



# HEAVY EQUIPMENT OPERATIONS

## 49.0200.00

### TECHNICAL STANDARDS

The standards for this program were adopted from the National Center for Construction Education Research (NCCER) in 2012. The Arizona Career and Technical Education Quality Commission, the validating authority for the Arizona Skills Standards Assessment System, endorsed these standards on December 18, 2012. These technical standards were reviewed in Spring 2022 with no recommended changes.

Note: Arizona's Professional Skills are taught as an integral part of the Heavy Equipment Operations program.

**The Technical Skills Assessment for Heavy Equipment Operations is available SY2022-2023.**

#### STANDARD 1.0 EXAMINE BASIC HEAVY EQUIPMENT OPERATION

- 1.1 Use basic HEO terminology to describe types of heavy equipment and their uses
- 1.2 Describe the purpose and objectives of an apprenticeship training program
- 1.3 Identify heavy equipment operator responsibilities
- 1.4 Identify the personal characteristics of a professional heavy equipment operator
- 1.5 Identify the importance of safety in relation to heavy equipment

#### STANDARD 2.0 PRACTICE HEAVY EQUIPMENT OPERATION SAFETY

- 2.1 Demonstrate safety measures when working in and around heavy equipment
- 2.2 Identify the purposes of specific signs, tags, barricades, and lockout/tagout devices on construction sites
- 2.3 Identify safeguards used in a highway construction work zone
- 2.4 Use a safety data sheet (SDS) for a hazardous chemical typically associated with heavy equipment to identify the long- and short-term health effects, first-aid measures, handling and storage, and/or required personal protective equipment
- 2.5 Identify basic and specific safety rules when operating heavy equipment
- 2.6 Identify general guidelines for safe transportation of heavy equipment
- 2.7 Identify general dangers of working around an excavation area with heavy equipment
- 2.8 Identify specific safety rules for operating tractors and hydraulic systems
- 2.9 Describe the purpose of the Occupational Safety and Health Act (OSHA)

#### STANDARD 3.0 IDENTIFY TYPES OF HEAVY EQUIPMENT

- 3.1 Identify the various types of heavy equipment used on a construction site
- 3.2 Identify the primary use (s) of each type of heavy equipment

#### STANDARD 4.0 DEMONSTRATE BASIC HEAVY EQUIPMENT OPERATION

- 4.1 Identify the basic operational guidelines and techniques for heavy equipment
- 4.2 Perform basic prestart inspection, startup, operational movement, and shutdown for heavy equipment
- 4.3 Identify the operating controls of a typical tractor
- 4.4 Identify safety issues when operating a tractor on slopes or hills
- 4.5 Start, warm up, and shut down gasoline-powered and diesel-powered engines
- 4.6 Perform basic maneuvering with heavy equipment
- 4.7 Connect hydraulic-powered attachments to equipment

#### STANDARD 5.0 PERFORM GRADING OPERATIONS

- 5.1 Define terms associated with grade work
- 5.2 Match types of stakes to their use
- 5.3 Identify markings on grade stakes and benchmark (BM) stakes
- 5.4 Identify equipment used by a heavy equipment operator to check stakes
- 5.5 Describe and calculate slope ratio
- 5.6 Distinguish between backslope and foreslope
- 5.7 Verify horizontal and vertical distance of cut and fill slope stakes
- 5.8 Verify finish subgrade on a cross slope
- 5.9 Define terms associated with plan reading, grade setting, and drainage
- 5.10 Identify construction industry practices for setting grades from a benchmark
- 5.11 Identify construction industry practices for setting grades using a laser level or string
- 5.12 Identify methods for keeping construction sites well drained
- 5.13 Identify how the grade of a trench and drainpipe is set
- 5.14 Interpret construction plans to determine grading requirements

#### **STANDARD 6.o PERFORM EARTHMOVING OPERATIONS**

- 6.1 Identify earthmoving equipment
- 6.2 Identify earthmoving operations
- 6.3 Explain the need for soil stabilization on a job site
- 6.4 Identify soil stabilization methods
- 6.5 Identify the best equipment for performing a given earthmoving operation
- 6.6 Lay out a basic earthmoving operation
- 6.7 Demonstrate the use of laser and GPS technology

#### **STANDARD 7.o OPERATE A DUMP TRUCK**

- 7.1 Identify the types of dump trucks and their uses
- 7.2 Describe the function and operation of the dump hoist, power takeoff unit, auxiliary axle, engine retarder, differential lockout, air brake system, and manual transmission
- 7.3 Demonstrate and state the steps of the preoperational safety inspection for equipment
- 7.4 Identify the duties and responsibilities of a dump truck operator
- 7.5 Identify the controls of a dump truck
- 7.6 Back up a dump truck with a trailer attached

#### **STANDARD 8.o OPERATE A ROLLER**

- 8.1 Identify the uses of a roller
- 8.2 Identify the components and controls on a typical roller
- 8.3 Identify the safety rules for operating a roller
- 8.4 Perform basic maneuvers with a roller

#### **STANDARD 9.o OPERATE A SCRAPER**

- 9.1 Identify the uses of a scraper
- 9.2 Identify the components and controls on a typical scraper
- 9.3 Identify safety rules for operating a scraper
- 9.4 Perform basic maneuvers with a scraper

## **STANDARD 10.0 OPERATE A LOADER**

- 10.1 Identify the uses of a loader
- 10.2 Identify the components and controls on a typical loader
- 10.3 Identify safety rules for operating a loader
- 10.4 Perform basic maneuvers with a loader

## **STANDARD 11.0 OPERATE A FORKLIFT**

- 11.1 Identify the uses of a forklift
- 11.2 Identify the components and controls on a typical forklift
- 11.3 Identify the safety rules for operating a forklift
- 11.4 Perform basic forklift operations

## **STANDARD 12.0 OPERATE A DOZER**

- 12.1 Identify the uses of a dozer
- 12.2 Identify the components and controls on a typical dozer
- 12.3 Identify safety rules for operating a dozer
- 12.4 Perform dozer prestart inspection and maintenance procedures
- 12.5 Perform basic maneuvers with a dozer
- 12.6 Perform basic earthmoving and excavation operations with a dozer

## **STANDARD 13.0 OPERATE A BACKHOE**

- 13.1 Identify types of backhoes
- 13.2 Identify the components and controls on a typical backhoe
- 13.3 Identify safety rules for operating a backhoe
- 13.4 Identify accessories used on a backhoe
- 13.5 Perform backhoe prestart inspection and maintenance procedures
- 13.6 Perform basic maneuvers with a backhoe
- 13.7 Perform basic earthmoving operations with a backhoe

## **STANDARD 14.0 OPERATE AN EXCAVATOR**

- 14.1 Identify types of excavators and their uses
- 14.2 Identify the components and controls on a typical excavator
- 14.3 Identify safety rules for operating an excavator
- 14.4 Perform basic maneuvers with an excavator
- 14.5 Perform basic earthmoving and excavation operations with an excavator

## **STANDARD 15.0 OPERATE A MOTOR GRADER**

- 15.1 Identify the uses of a motor grader
- 15.2 Identify types of motor graders and their uses
- 15.3 Identify the components and controls on a typical motor grader
- 15.4 Identify safety rules for operating a motor grader
- 15.5 Identify accessories used on a motor grader
- 15.6 Perform prestart inspection and maintenance
- 15.7 Perform basic maneuvers with a motor grader
- 15.8 Perform basic earthmoving operations with a motor grader

## **STANDARD 16.o COMPLETE FINISHING AND GRADING WORK**

- 16.1 Identify the requirements for finishing and final grading of earthwork
- 16.2 Use heavy equipment to perform fine grading and finishing work
- 16.3 Demonstrate techniques for finish grading of subgrade, base, slopes, parking areas, and drainage structures

## **STANDARD 17.o DEMONSTRATE KNOWLEDGE OF SOILS**

- 17.1 Identify the characteristics of different types of soils
- 17.2 Identify the various engineering properties of soil
- 17.3 Identify factors that affect soil density
- 17.4 Identify how soil factors affect equipment selection
- 17.5 Demonstrate wet digging techniques

## **STANDARD 18.o PLAN CONSTRUCTION SITES**

- 18.1 Identify the three phases of a construction project
- 18.2 Identify the steps in construction site planning
- 18.3 Identify the relationship of planning to project safety and success
- 18.4 Develop a construction site schedule
- 18.5 Identify costs associated with building a job
- 18.6 Define production and productivity
- 18.7 Identify the relationship of productivity and profit

## **STANDARD 19.o PERFORM EXCAVATION MATH**

- 19.1 Identify basic geometric shapes
- 19.2 Calculate the surface area of squares, rectangles, triangles, trapezoids, and circles using formulas
- 19.3 Calculate the volume of cubes, rectangular objects, prisms, and cylinders
- 19.4 Calculate the excavation volume of a job using information supplied on building plans
- 19.5 Calculate the weight of materials from an excavation from its volume

## **STANDARD 20.o INTERPRET CIVIL BLUEPRINTS**

- 20.1 Identify the types of drawings usually included in a set of plans and the information found on each type
- 20.2 Identify the different types of lines used on drawings
- 20.3 Recognize common abbreviations and symbols used on plans
- 20.4 Read and interpret drawings to determine the type of excavations needed to prepare the site
- 20.5 Identify the operator's duties to ensure that the job is completed safely and according to a site plan