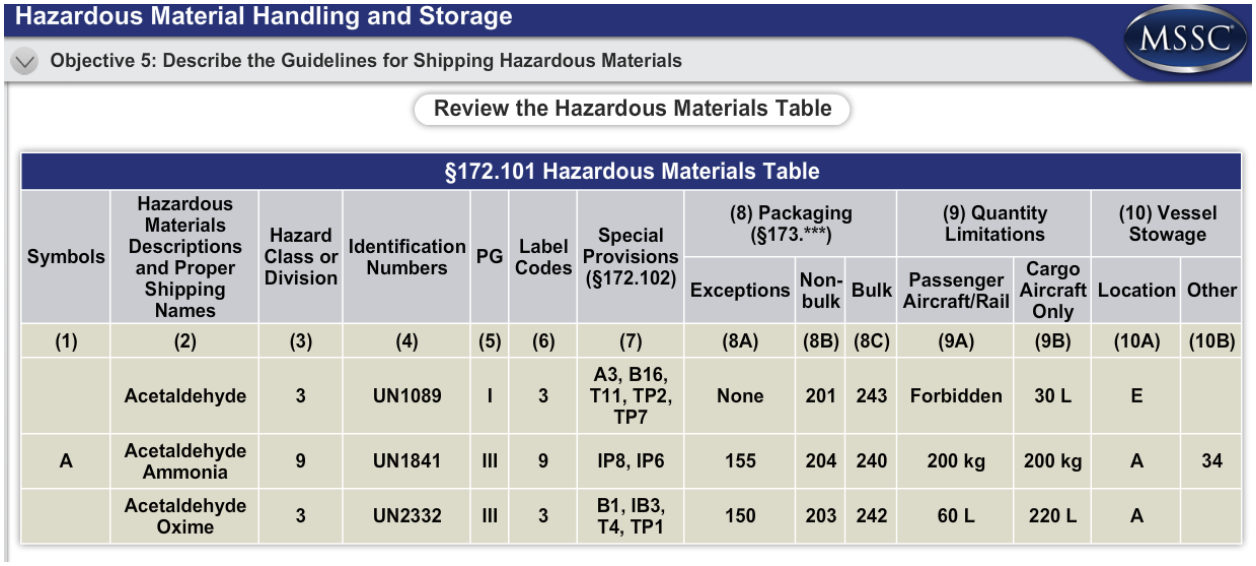
How the CAN Bus Functions

- Diagrams providing an overview of a CAN Bus including the network, BUS termination points, and nodes.

- Diagrams showing how the CAN makes a binary message and the complete CAN frame and the arbitration field, control, data, CRC field, and end of frame.
- Tables showing service manual diagnostic steps including the codes and diagnostic procedures.

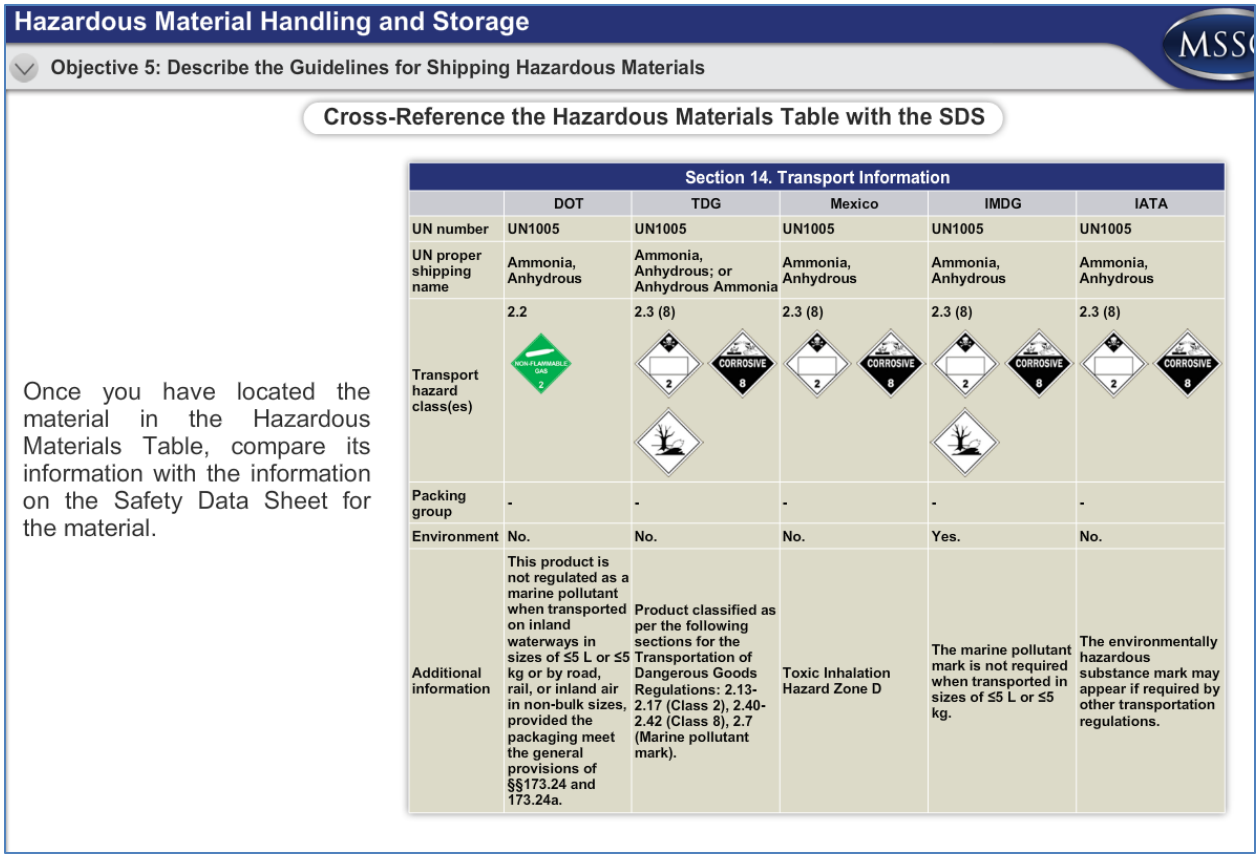
Students will need to learn how to read a Safety Data Sheet in order to complete the safety module. The Safety Data Sheet is a form with sixteen sections and simple tables. For example, Section 2 features a table with hazardous identification, Section 8 features a table with Permissible Exposure Limit (PEL) of the chemical, Section 11 has a table of toxicological information, Section 12 contains a table with ecological information, and section 13 includes a table with disposal considerations.

The first step in shipping hazardous materials is to review the Hazardous Materials Table published by the DOT. This table contains an alphabetical list of all materials the DOT designates as hazardous. It provides directions for the packaging, labels, UN ID, and paperwork required when shipping these materials. Once the material is located in the Hazardous Materials Table, students will need to compare its information with information in the Safety Data Sheet.



§172.101 Hazardous Materials Table

Symbols	Hazardous Materials Descriptions and Proper Shipping Names	Hazard Class or Division	Identification Numbers	PG	Label Codes	Special Provisions (§172.102)	(8) Packaging (§173.***)			(9) Quantity Limitations		(10) Vessel Stowage	
							Exceptions	Non-bulk	Bulk	Passenger Aircraft/Rail	Cargo Aircraft Only	Location	Other
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8A)	(8B)	(8C)	(9A)	(9B)	(10A)	(10B)
	Acetaldehyde	3	UN1089	I	3	A3, B16, T11, TP2, TP7	None	201	243	Forbidden	30 L	E	
A	Acetaldehyde Ammonia	9	UN1841	III	9	IP8, IP6	155	204	240	200 kg	200 kg	A	34
	Acetaldehyde Oxime	3	UN2332	III	3	B1, IB3, T4, TP1	150	203	242	60 L	220 L	A	



Additional examples of how the Graphic Literacy skill is used are provided below:

- Locate information on a Hazardous Waste label – simple, common label format with less than 20 data fields.
- Three step graphic instructions on a fire extinguisher. – very simple.
- Emergency Action Plan – simple common table with less than 20 data fields.
- Evacuation Plan – usually does have a legend showing fire alarm buttons, fire extinguisher, exits, fire hose, first aid kits, and escape routes.
- Line charts providing statistics for declining workplace injuries, and nonfatal occupational injuries and illnesses.
- Identify specific fields on a tag for logout/tagout.
- Identifying the type of hard hat on the tag (i.e., type 1 or 2).

To determine the level of Graphic Literacy skill needed to accomplish the learning objectives, the difficulty of the graphics and how hard it is for individuals to find the information they need on the graphic and then to make use of it was considered. Dr. Hill compared the requirements of the training program to WorkKeys Graphic Literacy skill Levels 3 through 5. Level 4 Graphic Literacy skills are required for entry into and for successful completion of the training.

At Graphic Literacy Level 3, workplace graphics are common and of simple or low moderate difficulty. Characteristics of simple graphics include a limited amount of data (i.e., less than twenty data points/fields); one level of data; one or two variables; and one or two axes (such as an x and/or y axis), if there are axes. Characteristics of low moderate graphics include a moderate amount of data; more than one level of data, but no nesting; several variables; one or two axes if there are axes; and if two simple graphics are required to solve the problem, they should be considered a low moderate graphic. At Graphic Literacy Level 3, students use one simple or low moderate graphic at a time to locate and find information and identify the next or missing step in a process.

Students will use Graphic Literacy Level 3 skills throughout the training when they are shown various diagrams and asked to identify and describe various parts. For example, students may be shown a diagram of a fuel injector system and its valve configuration and then asked to identify the specific parts and how they operate. In some instances, the diagrams are animated. For example, students will be shown an animated diagram of an internal combustion engine specifically showing how the piston goes up and down and the intake and exhaust valves close and open. They will then be expected to identify and describe each of the cycles in a 4-cycle engine.

Throughout the training, students are also expected to use Graphic Literacy Level 3 skills when they are presented with diagrams showing:

- how to inspect brake shoes and linings for wear or damage
- mast sections, piston cylinders
- how to measure maximum fork height, effective fork height, and liftoff
- the parts of a motor, torque and speed, and types of motors
- how an electromagnet is a contactor how inductance works, and how current can be induced from another winding
- drag link and hydrostatic steering systems and their mechanical and hydraulic components
- sine waves created by a single wave and a controller flowing in the three phases
- how an AC motor regenerates the battery
- a motor control circuit with a DC controller and a potentiometer
- set-ups for single, double, and multi-function hose setups
- an overview of a CAN Bus including the network, BUS termination points, and nodes
- how the CAN makes a binary message and the complete CAN frame and the arbitration field, control, data, CRC field, and end of frame
- brake oil lines, how they are bleed, and how the gear pump pumps hydraulic fluid from the main tank
- transmissions including call outs and exploded parts
- analog meters with needle moving along a scale
- multimeters that include ammeter, voltmeter, and ohmmeter
- different brake systems on specific powered industrial vehicles
- typical fuel systems and their components including fuel tank, fuel lines, fuel

pump, fuel filter, engine control module, air-fuel mixer-and-metering system, and fuel system sensors
- cooling systems for internal combustion engine and radiators
- internal combustion engines showing the 4-stroke process, breaker points assembly, and components of the starting system
- how to identify and describe the function of the cooling system, engine air filter and PCV valve
- explain the concept of compression ratio

Students will also use Graphic Literacy Level 3 skills when they locate information in tables or complete forms that are of simple or low moderate difficulty. Some examples include:

- a simple table showing the differences between two types of batteries.
- a simple table showing common battery hazards and dos and don'ts.
- identifying minimum weight specified and amp hour capacity on vehicle's capacity plate on the battery information label (simple table).
- a sample maintenance service table for IC electrical systems is provided and shows the item, service, and page number and includes what needs to be done every 10 service hours, 50 service hours, and one month after delivery of a new truck.
- periodic maintenance table for an engine cooling system.
- tables showing fluid change intervals and recommended fluid for oil cooled wet disc brakes.
- completing a Capacity Plate Change Request form
- table showing typical attachment hydraulic functions for specific attachments including attachment, single function, double function, and triple function.
- a reference table of primary attachment types, the functions they perform, and within what industries they are used.
- table showing measurements for each carriage class.
- reference table to using when calculating the clamp force/load weight ratio.
- finding the amount of oil flow and the hydraulic pressure to an attachment in manufacturer's price pages.

Students will need Level 3 Graphic Literacy skills when they use line graphs of low moderate difficulty to show a typical lug curve running from the peak torque point to the balance point, and to show the lugging ability of an engine (i.e., torque output is plotted against engine speed). Students will also need to understand a simple line chart showing how the smaller the swash plate angle, the lesser the pump displacement.

At Graphic Literacy Level 4, workplace graphics are common and of low to high moderate difficulty. Characteristics of low moderate graphics include a moderate amount of data; more than one level of data, but no nesting; several variables; one or two axes, if there are axes; and if two simple graphics are required to solve the problem, they should be considered a low moderate graphic. At Graphic Literacy Level 4, students can

use one or two low moderate graphics at a time to locate information in a graphic using information found in another graphic; compare two or more pieces of information; identify a trend/pattern/relationship; make an inference or decision; and identify the graphic that accurately represents the data. High moderate graphics may be less common at Graphic Literacy Level 4 and have characteristics which include a moderate amount of data; more than one level of data and it may be nested; many variables such as types of wood, drill speeds, hole diameter, and type of bit; one or two axes (such as an x and/or y axis), if there are axes; and if a low moderate graphic and a simple graphic are required to solve the problem, they should be considered a high moderate graphic. At Level 4, students can use one high moderate graphic to locate and find information and identify the next or missing step in a process.

Students will use Level 4 Graphic Literacy skills when they are comparing and identifying the differences between the components and functions of fuel systems; and describing the purpose and function of a typical IC engine ignition system and the differences between ignition system types including the identification of specific parts of an ignition system in a diagram including ignition coil, spark plugs, ignition switch, distributor, breaker points, battery, and distributor cap. In addition, students will need Level 4 skills when they use a side-by-side table comparing two steering systems, are asked to identify the differences between traditional and electronic ignition systems including traditional, multiple coil distributorless and direct ignition systems. Students will also need Level 4 skills in order to understand the graph and diagram of a direct current versus an alternating current.

Students will need Level 4 Graphic Literacy skills when they use tables, charts, and schematics/wiring diagrams to troubleshoot and make decisions. For example, students will use troubleshooting tables and charts showing the complaint/condition, the possible cause, and correction/remedy for basic engines, masts, transmissions, front drive axle and differential, and a hydrostatic steering system. They will also need Level 4 skills when they use a fuel comparison chart showing the properties and characteristics, of LPG vs Gasoline systems to troubleshoot, use a truck's electric schematic and wiring diagram to perform basic checks for troubleshooting error codes by performing pin-to-pin and wire-to-wire checks for continuity, voltage and resistance. They will also need Level 4 skills in order to follow the diagnostic steps including the codes and diagnostic procedures provided in service manual tables.

While a lot of the graphics students are presented with require Level 3 Graphic Literacy skills, they are quickly presented with graphics that require Level 4 skills so students must have Level 4 skills when they enter the training and to effectively complete the training.

WORKPLACE DOCUMENTS

WorkKeys Workplace Documents is the skill people use when they read and use written text in order to do a job. The written texts include memos, letters, directions, notices, bulletins, policies, and regulations. It is often the case that these workplace communications are not necessarily well written or targeted to the appropriate audience. Workplace Documents materials do not include information that is presented graphically, such as in charts, forms, or blueprints. Workplace Documents skills are required for 100% of the learning objectives/standards.

To determine the level of Workplace Documents skill needed for the learning objectives/standards students complete the difficulty of the reading materials and how hard it is for students to find the information they need and make use of it was considered. Dr. Hill evaluated the training material as it compares to WorkKeys Workplace Documents skill Levels 3 through 6. While students will probably master Level 5 Workplace Documents skills by the time they complete the course, they can enter and successfully complete the course with Level 4 Workplace Document skills.

At Workplace Documents Level 4, reading materials include policies, procedures, and notices. Materials are straightforward with some long sentences and contain a number of details. These materials use common words, but do have some harder words, too. They describe procedures that include several steps. When following procedures, students must think about changing conditions that affect what they should do. For example, they can follow directions that include if-then statements. When students use Level 4 skills they can identify the main idea and details that may not be clearly stated, use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms), apply information/instructions to a situation that is the same as the situation in the reading materials, and choose what to do when changing conditions call for a different action.

Students will need Level 4 Workplace Document skills to follow the steps of a procedure such as lock out/tag out. Below is an example of step-by-step instructions a student will need to follow when inspecting a brake control valve:

1. *Release the parking brake lever.*
2. *Remove the grommet from the adjusting hole. Turn the adjuster assembly up all the way until the lining-to drum clearance is removed.*
3. *From this position, turn the adjuster assembly back (down) about eight notches to obtain the correct lining-to-drum clearance.*
4. *To measure the lining-to-drum clearance, remove the grommet from the dust cover and insert a thickness gauge.*

In order to understand how things work, students will need to read step-by-step descriptions of how things work such as a synchromesh transmission. An example of "how it works" description is provided below:

1. *Between the lock-up splines and the drive gear are friction cones called synchronizers.*
2. *The sliding collar moves toward the gear to be engaged, bringing the friction cones into contact.*
3. *Friction between the cones equalizes the speeds of the gear and the shaft (synchronization).*
4. *The lock-up spline is engaged.*
5. *The collar couples the free-wheeling gear to the drive gear and shaft.*

Students will need to take conditionals into account. Several examples are provided below:

If the forks can extend only to a point even with rack or 4 inches above the rack beams (the standard thickness of a pallet), the load cannot be lifted high enough to safely clear the rack beams. If deflection of the forks and mast is present, the edge of the pallet farthest from the mast will be the lowest point, and the load must be raised so the pallet will pass freely over both the back and front rack beams.

When you examine the brake drum you will see indications of wear around the inner surface. This is normal unless the wear pattern is deep, in which case the drum may need to be turned on a break lathe to restore the surface. However, if the drums are worn past the tolerance listed in your manual, usually 0.060 in. (1.52mm), they will need to be replaced. You can check this tolerance by measuring the drum with a micrometer.

Students will also learn how to choose what to do when changing conditions call for a different action. For example,

It is important to match the amp hour capacity of the battery to the charger. If you are trying to charge an 850-amp hour battery on a 1200-amp hour charger you will overheat the battery. A 1200-amp hour battery on an 850-amp hour charger will undercharge the battery. Old chargers come with one specific voltage and amp hour capacity, but the new smart chargers read voltage automatically and allow you to select amp hour capacity. Check the type of charger being used.

At Level 5, workplace documents include policies, procedures, announcements, legal, and multiple related documents that have many details. The information that students need is generally stated directly, but it is hard to find because there are so many details, and some may not be needed for the learning objectives/standards being performed (extraneous information). The materials include technical terms, jargon, and acronyms, or words that have several meanings. The documents may have complex sentences and/or contain conditional situations. When students use Level 5 skills on the job, in addition to using the skills described at Levels 3 and 4, they can figure out the appropriate meaning of a word based on how the word is used, and identify the appropriate meaning of technical term, jargon, or an acronym that is defined in the document. Students will also need to apply technical terms and jargon to stated situations, apply information/instructions to a new situation that is similar to the one

described in the material while considering changing conditions, and apply complex information/instructions that include conditionals to situations described in the materials. They may also need to make some inferences to accomplish their goal.

Students will need to learn an enormous amount of terminology throughout the course including words associated with engines and lift trucks. While the words are always defined, they are not always common such as pollutants, emissions, presence sensing restraints, petroleum-based, ignition sources, lugging, electromechanical restraints, contaminant, nodes, transceiver, and inertia energy.

In addition, they will also need to learn a lot of acronyms such as National Institute of Occupational Safety and Health (NIOSH), personal protective equipment (PPE), Hazardous Communications Standard (HCS or HazCom), Safety Data Sheet (SDS), Controlled Area Network (CAN), and Permissible Exposure Limit (PEL).

Figuring out the appropriate meaning of a word based on how the word is used and identifying the appropriate meaning of technical terms, jargon, or an acronym that are defined in the document are characteristics of Workplace Document Level 5 skills. They also need to be able to apply technical terms and jargon to stated situations. They will learn to apply complex information/instructions that include conditionals and make inferences to accomplish goals by the time they complete the training. As a result, students need Level 4 Workplace Documents skills when they enter the program and will probably have Workplace Documents Level 5 skills upon successful completion of the training.

Section 3

Results and Recommendations

The results of this project and review of its findings can be used to help guide the selection of students into the program and to encourage skill development for those applicants whose skills currently do not match the recommendations for entry. The table shows the results for entry- and exit-level performance for CFT online curriculum. Entry level is defined as the students' first day in the program, before they gain program specific knowledge from training or experience. Exit level is the point at which a student has successfully completed the training requirements. The exit levels are provided for use as training goals.

The results of this curriculum profile support the claim that the ACT NCRC helps ensure that individuals have the academic and employability skills needed to enter a demanding MSSC Certified Forklift Technician (CFT) certification program of training. Accelerating the use of these credentials will help individuals find jobs and provide employers with workers who have the academic, employability, and 21st century skills important to success.

The Manufacturing Skill Standards Council and ACT should continue to recognize the benefits to relative stake-holders of "stacking" MSSC certification credentials upon ACT's WorkKeys Assessments, specifically the National Career Readiness Certificate (NCRC) as the "foundation" for MSSC's Certified Forklift Technician (CFT) credentialing program.

Skill Level Recommendations for Entry into and Exit from the CFT curriculum

WorkKeys Skill	Skill Level Range	Entry	Exit
Workplace Documents	3-7	4	5
Graphic Literacy	3-7	4	4
Applied Math	3-7	4	4

Appendix A

Skill Descriptions

Applied Math Skill

WorkKeys® Applied Math is the skill people use when they use mathematical reasoning and problem-solving techniques to solve work-related problems. Students may use calculators and conversion tables to help with the problems, but they still need to use math skills to think them through.

There are five levels of difficulty. Level 3 is the least complex and Level 7 is the most complex. The levels build on each other, each incorporating the skills assessed at the previous levels. For example, at Level 5, students need the skills from Levels 3, 4, and 5. Examples are included with each level description.

When deciding what level of the Applied Math skill students need for the objectives they do at work, consider the following questions:

- How is the information presented? That is:
- Is it presented in the same order that it is needed?
- Is it necessary to change the order that the information is in before the math can be performed?

Is all the information needed for solving the problems provided? That is:

- Is all the information presented in the right form?
- Is it necessary to do some calculations to get some of the important information?
- Does the problem require a formula?
- Does the information need to be taken from a graphic?

What kind of mathematical operations do students perform? That is:

- Can the math problem be completed in one step?
- Does the problem need to be done in several steps?
- Is it necessary to convert measurements from one form to another, either within or between systems of measurement?

Applied Math Level 3

Level 3 problems can easily be translated from a word problem to a math equation requiring a single type of math operation. All the needed information is presented in a logical order and there is no extra information given.

When students use Level 3 Applied Math skills on the job, they can:

- Solve problems that require a single type of mathematical operation. They add or subtract either positive or negative numbers (such as 10 or -2). They multiply or divide using only positive numbers (such as 10).
- Convert a familiar fraction (such as ½ or ¼ to a decimal) and convert from a decimal to a common fraction; OR convert between decimals to percentages (such as 0.75 to 75%).
- Convert between familiar units of money and time (for example, one hour equals 60 minutes or ½ of a dollar equals $0.50)
- Add the prices of several products to reach a total, and they can make the correct change for a customer.

Applied Math Level 4

At Level 4, objectives may present information out of order and may include extra, unnecessary information. One or two operations may be needed to solve the problem. A chart, diagram, or graph may be included.

When students use Level 4 Applied Math skills on the job, they can use the skills described at Level 3, and they can:

- Solve problems that require one or two operations. They may add, subtract, or multiply using positive or negative numbers (such as 10, -2), and they may divide positive numbers (such as 10).
- Figure out an average or mean of a set of numbers (such as $\frac{(10+11+12)}{3}$). For this they use whole numbers and decimals.
- Figure out simple ratios (such as $\frac{3}{4}$), simple proportions (such as $\frac{10}{100}$ cases), or rates (such as 10 mph).
- Add commonly known fractions, decimals, or percentages (such as ½, .75, or 25%).
- Add or subtract fractions that share a common denominator (such as $\frac{1}{8} + \frac{3}{8} + \frac{7}{8}$).
- Multiply a mixed number (such as $12\frac{1}{8}$) by a whole number or decimal.
- Put the information in the right order before they perform calculations.

For example, at this level, students can figure out sales tax or a sales commission on a previously calculated total, and they can find out rates of use or business flow.

Applied Math Level 5

In Level 5 problems, the information may not be presented in logical order; the item may contain extraneous information; it may contain a chart, graph or diagram; and the mathematical set-up may be complicated. In solving, the test taker may need to perform multiple operations. For example, at this level students may complete an order form by totaling an order and then computing tax.

When students use Level 5 Applied Math skills on the job, they can use the skills described at Levels 3 and 4, and they can:

- Decide what information, calculations, or unit conversions to use to find the answer to a problem.
- As part of a multiple step problem, the student may have to find one value and use it to find another value that answers the question.
- Add and subtract fractions with unlike denominators (such as ½ - ¼).
- Convert units within or between systems of measurement (e.g., time, measurement, and quantity) where the formula is provided such as converting from ounces to pounds or from centimeters to inches.
- Solve problems that require mathematical operations Calculate using mixed units, such as adding 3.50 hours and 4 hours 30 minutes or subtracting 3 feet and 10 inches from 6 feet and 4 inches.
- Identify the best deal by doing one- and two-step calculations and then comparing the results to determine the solution that meets the stated conditions.
- Calculate perimeters, circumference, and areas of basic shapes like rectangles and circles.
- Calculate a given percentage of a given number and then use that percentage to determine the solution (e.g., find the total cost of a product after calculating discount, markup or tax.
- Identify where a mistake occurred in a calculation (such as identifying the row in a spreadsheet where a problem occurred).

Applied Math Level 6

Level 6 objectives may require considerable translation from verbal form to mathematical expression. They generally require considerable setup and involve multiple-step calculations.

When students use Level 6 Applied Math skills on the job, they can use the skills described at Levels 3, 4, and 5, and they can:

- Use fractions with unlike denominators and calculate reverse percentages.
- Convert units within or between systems of measurement (e.g., time, measurement, and quantity) where multiple-step conversions are required and the formulas are provided such as converting from kilometers to meters to feet.
- Identify why a mistake occurred in a solution.
- Find the best deal and use the result for another calculation.
- Find the area of basic shapes (rectangles and circles) when it may be necessary to rearrange the formula, convert units of measurement in the calculations, or use the result in further calculations.
- Find the volume of rectangular solids.
- Calculate rates, productions rates, rate by time (such as, production rate is 59 cups produced per hour, how many will be produced in an 8 hour shift).
- Identify the correct equation for solving a problem

Applied Math Level 7

At Level 7, the task may be presented in an unusual format and the information presented may be incomplete or require the student to make an assumption. Tasks often involve multiple steps of logic and calculation, and multiple operations.

When students use Level 7 Applied Math skills on the job, they can use the skills described at Levels 3, 4, 5, and 6, and they can:

- Solve problems that include ratios, rates, or proportions with at least one of the quantities related to a fraction
- Identify the reason for a mistake.
- Convert between units of measurement that involve fractions, mixed numbers, decimals, or percentages.
- Find the area of multiple shapes or find the area of a composite shape.
- Calculate volumes of spheres, cylinders, or cones
- Calculate the volume when it may be necessary to rearrange the formula, convert units of measurement in the calculations, or use the result in further calculations
- Set up and manipulate ratios, rates or proportions where at least one of the quantities is a fraction.
- Determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost.
- Apply basic statistical concepts for example calculate the weighted mean, interpret measures of central tendency, or interpret measure of spread and tolerance.

GRAPHIC LITERACY SKILL

The WorkKeys Graphic Literacy skill is the skill people use when they work with workplace graphics such as tables, graphs, charts, digital dashboards, flow charts, timelines, forms, maps, and blueprints. Students use this skill when they find, summarize, compare, and analyze information to make decisions using workplace graphics to solve work-related problems.

There are five levels. Level 3 is the least complex and Level 7 is the most complex. At each new level, students need more demanding skills in addition to the skills used at the previous levels. For example, Level 5 includes the skills used at Levels 3, 4, and 5. At the lower levels, students may need to locate or find information in a simple graphic. At the higher levels, students may use information in one or more difficult graphics to draw conclusions and make decisions. The complexity can also increase as the quantity and/or density of the information increases.

Skill levels depend on two things: the complexity of the graphic and the task that the student is asked to perform. When you consider what skill level is needed for the tasks that students complete on the job, think about the following things:

How complex is the workplace graphic?

- Is the graphic simple or difficult, common or uncommon?
- Is the content familiar or unfamiliar?
- How many graphics are there? Is there one graphic, two graphics, multiple graphics, or a composite graphic (such as a bar chart with a line graph over it)?
- How many pieces of information are presented? Is there a lot of data presented or not very much?
- How many variables are there? Are there one or two variables such as weight and age or are there many variables such as height, weight, age, gender, and body mass index?
- If there are axes, how many are there (such as x and y)?
- How many levels of data are there? Is the data nested such as major cities within states?

How complicated is the student's task when using the graphics? That is:

- Is it only necessary to locate, find, or compare information in a single graphic, or is it necessary to use the information in another graphic?
- Does the next step in a process or procedure need to be identified?
- Do trends, patterns, or relationships in a graphic need to be identified, compared, or interpreted?

- Is the information in the graphic used to make inferences or decisions? Does the inference or decision need to be justified?
- Is it necessary to identify the graphic that accurately represents the data or is the most effective? Does the choice need to be justified?

Graphic Literacy Level 3

At Level 3, workplace graphics are common and of simple or low moderate difficulty.

Characteristics of simple graphics include:

- A limited amount of data (i.e., less than twenty data points/fields)
- One level of data such as number of items in inventory
- One or two variables such as day of the week and number of items in inventory
- If there are axes, there will be one or two, such as an x and/or y axis

Characteristics of low moderate graphics include:

- A moderate amount of data
- More than one level of data, but no nesting
- Several variables
- If there are axes, there will be one or two
- If two simple graphics are required to solve the problem, they should be considered a low moderate graphic.

At Level 3, students use one simple or low moderate graphic at a time to perform the following tasks:

- Locate and find information
- Identify the next or missing step in a process

Graphic Literacy Level 4

At Level 4, workplace graphics are common and of low to high moderate difficulty.

Characteristics of low moderate graphics include:

- A moderate amount of data
- More than one level of data, but no nesting
- Several variables
- If there are axes, there will be one or two
- If two simple graphics are required to solve the problem, they should be considered a low moderate graphic.

At Level 4, students have demonstrated all of the skills defined at Level 3 and they can use one or two low moderate graphics at a time to perform the following tasks:

- Locate information in a graphic using information found in another graphic
- Compare two or more pieces of information
- Identify a trend/pattern/relationship
- Make an inference or decision
- Identify the graphic that accurately represents the data

High moderate graphics may be less common and have the following characteristics:

- A moderate amount of data
- More than one level of data and it may be nested
- Many variables such as types of wood, drill speeds, hole diameter, and type of bit
- If there are axes, there will be one or two such as an x and/or y axis.
- If a low moderate graphic and a simple graphic are required to solve the problem, they should be considered a high moderate graphic.

At Level 4, students have demonstrated all of the skills defined at Level 3 and they can use one high moderate graphic to perform the following tasks:

- Locate and find information
- Identify the next or missing step in a process

Graphic Literacy Level 5

At Level 5, workplace graphics may be less common and of low moderate, high moderate, or difficult complexity.

Characteristics of low moderate graphics include:

- A moderate amount of data
- More than one level of data, but no nesting
- Several variables
- If there are axes, there will be one or two.
- If two simple graphics are required to solve the problem, they should be considered a low moderate graphic.

At level 5, students have demonstrated all of the skills defined at Levels 3 and 4, and they can use a low moderate graphic to perform the following tasks:

- Compare two or more pieces of information
- Interpret a trend/pattern/relationship
- Make a reasonable inference or decision based on one graphic after finding information in another graphic
- Justify a decision or inference based on information
- Identify the most effective graphic for the task
- Justify the most effective graphic for the task

High moderate graphics may be less common and have the following characteristics:

- A moderate amount of data
- More than one level of data and it may be nested
- Many variables
- If there are axes, there will be one or two.
- If a low moderate graphic and a simple graphic are required to solve the problem, they should be considered a high moderate graphic.

Graphic Literacy Level 5 Continued

At Level 5, students have demonstrated all of the skills defined at Level 3 and 4, and they can use one high moderate graphic to perform the following tasks:

- Locate information in a graphic using information found in another graphic
- Compare two or more pieces of information
- Identify a trend/pattern/relationship
- Make an inference or decision
- Identify the graphic that accurately represents the data

Difficult graphics are likely to be less common or a composite of graphics and have the following characteristics:

- Data presented is dense.
- More than one level of data and nesting is likely
- Many variables such as types of wood, drill speeds, hole diameter, and type of bit
- If there are axes, there will be three or more such as an x, y, and z axis.
- If a high moderate graphic and a low moderate graphic are required to solve the problem, they should be considered a difficult graphic.

At Level 5, students have demonstrated all of the skills defined at Level 3 and 4, and they can use one difficult graphic to perform the following tasks:

- Locate and find information
- Identify the next or missing step in a process

Graphic Literacy Level 6

At Level 6, workplace graphics may be less common and of high moderate or difficult complexity.

High moderate graphics may be less common and have the following characteristics:

- A moderate amount of data
- More than one level of data and it may be nested
- Many variables
- If there are axes, there will be one or two
- If a low moderate graphic and a simple graphic are required to solve the problem, they should be considered a high moderate graphic.

At level 6, students have demonstrated all of the skills defined at Levels 3, 4 and 5, and they can use a high moderate graphic to perform the following tasks:

- Compare two or more pieces of information
- Interpret a trend/pattern/relationship
- Make a reasonable inference or decision based on one graphic after finding information in another graphic
- Justify a decision or inference based on information
- Identify the most effective graphic for the task
- Justify the most effective graphic for the task

Difficult graphics are likely to be less common or a composite of graphics and have the following characteristics:

- Data presented is dense.
- More than one level of data and nesting is likely
- Many variables
- If there are axes, there will be three or more.
- If a low moderate graphic and a high moderate graphic are required to solve the problem, they should be considered a difficult graphic.

Graphic Literacy Level 6 Continued

At Level 6, students have demonstrated all of the skills defined at Level 3, 4 and 5, and they can use one difficult graphic to perform the following tasks:

- Locate information in a graphic using information found in another graphic
- Compare two or more pieces of information
- Identify a trend/pattern/relationship
- Make an inference or decision
- Identify the graphic that accurately represents the data

Graphic Literacy Level 7

At Level 7, workplace graphics may be less common and of difficult complexity.

Difficult graphics are likely to be less common or a composite of graphics and have the following characteristics:

- Data presented is dense.
- More than one level of data and nesting is likely
- Many variables
- If there are axes, there will be three or more.
- If a low moderate graphic and a high moderate graphic are required to solve the problem, they should be considered a difficult graphic.

At level 7, students have demonstrated all of the skills defined at Levels 3, 4, 5 and 6, and they can use a difficult graphic to perform the following tasks:

- Compare two or more trends/patterns/relationships
- Interpret a trend/pattern/relationship
- Make a reasonable inference or decision based on one graphic after finding information in another graphic
- Justify an inference or decision based on information
- Identify the most effective graphic for the task
- Justify the most effective graphic for the task

WORKPLACE DOCUMENTS SKILL

WorkKeys Workplace Documents is the skill people use when they read and use written text in order to do a job. The written texts include memos, letters, directions, notices, bulletins, policies, and regulations. It is often the case that these workplace communications are not necessarily well written or targeted to the appropriate audience. Workplace Documents materials do not include information that is presented graphically, such as in charts, forms, or blueprints.

There are five levels of difficulty. Level 3 is the least complex and Level 7 is the most complex. The levels build on each other, each incorporating the skills assessed at the preceding levels. For example, at Level 5, students need the skills from Levels 3, 4, and 5. The reading materials at Level 3 are short and direct. The material becomes longer, denser, and more difficult to use as readers move toward Level 7. The tasks also become more complex as readers move from Level 3 to Level 7. At Level 3, readers begin by finding very obvious details and following short instructions. At the more complex levels, tasks can also involve more application and interpretation.

When you consider what level of Workplace Documents skill is needed for the tasks students complete on the job, you might consider the following questions:

How difficult are the materials? For example:

- Are the sentences short, simple, and clear, or are they complex and possibly even confusing?
- Do the materials use only common words, or do they include difficult words, jargon, and words used in unfamiliar ways?
- How much extra information is included?

How complicated is the task? For example:

- Is it only necessary to use information that is stated clearly?
- Is it necessary to draw conclusions based on the reading materials before using the information?
- Do the students need to apply the information to a situation exactly like the one described in the materials or to one that is quite different?

Workplace Documents Level 3

Level 3 reading materials include basic company policies, procedures, and announcements. They are short and simple, with no extra information. Students read the materials to find out what they should do. All the information they need is stated clearly and directly, using easy words and straightforward sentences.

When students use Level 3 Workplace Documents skills on the job, they can:

- Pick out the main ideas and clearly stated details.
- Choose the correct meaning of a word when the word is clearly defined in the reading.
- Choose the correct meaning of common everyday and workplace words (such as student, timecard, office).
- Choose when to perform each step in a short series of steps.
- Apply instructions to a situation that is the same as the one they are reading about (such as knowing what button to push first after reading instructions on how to run a copy machine).

Workplace Documents Level 4

Level 4 reading materials include company policies, procedures, and notices. They are straightforward, but have longer sentences and contain a number of details. These materials use common words, but do have some harder words, too. They describe procedures that include several steps. When following the procedures, students must think about changing conditions that affect what they should do.

When students use Level 4 Workplace Documents skills on the job, in addition to using Level 3 skills, they can:

- Identify important details that may not be clearly stated.
- Use the reading material to figure out the meaning of words that are not defined for them.
- Apply instructions with several steps to a situation that is the same as the situation in the reading materials.
- Choose what to do when changing conditions call for a different action. For example, they can follow directions that include "if-then" statements.

Workplace Documents Level 5

At Level 5, policies, procedures, and announcements have many details. The information that students need to finish a task is stated directly, but it is hard to understand because of the way it is worded. The materials include jargon, technical terms, and acronyms or words that have several meanings. Students must consider several factors in order to identify a course of action that will accomplish their goals.

When students use Level 5 Workplace Documents skills on the job, in addition to using the skills described at Levels 3 and 4, they can:

- Figure out the correct meaning of a word based on how the word is used.
- Identify the correct meaning of an acronym that is defined in the document.
- Identify the meaning of a technical term or of jargon that is defined in the document.
- Apply technical terms and jargon and relate them to stated situations.
- Apply straightforward instructions to a new situation that is similar to the one described in the material.
- Apply complex instructions that include conditionals to situations described in the materials.

Workplace Documents Level 6

Level 6 materials include elaborate procedures, complicated information, and legal regulations found in all kinds of workplace documents. They use complicated sentences with difficult words, jargon, and technical terms. Most of the information is not clearly stated.

When students use Level 6 Workplace Documents skills on the job, in addition to using the skills described at Levels 3, 4, and 5, they can:

- Identify implied details.
- Use technical terms and jargon in new situations.
- Figure out the less common meaning of a word based on the context.
- Apply complicated instructions to new situations.
- Figure out the principles behind policies, rules, and procedures.
- Apply general principles from the materials to similar and new situations.
- Explain the rationale behind a procedure, policy, or communication.

Workplace Documents Level 7

At Level 7, the reading materials are very complex. The information includes a lot of details, and the concepts are complicated. The vocabulary is difficult. Unusual jargon and technical terms are used, but they are not defined. The writing often lacks clarity and direction. Readers must draw conclusions from some parts of the reading and apply them to other parts.

When students use Level 7 Workplace Documents skills on the job, in addition to using the skills at Levels 3, 4, 5, and 6, they can:

- Figure out definitions of difficult, uncommon words based on how they are used.
- Figure out the meaning of jargon or technical terms based on how they are used.
- Figure out the general principles behind the policies and apply them to situations that are quite different from any described in the materials.

Appendix B

Learning Objectives

The Learning Objectives for the training program are shown in the table below. An "X" in a skill column means that the objective on that row requires that skill.

Objective/ Skill		Applied Math	Graphic Literacy	Workplace Documents
Unit 1: Safety Responsibilities				
OBJ 1	Define Workplace Health and Safety and Explain its Importance			X
OBJ 2	Describe the Importance of Safety Policies		X	X
OBJ 3	Describe the Results of Unsafe Behavior		X	X
OBJ 4	Describe the Purpose of the Occupational Safety and Health Administration			X
OBJ 5	Describe the Purpose of the Environmental Protection Agency			X
OBJ 6	Describe the Purpose of NIOSH, EPCRA, and State Safety Agencies		X	X
OBJ 7	Describe the Safety Responsibilities within a Company			X
OBJ 8	Describe How to Locate Safety Regulations and Policies			X
Unit 2: Practicing Safety in the Workplace				
OBJ 1	Explain How to Create a Culture of Safety in the Workplace		X	X
OBJ 2	Define an Injury and Identify Common Types			X
OBJ 3	Define an Accident and Identify Common Types			X
OBJ 4	Define Personal Protective Equipment			X
OBJ 5	Identify Seven Types of Personal Protective Equipment			X
OBJ 6	Describe an Employer's PPE Responsibilities			X
OBJ 7	Describe How to Identify Hazards in the Workplace			X
OBJ 8	Describe 11 Types of Hazards Found in the Workplace		X	X

Objective/ Skill		Applied Math	Graphic Literacy	Workplace Documents
Unit 3: Types of PPE				
OBJ 1	Describe the Types of Head PPE			X
OBJ 2	Describe the Types of Eye PPE			X
OBJ 3	Describe the Types of Ear PPE			X
OBJ 4	Describe the Types of Hand and Arm PPE			X
OBJ 5	Describe the Types of Foot PPE			X
OBJ 6	Describe the Types of Respiratory PPE			X
OBJ 7	Describe the Types of Body PPE			X
Unit 4: Hazardous Materials Standards				
OBJ 1	Describe Three Categories of Hazardous Materials and Give Examples of Each			X
OBJ 2	Define the GHS and HCS Communications Standards			X
OBJ 3	Describe How to Interpret the HazCom Labeling System		X	X
OBJ 4	Define a Safety Data Sheet and Explain Its Use		X	X
OBJ 5	Describe the NFPA and HMIS Hazardous Material Identifications Systems		X	X
Unit 5: Hazardous Material Handling and Storage				
OBJ 1	Describe the Guidelines for Handling Hazardous Materials			X
OBJ 2	Describe the Guidelines for Storing Hazardous Materials	X		X
OBJ 3	Describe How to Dispose of Hazardous Materials			X
OBJ 4	Describe the DOT Hazardous Material Identification System		X	X
OBJ 5	Describe the Guidelines for Shipping Hazardous Materials		X	X
Unit 6: Machine Safety				
OBJ 1	Describe Clothing Safety Guidelines for Machine Operators			X
OBJ 2	Describe the Machine Operation Safety Guidelines			X
OBJ 3	Describe the Types of Machine Guards			X

Objective/ Skill		Applied Math	Graphic Literacy	Workplace Documents
OBJ 4	Describe the Operation of Machine Interlocks			X
OBJ 5	Describe the Operation Emergency Stop Controls		X	X
OBJ 6	Describe the Function of a Lockout/Tagout system		X	X
OBJ 7	Describe How to Perform an Electrical Lockout/Tagout		X	X
Unit 7: Material Handling Safety				
OBJ 1	Describe the Types of Manual Material Handling Equipment			X
OBJ 2	Describe Basic Safety Rules for Hoist and Crane Use			X
OBJ 3	Describe Basic Safety Rules for Forklift use			X
Unit 8: Work Area Safety				
OBJ 1	Describe the Elements of a Safe Work Station			X
OBJ 2	Describe How to Maintain a Safe Work Station			X
OBJ 3	Describe the Guidelines for Walkway Safety			X
OBJ 4	Describe the Guidelines for Platform Safety			X
OBJ 5	Describe the Guidelines for Ladder Safety	X	X	X
OBJ 6	Define Ergonomics and Explain Its Importance			X
OBJ 7	Describe the Guidelines for Ergonomic Safety			X
OBJ 8	Describe the Guidelines for Lifting Objects			X
Unit 9: Fire and Electrical Safety				
OBJ 1	Describe the Elements of a Fire		X	X
OBJ 2	Describe the Four Types Fires			X
OBJ 3	Describe Combustible and Flammable Fire Prevention Guidelines			X
OBJ 4	Describe How to Select a Fire Extinguisher		X	X
OBJ 5	Describe How to Use a Fire Extinguisher			X
OBJ 6	Describe Electrical Safety Guidelines			X
OBJ 7	Describe How to Maintain Fire and Safety Equipment and Facilities			X
Unit 10: Emergency and Accident Response				
OBJ 1	Describe Categories of Emergencies			X

Objective/ Skill		Applied Math	Graphic Literacy	Workplace Documents
OBJ 2	Describe the Elements of an Emergency Action Plan		X	X
OBJ 3	Describe How to Respond to an Emergency			X
OBJ 4	Describe How to Respond to a Workplace Accident			X
OBJ 5	Describe How to Use an Eyewash Station			X
OBJ 6	Describe How to Report a Workplace Accident			X
Unit 11: Gasoline & LPG Fuel Systems				
Standard 72	Explain the differences between gasoline and liquid petroleum gas fuels.		X	X
Standard 73	Understand safety procedures with gasoline and liquid petroleum gas fuels.			X
Standard 74	Explain the function of each major component of a typical gasoline and liquid petroleum gas fuel system.		X	X
Standard 75	Identify the basic maintenance checks on both a liquid petroleum gas fuel system and a gasoline fuel system.		X	X
Standard 76	Identify the basic problems of both a liquid petroleum gas fuel system and a gasoline fuel system and initiate a corrective action.		X	X
Unit 12: Front Drive Axle & Differential				
Standard 70	Identify and describe the major components of the front axle and differential.		X	X
Standard 71	Describe front axle and differential maintenance and troubleshooting procedures.		X	X
Unit 13: Basic Engines				
Standard 19	Define internal combustion (IC) engine.			X
Standard 20	Identify the four fuels used in an IC engine and explain the advantages and disadvantages of each.			X
Standard 21	Identify and describe each of the cycles in a 4-cycle engine.		X	X
Standard 22	Explain the concept of compression ratio.		X	X
Standard 23	Identify and describe the function of each major component of an IC engine.		X	X

Objective/ Skill		Applied Math	Graphic Literacy	Workplace Documents
Standard 24	Describe the purpose and function of a typical IC engine ignition system and the differences between ignition system types.		X	X
Standard 25	Identify and describe the function of the cooling system, engine air filter and PCV valve.		X	X
Unit 14: Brake Systems				
Standard 32	Identify the components of typical vehicle braking systems.		X	X
Standard 33	Describe the function of the master cylinder as part of the braking system.		X	X
Standard 34	Describe the function of the brake lines as part of the braking system.		X	X
Standard 35	Describe the function of the power assist as part of the braking system.		X	X
Standard 36	Describe and identify the components of the drum and disc type brake systems.		X	X
Standard 37	Describe and identify the components of the magnetic brake system.		X	X
Standard 38	Identify routine maintenance procedures that must be perform on brakes.	X	X	X
Unit 15: Oil Cooled Wet Disc Brakes				
Standard 91	Understand the features and benefits of using a wet brake system for electrical and mechanical systems.		X	X
Standard 92	Identify and understand the troubleshooting and maintenance procedures.	X	X	X
Standard 93	Identify and understand the general theory of operation and individual components of the braking and cooling systems and their corresponding functions.		X	X
Unit 16: Cooling Systems				
Standard 66	Explain what causes engine heat.		X	X
Standard 67	Describe the purpose and operation of an engine cooling system.		X	X
Standard 68	Cooling system periodic maintenance items.	X		X

Objective/ Skill		Applied Math	Graphic Literacy	Workplace Documents
Standard 69	Understand cooling system safety procedures.			X
Unit 17: Steering Systems				
Standard 94	Describe types of steering systems – electric steering system and hydrostatic system and explain how they work.		X	X
Standard 95	Describe the basic components of a steering system.		X	X
Standard 96	Given a drawing, locate and identify the basic components of a hydrostatic steering system.		X	X
Standard 97	Describe the functions of each component on a hydrostatic steering system and explain how a steering system works.		X	X
Standard 98	Identify the basic maintenance checks on a steering system.	X		X
Standard 99	Identify the basic problems of the steering system and initiate a corrective action.		X	X
Unit 18: Transmissions				
Standard 100	Describe the operation of a manual transmission.		X	X
Standard 101	Describe the operation of a power shift transmission.		X	X
Standard 102	Describe how to perform basic transmission maintenance.		X	X
Standard 103	Describe transmission troubleshooting procedures.		X	X
Standard 104	Understand the usage of the inching system.		X	X
Unit 19: Masts				
Standard 52	Identify each component of the mast assembly.		X	X
Standard 53	Identify mast types.			X
Standard 54	Define the purpose of the mast as related to powered industrial trucks.			X
Standard 55	Explain and identify mast terminology.	X	X	X
Standard 56	Describe the function of each mast component.		X	X
Standard 57	Describe the steps to be followed for maintenance and to diagnose and correct problems.		X	X
Standard 58	Identify and describe the function of forks, carriage wear, and lift chain wear adjustments.			X

Objective/ Skill		Applied Math	Graphic Literacy	Workplace Documents
Unit 20: Attachments for Lift Trucks				
Standard 59	Explain basic attachment functions.		X	X
Standard 60	Define the different types of attachments.		X	X
Standard 61	Describe attachment mounting.	X	X	X
Standard 62	Describe routines for adding attachments and explain capacity reduction with attachment usage.	X	X	X
Unit 21: AC Motors				
OBJ 1	Explain what Alternating Current (AC) is.		X	X
OBJ 2	Describe AC motors and how they work.		X	X
OBJ 3	Describe AC controllers and how they work.		X	X
OBJ 4	Explain the advantages and disadvantages of AC.		X	X
Unit 22: Motors & Magnetism				
OBJ 1	Discuss the properties of a magnet.		X	X
OBJ 2	Explain how an electromagnet functions as a contactor.		X	X
OBJ 3	Describe inductance.		X	X
OBJ 4	Explain how a motor operates.		X	X
OBJ 5	Describe the concepts of speed and torque.		X	X
OBJ 6	Compare the forward and reverse movements of a motor.		X	X
Unit 23: How to Use Meters for Testing Electrical Circuits & Components				
Standard 77	Define the different types of meters and what they measure (digital DVOM CAT 3 and CAT 4, Fluke 179, 87, or similar).		X	X
Standard 78	Define the multimeter functions and what they are used to measure.		X	X
Standard 79	Demonstrate the ability to locate plugs, pin connectors, and wire numbers.		X	X
Standard 80	Demonstrate the ability to use the multimeter to test for current, voltage, and resistance.	X	X	X
Standard 81	Explain how to test a diode, capacitor test, and check resistance.	X	X	X

Objective/ Skill		Applied Math	Graphic Literacy	Workplace Documents
Standard 82	Explain voltage drop and the application on each component.	X	X	X
Unit 24: IC Electrical Systems				
Standard 83	Describe the function of the starting system as part of the electrical system.		X	X
Standard 84	Identify and describe the function of each of the starting system components.		X	X
Standard 85	Describe the function of the charging system as part of the electrical system.		X	X
Standard 86	Describe the function of the ignition system as part of the electrical system.		X	X
Standard 87	Identify the unique components and explain the differences between traditional, electronic, and advanced electronic ignition systems.		X	X
Standard 88	Identify and describe the function of each of the ignition system components.		X	X
Standard 89	Identify routine maintenance procedures that must be performed on the IC Electrical System.		X	X
Standard 90	Perform basic troubleshooting and diagnosis of common problems associate with the ignition system.		X	X
Unit 25: Introduction to CAN Bus				
OBJ 1	Define CAN Bus.		X	X
OBJ 2	List Benefits of using CAN Bus.		X	X
OBJ 3	Describe the basic concepts and principles underlying the working of CAN Bus.		X	X
OBJ 4	List the basic principles to troubleshoot a CAN Bus system.		X	X
OBJ 5	List the broad steps to troubleshoot a CAN Bus system.		X	X
Unit 26: Batteries				
Standard 45	Demonstrate proper troubleshooting methods.		X	X
Standard 46	Describe the basic construction of an industrial battery.		X	X

Objective/ Skill		Applied Math	Graphic Literacy	Workplace Documents
Standard 48	Identify key safety concerns that should be followed when handling batteries.		X	X
Standard 49	Explain how to charge batteries properly and safely.		X	X
Unit 27: Industrial Batteries				
Standard 45	Demonstrate proper troubleshooting methods.		X	X
Standard 47	Recognize and understand the differences between various types of batteries		X	X
Standard 50	Perform basic battery maintenance.	X	X	X
Standard 51	Understand forklift battery requirements, size, amp hour, voltage, etc.	X	X	X