



MANUFACTURING
SKILL STANDARDS
COUNCIL

“Certifying the Industrial Athlete of the Future”



National Forklift Technical Standards

2017 Edition

In collaboration with

Material Handling Equipment Distributors
Association



Manufacturing Skill Standards Council

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Background

Welcome to the National Forklift Technical Standards. The nationwide Manufacturing Skill Standards Council (MSSC) collaborated with the Material Handling Distributors Association (MHEDA) to develop these standards.

An industry-led non-profit, MSSC is the national leader in developing and disseminating standards-based training and certification systems for industry-wide core competencies needed for front-line work in advanced manufacturing and logistics. (see www.msscusa.org and *MSSC: Nation's Gold Standard* for details).

MHEDA is the premier trade association dedicated to serving the material handling equipment distributors community. Over 600 distributor and manufacturing companies worldwide utilize MHEDA's resources to help their business stay competitive and employees stay connected. (see www.mheda.org for further background.)

In the fall of 2016, MSSC facilitated meetings with industry subject matter experts recruited by MHEDA to draft these standards. In the first half of 2017, MHEDA validated these standards with a broad, demographically representative cross-section of its members. That validation resulted in 89-92% approval ratings these standards.

These Technical Standards are based on the technical systems and engineering principles that underpin most forklift vehicles and describe the key work activities and performance indicators associated with work on these systems. Since these standards are based on common technical and engineering aspects of forklift construction, they lend themselves to the development of an entry-level, nationwide MSSC training and certification system, called "*MSSC-Certified Forklift Technician (CFT)*."

CFT is Intended for training and certification testing by education and training institutions, mostly community colleges and secondary schools, and designed for consistent, nationwide use. This system is intended to help the forklift distribution community maintain a robust supply of higher skilled job applicants from the nation's schools and a quality benchmark for incumbent workers.

These standards are intended to represent an authoritative definition of work activities and performance indicators that will raise the quality of technical maintenance services throughout the forklift industry. MSSC and MHEDA will be reviewing these standards biennially with industry subject matter experts to ensure that they are keeping pace with industry best practices and technological change.

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FORKLIFT TECHNICAL STANDARDS

1. Basic Safety

- a. Understand Lock out/Tag out procedures
- b. Understand basic forklift safety devices
- c. Understand workstation safety procedures
- d. Understand Personal Protection Equipment procedures
- e. Understand hazardous safety procedures

2. Basic Engines

- a. Define internal combustion (IC) engine
- b. Identify the four fuels used in an IC engine and explain the advantages and disadvantages of each
- c. Identify and describe each of the cycles in a 4-cycle engine
- d. Explain the concept of compression ratio
- e. Identify and describe the function of each major component of an IC engine
- f. Describe the purpose and function of a typical IC engine ignition system and the differences between ignition system types
- g. Identify and describe the function of the cooling system, engine air filter and PCV valve

3. Basic Hydraulics

- a. Understand the overview and theory of hydraulics
- b. Identify the components and explain their basic function
- c. Demonstrate the ability to identify the hydraulic components depicted by industry standard graphic symbols on a simple hydraulic schematic
- d. Demonstrate the ability to trace fluid flow during operation
- e. Understand hydraulic system safety Identify the first safety related task to be performed before opening or breaking a connection in a hydraulic system
- f. Explain attachment hydraulic controls, functions, hosing, pressure and flow control

4. Brake Systems

- a. Identify the components of typical vehicle braking systems
- b. Describe the function of the master cylinder as part of the braking system
- c. Describe the function of the brake lines as part of the braking system
- d. Describe the function of the power assist as part of the braking system
- e. Describe and identify the components of the drum and disc type brake systems
- f. Describe and identify the components of the magnetic brake system.
- g. Identify routine maintenance procedures that must be perform on brakes

5. Basic Laws of Electricity

- a. Describe ohm's law.
- b. Define electrical terms
- c. Describe voltage, current and resistance and their units of measure
- d. Describe a series circuit and the three rules that apply to them
- e. Describe a parallel circuit and the three rules that apply to them
- f. Describe the effects of component failures

6. Batteries

- a. Demonstrate proper troubleshooting methods
- b. Describe the basic construction of an industrial battery
- c. Recognize and understand the differences between various types of batteries
- d. Identify key safety concerns that should be followed when handling batteries
- e. Explain how to charge batteries properly and safely
- f. Perform basic battery maintenance
- g. Understand forklift battery requirements, size, amp hour, voltage, etc.

7. Masts

- a. Identify each component of the mast assembly
- b. Identify mast types
- c. Define the purpose of the mast as related to powered industrial trucks
- d. Explain and identify mast terminology
- e. Describe the function of each mast component
- f. Describe the steps to be followed for maintenance and to diagnose and correct problems
- g. Identify and describe the function of forks, carriage wear, and lift chain wear adjustments

8. Basic Attachments for Lift Trucks

- a. Explain basic attachment functions
- b. Define the different types of attachments
- c. Describe attachment mounting
- d. Describe routines for adding attachments and explain capacity reduction with attachment usage

9. Cooling Systems

- a. Explain what causes engine heat
- b. Describe the purpose and operation of an engine cooling system
- c. Cooling system periodic maintenance items
- d. Understand cooling system safety procedures

10. Front Drive Axle & Differential

- a. Identify and describe the major components of the front axle and differential
- b. Describe front axle and differential maintenance and troubleshooting procedures

11. Gasoline & LPG Fuel Systems

- a. Explain the differences between gasoline and liquid petroleum gas fuels
- b. Understand safety procedures with gasoline and liquid petroleum gas fuels
- c. Explain the function of each major component of a typical gasoline and liquid petroleum gas fuel system
- d. Identify the basic maintenance checks on both a liquid petroleum gas fuel system and a gasoline fuel system
- e. Identify the basic problems of both a liquid petroleum gas fuel system and a gasoline fuel system and initiate a corrective action

12. Use Meters for Testing Electrical Circuits & Components

- a. Define the different types of meters and what they measure (digital DVOM CAT 3 and CAT 4, Fluke 179, 87, or similar)
- b. Define the multimeter functions and what they are used to measure
- c. Demonstrate the ability to locate plugs, pin connectors and wire numbers
- d. Demonstrate the ability to use the multimeter to test for current, voltage and resistance
- e. Explain how to test a diode, capacitor test, and check resistance
- f. Explain voltage drop and the application on each component

13. IC Electrical Systems

- a. Describe the function of the starting system as part of the electrical system
- b. Identify and describe the function of each of the starting system components
- c. Describe the function of the charging system as part of the electrical system
- d. Describe the function of the ignition system as part of the electrical system
- e. Identify the unique components and explain the differences between traditional, electronic and advanced electronic ignition systems
- f. Identify and describe the function of each of the ignition system components

- g. Identify routine maintenance procedures that must be performed on the IC Electrical System
- h. Perform basic troubleshooting and diagnosis of common problems associate with the ignition system

14. Oil Cooled Wet Disc Brakes of Electrical and Mechanical Braking Systems

- a. Understand the features and benefits of using a wet brake system for electrical and mechanical systems
- b. Identify and understand the troubleshooting and maintenance procedures
- c. Identify and understand the general theory of operation and individual components of the braking and cooling systems and their corresponding functions

15. Steering Systems

- a. Describe types of steering systems – electric steering system and hydrostatic system and explain how they work
- b. Describe the basic components of a steering system
- c. Given a drawing, locate and identify the basic components of a hydrostatic steering system
- d. Describe the functions of each component on a hydrostatic steering system and explain how a steering system works
- e. Identify the basic maintenance checks on a steering system
- f. Identify the basic problems of the steering system and initiate a corrective action

16. Transmissions

- a. Describe the operation of a manual transmission
- b. Describe the operation of a power shift transmission
- c. Describe how to perform basic transmission maintenance
- d. Describe transmission troubleshooting procedures
- e. Understand the usage of the inching system