22101
Orientation to the Trade

Heavy Equipment Operations

Overview
Heavy equipment operators are highly skilled workers who are needed on every construction site and in every mining operation. A skilled operator has many opportunities for advancement with an employer or as an entrepreneur. Many of the large excavating and site-development companies operating today were founded by equipment operators who started with a single machine.

Learning Objective 1
Successful completion of this module prepares trainees to:
Explain the role of heavy equipment operators in the construction industry.

a. Explain the uses of heavy equipment.
b. Identify and describe the different types of heavy equipment.
c. Describe the career opportunities associated with heavy equipment operation.
d. Describe the training available to heavy equipment operators.

Learning Objective 2
Successful completion of this module prepares trainees to:
Explain the responsibilities and characteristics required of heavy equipment operators.

a. Describe employee responsibilities.
b. Explain the importance of human relations.
c. Explain the importance of safety in the operation of heavy equipment.

Performance Tasks
This is a knowledge-based module; there are no performance tasks.
Recommended Teaching Time: 5.0 hours
Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08101
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
Heavy Equipment Safety

Heavy Equipment Operations

Overview

Working in and around heavy equipment is hazardous. Heavy equipment operators and other workers need to work together to keep the job site safe. The heavy equipment operator’s job is to operate the equipment in a manner that protects both the operator and other workers. When working around heavy equipment, operators must act in a way that does not place them or their co-workers in danger of an accident.

This module covers some of the dangers about working around heavy equipment. Because heavy equipment work is hazardous, there are a number of specific rules and procedures in place to decrease the chances for an accident. This module provides basic information about how to stay safe around heavy equipment.

Learning Objective 1

Successful completion of this module prepares trainees to:

Explain work zone safety requirements.

a. Describe signs, barriers, and other devices and methods used for work zone safety.
b. Describe traffic control safety methods.

Learning Objective 2

Successful completion of this module prepares trainees to:

Explain hazard communication.

a. Explain the purpose and content of Safety Data Sheets (SDS)
b. Describe the labeling systems used for hazardous materials.
c. Describe noise control methods.

Learning Objective 3

Successful completion of this module prepares trainees to:
Identify and describe safety practices associated with heavy equipment operation.

a. List job site and equipment safety requirements.
b. Explain the safety hazards associated with weather.
c. Explain safety practices associated with equipment maintenance.

**Learning Objective 4**

*Successful completion of this module prepares trainees to:*

Identify safety practices associated with trenches and excavations.

a. Explain how soil composition relates to trench failures.
b. Describe the methods used to protect workers in trenches and excavations.
c. Identify personal safety hazards related to dust and soils.

**Performance Tasks**

1. Place barricades and temporary traffic control devices for a highway construction zone.
2. Demonstrate how to use flags or paddles to control traffic.
3. Demonstrate how to use various types of personal protective equipment (PPE):
   - Hard hat
   - Safety glasses
   - Ear protection
   - Gloves
   - Safety harness
   - Reflective safety vest

Recommended Teaching Time: 15 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08101
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

**Performance Task 1**
• Reflective safety vest
• Traffic control barricades and barriers

**Performance Task 2**
• Red traffic control flag

**Performance Task 3**
• Hard hat
• Safety glasses
• Ear protection
• Gloves
• Safety harness
• Reflective safety vest
Identification of Heavy Equipment

Course Planning Tools

Module 22103
22103
Identification of Heavy Equipment

Heavy Equipment Operations

Overview
There are many different types of machines in the heavy equipment domain. Each machine was initially designed for a particular type of work, but many can be modified with attachments to perform other functions. Heavy equipment operators must know the capabilities and limitations of the machine being operated. Operators also must be familiar with the various attachments that can be used with any given machine and know how to use them. With such levels of knowledge, the equipment operator will have many opportunities for advancement.

Learning Objective 1
Successful completion of this module prepares trainees to:
Identify and describe heavy equipment used in construction and mining.

a. Identify and describe equipment used in excavating and grading construction sites.
b. Identify and describe trenching equipment.
c. Identify and describe heavy equipment used in mining.

Learning Objective 2
Successful completion of this module prepares trainees to:
Describe the vehicle drive systems used in heavy equipment.

a. Describe engines used in heavy equipment.
b. Describe auxiliary systems, including fuel, exhaust, cooling, electrical, lubrication, and air filtration systems.

Learning Objective 3
Successful completion of this module prepares trainees to:
Explain hydraulic systems and their components.
a. Explain hydraulic system fundamentals.
b. Identify and describe the equipment and components used in hydraulic systems.

Performance Tasks

1. Identify the various types of heavy equipment and explain their uses.
2. Identify the basic parts of each type of equipment and explain the differences in models among the types of equipment.

Recommended Teaching Time: 5.0 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 22103
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1
- Images of Heavy Equipment

Performance Task 2
- Images of Heavy Equipment
Basic Operational Techniques

Course Planning Tools

Module 22104
Overview

Learning to operate a piece of heavy equipment is something like learning to drive and take care of a car. One of the first things an operator must learn is how to check the vehicle before starting it. Visual inspections of the vehicle are critical. The tires should appear to be inflated and undamaged. The lights and horn should be functional. All vehicle body parts need to be in place and usable. After the vehicle has been checked out, the operator should get into the operator’s seat, fasten the seat belt, and become familiar with all the instruments and controls.

After verifying that the vehicle is safe to use, and after becoming familiar with the controls, the operator can start the vehicle, move it forward, change its direction, stop it, and move it backwards before parking it. Heavy equipment operators must learn to do such basic actions before they can move on to operating any attachments installed on the heavy equipment.

Learning Objective 1

Successful completion of this module prepares trainees to:

Describe the prestart procedures for heavy equipment.

a. Describe how to safely mount a vehicle.
b. Describe common operator prestart inspection procedures for equipment, attachments, and tires.
c. Describe common operator prestart inspection procedures for power trains.
d. Describe common operator prestart inspection procedures for hydraulic systems.
e. Describe common operator prestart inspection procedures for electrical systems.

Learning Objective 2

Successful completion of this module prepares trainees to:

Describe the procedures for starting, operating, and shutting down heavy equipment.

a. Describe how to perform initial checks.
b. Describe basic operating procedures for the various items of equipment.
c. Explain how to properly shut down and secure equipment.
Performance Tasks

1. Perform basic prestart inspection, startup, operational movement, and shutdown for 3 of the 13 listed pieces of heavy equipment:

   • Utility tractors
   • Dozers
   • Loaders
   • Backhoes
   • Excavators
   • Compaction equipment
   • Motor graders
   • Scrapers
   • On-road dump trucks
   • Off-road dump trucks
   • Forklifts
   • Skid steers
   • Trenchers

Recommended Teaching Time: 27.5 hours

Classroom Equipment and Materials

• Whiteboard and markers
• Pencils and paper
• PowerPoint® Presentations for Module 22104
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

Performance Task 1

• Standard eye protection
• Gloves
• Proper footwear as designated by the instructor or training facility provider
• Hearing protection as designated by the instructor or training facility provider
• Hard hats
• Reflective vests
• Utility tractors
• Dozers
• Loaders
• Backhoes
• Excavators
• Compaction equipment
• Motor graders
• On-road dump trucks
• Off-road dump trucks
• Forklifts
• Skid steers
• Trenchers
Utility Tractors

Course Planning Tools

Module 22105
Overview
In addition to the truly heavyweight types of construction equipment described in other modules in this curriculum, there are useful machines called tractors that can effectively and economically handle lighter construction tasks that would be a waste of a heavier equipment’s capabilities. These tasks can involve pulling, towing, finish grading, and special operations such as hole drilling.

Learning Objective 1
Successful completion of this module prepares trainees to:
Describe the different types of utility tractors and their equipment.

a. Explain the drive system used on utility tractors.
b. Identify and describe the instruments used on utility tractors.
c. Identify and describe the controls used on utility tractors.
d. Identify and describe the hitches and attachments used on utility tractors.

Learning Objective 2
Successful completion of this module prepares trainees to:
Describe the procedures for starting, operating, and shutting down a utility tractor.

a. Describe the safety rules for operating a tractor.
b. Identify the daily inspection and maintenance requirements for utility tractors.
c. Explain how to properly start up, operate, and shut down a utility tractor.
d. Explain how to connect attachments to a utility tractor.

Performance Tasks
1. Perform prestart inspection and maintenance procedures.
2. Properly start, warm up, and shut down a gas-powered and diesel-powered engine tractor.
3. Perform basic maneuvering with a tractor.
4. Attach implements to a drawbar and three-point hitch.
5. Attach and detach implements to a power takeoff.

Recommended Teaching Time: 17.5 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08101
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

**Performance Task 1**

- Standard eye protection
- Gloves
- Proper footwear as designated by the instructor or training facility provider
- Hearing protection as designated by the instructor or training facility provider
- Hard hats
- Reflective vests
- Functional utility tractors
- Utility tractor attachments

**Performance Tasks 2 & 3**

- Standard eye protection
- Gloves
- Proper footwear as designated by the instructor or training facility provider
- Hearing protection as designated by the instructor or training facility provider
- Hard hats
- Reflective vests
- Functional utility tractors
• Utility tractor attachments

**Performance Task 4**
• Standard eye protection
• Gloves
• Proper footwear as designated by the instructor or training facility provider
• Hearing protection as designated by the instructor or training facility provider
• Hard hats
• Reflective vests
• Functional utility tractors
• Utility tractor attachments

**Performance Task 5**
• Standard eye protection
• Gloves
• Proper footwear as designated by the instructor or training facility provider
• Hearing protection as designated by the instructor or training facility provider
• Hard hats
• Reflective vests
• Functional utility tractors
• Utility tractor attachments
Introduction to Earthmoving

Course Planning Tools

Module 22201
Introduction to Earthmoving

Heavy Equipment Operations

Overview

One of the main purposes of heavy equipment operations is moving earth to excavate, fill, and shape the land surface. In this module you will receive an overview of the various aspects of earthmoving operations. These include the planning and safety measures involved, typical equipment used, grading methods, worksite practices, and soil properties and stabilization.

Learning Objective 1

Successful completion of this module prepares trainees to:

Describe earthmoving operations.

a. Describe the general approach to excavations and related planning.
b. Describe the characteristics of different types of soils.
c. Explain how plans and specifications are used in earthmoving.
d. Describe methods used to lay out slopes and grades.
e. Explain how to set up and coordinate operations, including setting up of staging areas, determining cycle times, and site preparation.
f. Describe site drainage requirements.
g. Explain the safety practices related to earthmoving operations.

Learning Objective 2

Successful completion of this module prepares trainees to:

Describe the equipment and methods used in excavating.

a. Describe how to measure production for various earthmoving activities.
b. Describe the equipment and methods used in loading excavated soil.
c. Describe the equipment and methods used in hauling excavated soil.
d. Describe the equipment and methods used in dumping excavated soil.
e. Describe fill, backfill, and embankment construction.
Learning Objective 3

Successful completion of this module prepares trainees to:

Describe the different methods used in stabilizing soils.

a. Identify the different types of binders.
b. Explain how to apply binders to soil.
c. Explain soil compacting.

Performance Tasks

1. Lay out a basic earthmoving operation.
2. Identify and select the proper equipment for a given earthmoving operation.
3. Draw a plan for basic earthmoving operations:
   - Clearing and grubbing
   - Excavating the foundation
   - Constructing embankments
   - Backfilling
   - Compacting

Recommended Teaching Time: 12.5 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 22201
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
22106
Grades
Heavy Equipment Operations

Overview
Heavy equipment operators are often involved in moving earth to level the ground in preparation for planned construction. The proper completion of this phase is essential for the ultimate stability of the final structure or road. Project engineers coordinate the work of surveyors and equipment operators to establish the required land surface, cutting high areas and filling low areas as needed. In this module, you will receive an introduction to the surveying and civil-engineering methods involved in changing the lay of the land's surface as part of a construction project.

Learning Objective 1
Successful completion of this module prepares trainees to:
Explain how to plan and lay out a site for grading.

a. Explain the planning process for grading.
b. Explain how to mark and set grade stakes.

Learning Objective 2
Successful completion of this module prepares trainees to:
Describe the equipment and methods used in making site measurements and establishing finish grades.

a. Explain how to make horizontal and vertical measurements.
b. Describe the electronic equipment and systems used in site measurement and grading.
c. Explain how to establish and check finish grade.

Performance Tasks
1. Identify types of stakes and markings on stakes.
2. Check horizontal and vertical distances of cut and fill slope stakes.
3. Check finish subgrade on a cross slope.

Recommended Teaching Time: 15.0 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 22106
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Standard eye protection
- Gloves
- Proper footwear as designated by the instructor or training facility provider
- Hearing protection as designated by the instructor or training facility provider
- Hard hats
- Reflective vests
- Various types of stakes
- Marking utensils

Performance Task 2

- Standard eye protection
- Gloves
- Proper footwear as designated by the instructor or training facility provider
- Hearing protection as designated by the instructor or training facility provider
- Hard hats
- Reflective vests
- Sight level, measuring tape, plumb bob
- Surveyor's level, leveling rod
Performance Task 3

- Standard eye protection
- Gloves
- Proper footwear as designated by the instructor or training facility provider
- Hearing protection as designated by the instructor or training facility provider
- Hard hats
- Reflective vests
- Pocket leveling rod, level, and tape measure
- Automatic level and leveling rod, laser level and detector