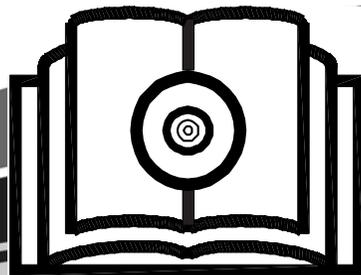


Vermeer®

Operation and Safety — Horizontal Directional Drills and Tracking Equipment



VIDEO GUIDEBOOK

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INTRODUCTION

This guidebook has been developed to supplement the operation and safety video for tracking equipment and horizontal directional drills. The video and guidebook are one part of a complete set of materials intended to present basic information about safe and productive use of tracking equipment and the Vermeer Horizontal Directional Drill. The video and guidebook are not intended to be a comprehensive course on horizontal directional drilling operations and safety. Vermeer presents this material only as a reference and guide. Read and study the Operator's manuals for tracking equipment and the Horizontal Directional Drill model being used for more details on operations and safety practices.

It is important that everyone who uses the tracking equipment or works around the Horizontal Directional Drill see the Operation and Safety video and work through this guidebook. Vermeer Corporation gives you permission to reproduce this guidebook as necessary to inform other workers. Additional copies are also available from your Vermeer dealer.

Be aware that this material is not intended to license or certify any person, nor does registration of attendance or completion of these materials imply that a person is skilled or competent as a Horizontal Directional Drill operator.

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Instructions

At the end of each video section, the narrator will ask you to stop the video and do the corresponding section in the Guidebook. You will find those sections following this introduction. The questions will reinforce ideas and information presented in the video.

For some questions, more than one answer may be appropriate. Check as many answers as necessary to complete the question correctly.

The correct answers are found at the end of each section.

Section 1—Horizontal Directional Drilling Machine Safety

1. Which people need to fully understand the entire directional drilling process?
 - a. only the drill operator
 - b. only the bore tracking equipment operator
 - c. any people living or working within 150 ft (46 m) of the bore path
 - d. all directional drilling crew members

2. Before a crew member operates the directional drill, they are advised to:
 - a. Obtain a valid Commercial Driving License for the state, province or district where the drill will be operated.
 - b. Read the *Operator's Manual*.
 - c. Study the HDD Safety Video and complete this guidebook.
 - d. Initially, operate the drill under supervision of an experienced HDD operator.

3. What personal protective equipment is required for the drill operator while drilling, or while driving in the anchor stakes?
- a. hard hat
 - b. safety glasses
 - c. if working near road traffic, a high-visibility safety vest
 - d. electrically insulated boots
 - e. electrically insulated gloves, unless the machine has a sit-down operator station
 - f. leather gloves, if the machine has a sit-down operator station
4. True or False. Crew members working near the drill head or along the bore path must wear electrically insulated (lineman's) boots.
- a. True
 - b. False
5. True or False. On machines with rollover protection, seat belts must be used when transporting to provide protection in a rollover situation.
- a. True
 - b. False

6. When unloading a machine from a trailer, it is important to:
- a. Place the trailer on level ground.
 - b. Avoid unloading the machine if the trailer surface is slippery.
 - c. Wear your seat belt (if equipped).
7. When placing the orange warning cones around the machine, which of the following actions are **not** necessary?
- a. Place them 6 ft (2 m) from the corners of the fluid-mixing machine and drilling unit.
 - b. Place them with the safety signs facing outward.
 - c. Place barricade tape around the machine.
 - d. All are required.
8. (Select the best answer.) Who is allowed to work inside the warning cone area, while drilling is underway?
- a. personnel trained about the potential hazards
 - b. personnel wearing the safety equipment that is appropriate to their duties
 - c. personnel that are both trained and wearing the correct gear

- 9.** How much prior warning does the Strike Alert system give before the ground, drill stem or machine becomes electrified?
- a.** one minute
 - b.** fifteen seconds
 - c.** It does NOT give prior warning! When it sounds, electrical contact has already occurred.
- 10.** Which of the following are important safety items to check or test before boring?
- a.** Test the remote lockout system (if equipped).
 - b.** Test the Strike Alert system.
 - c.** Test the fluid pump operation.
 - d.** Check two-way radio communication.
 - e.** Check the engine temperature.

- 11.** Used in the context of directional drilling, the term “lockout” means to disable drill rotation, thrust, pullback, and drilling fluid flow. This makes it safe for crew members to approach the drill head or drill string at the exit pit.

On a machine without remote lockout, the machine is considered “locked out” when:

- a.** The drill operator has been told via radio or hand signals not to move the controls, and he has acknowledged the message.
- b.** The drill operator has shut off the directional drill’s engine.
- c.** The directional drill engine has been shut off and the key has been taken to the exit pit.

- 12.** On a machine equipped with a remote lockout system, the drilling machine is considered “locked out” when:

- a.** The red lockout button is pressed on the handheld transmitter.
- b.** The handheld transmitter has confirmed that the machine is locked out.
- c.** The drill operator has communicated he will not touch the controls.

- 13.** It is important to lock out the drilling machine when working on the drill string or tooling because:
- a.** Serious injury or death will result if you become entangled in the tooling or if you are struck by a wrench.
 - b.** The drill string can thrust out and potentially crush or impale you.
 - c.** It saves fuel.
 - d.** It prevents unplanned drill string operation or fluid flow.
- 14.** True or False. If your machine is not equipped with a remote lockout system, the only acceptable method for locking out the machine is to shut off the engine and deliver the key to the exit pit.
- a.** True
 - b.** False
- 15.** True or False. Using a power breakout device or pipe wrench on a drill string or drilling tool without locking out the machine could result in serious injury or death.
- a.** True
 - b.** False

16. True or False. The Vermeer Splinelok tool connection system provides an inherent safety benefit because pipe wrenches or a portable breakout device are not needed.

a. True

b. False

17. When attaching the drill head to the first drill stem at the machine, is it acceptable to hold the tool by hand and use drill stem rotation to spin on the head?

a. Yes

b. No

18. When changing tools or working on the drill string at the exit end of the bore, which of the following is acceptable **by itself** to prevent unplanned drill string operation:

a. Communicate by radio and instruct the operator to stop operation.

b. After communicating with the operator, send a “Lockout” command using the remote lockout system and wait for a confirmation signal that the lockout command was successful.

c. Instruct the operator to shut off the engine, have the operator remove the key and deliver it to the exit site.

19. True or False. When using the Vermeer Portable Breakout device it is essential to lock out the machine.

a. True

b. False

20. The Vermeer Portable Breakout Device provides an inherent safety benefit when removing a direct coupled tool (such as a mud motor) by:

a. reducing the torque on the connection.

b. eliminating the use of a backhoe to apply pressure to a pipe wrench.

c. reducing the length of the breakout device so it is less likely to injure you if the drill string unexpectedly starts.

21. When pulling back using a reamer, is the use of a properly functioning swivel between the reamer and a trailing object required for safety?

a. Always

b. Never

c. Sometimes

22. True or False. The Vermeer reamer carrier is intended to provide a convenient way to lift a reamer with an auxiliary lifting machine such as a backhoe and spin the tool on by hand.

a. True

b. False

23. Assume you are trailing in drill stem. You have added drill stem behind the reamer and swivel. You have begun to pull back. If it is necessary to stop and add additional drill stem, it is permissible to use a pipe wrench provided that:

a. The operator has said he will not start the drill string.

b. The machine is locked out, and a properly functioning swivel is installed between the reamer and the drill string.

24. When you have installed a reamer and are ready to begin pullback, which of the following must you do if using a remote lockout system?

- a.** Clear everyone from the area of exposed drill string and the final product.
- b.** Remove all wrenches or portable breakout device from the drill string.
- c.** Communicate your intentions to the operator.
- d.** Wait for operator to confirm your verbal radio communication.
- e.** Press the green “run” button for two seconds and listen for the remote transmitter to confirm that the run command was successful.

25. In order to resume operation after locking out the machine by delivering the key to the exit site, the key must be returned to the drill operator. What action must the operator take before safely starting drill string rotation?

- a.** Start the engine and begin operating.
- b.** Using radio communication, request permission from personnel at the exit end to resume operation.
- c.** Receive confirmation back that operation may resume.

Section 1—Answers and Explanations

Q1: Answer d

Q2: Answers b, c, and d

Q3: Answers a, b, c, d, and e; although leather gloves over the electrically insulated gloves are allowed, or leather gloves may be worn if electrically insulated gloves are not required

Q4: Answer a

Q5: Answer a

Q6: Answers a, b, and c

Q7: Answer c

Q8: Answer c

Q9: Answer c

Q10: Answers a, b, and d; the other two are not safety items

Q11: Answer c

Q12: Answer b; unless the system confirms the drill is locked out, it is not safe to approach the drill head or drill string.

Q13: Answers a, b, and d

Q14: Answer a

Q15: Answer a

Q16: Answer a

Q17: Answer b

Q18: Answers b and c

Q19: Answer b; False - the machine must be locked out so the drill string will not start unexpectedly. Using a compact Portable Breakout Device is never a substitute for locking out the machine.

Q20: Answers b and c

Q21: Answer a

Q22: Answer a

Q23: Answer b

Q24: Answers a, b, c, d and e

Q25: Answers b and c

A purpose of this test is to help you evaluate your personal knowledge and to reinforce what you learned from viewing the video. If you are not satisfied with your answers to one or more of the test questions, you should review the video tape to better understand why some answers are correct.

When you are ready, continue by viewing the second section of the video tape.

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Section 2—Safe Operation of Directional Boring Electronics and Tracking Equipment

1. Vermeer Corporation has provided a number of instructional items to help you operate your Vermeer horizontal directional drill safely and efficiently. Check all the items you are aware of.
 - a. video
 - b. this guidebook
 - c. operator's manual
 - d. maintenance manual
 - e. decals or safety signs to advise and warn
 - f. training by Vermeer dealer personnel

2. Identify the key factors in safely completing the job.
 - a. crew training
 - b. proper planning of the bore
 - c. site preparation
 - d. personal preparation

3. True or False. When making the bore, the tracking operator guides the bore.

a. True

b. False

4. A high-visibility vest is recommended when working near traffic.

a. True

b. False

5. Rubber-soled footwear must be worn during the bore.

a. True

b. False

6. Proper eye protection must be worn whenever the drill head is exposed during the bore.

a. True

b. False

7. Upon arrival at the jobsite, confirm that:

- a.** The contractor has contacted “One-Call”.
- b.** Homes and buildings within 100 ft (30 m) of the bore path have been evacuated.
- c.** The locations of utilities have been accurately marked.
- d.** Other utilities that do not subscribe to “One-Call” have been contacted.

8. Underground utilities in the potential bore path must be exposed because:

- a.** OSHA requires it.
- b.** Utilities installations can harm you.
- c.** Damage can cause interruption of important services.

9. Where existing utilities intersect the bore path:

- a.** The utilities must be fully exposed as least as deep as the proposed bore.
- b.** Utilities must be exposed by a means that will not damage them, such as hand tools or vacuum excavation.
- c.** If boring parallel to the utility, expose it in two places, so you can predict the utility’s depth and direction.

10. The depth of the bore at the location of an existing utility must accommodate:

- a.** the level of the local water table.
- b.** the bend radius of the drilling equipment and/or installed product.
- c.** the size of the largest backreamer to be used.
- d.** the size of the product to be installed.

11. Look for and investigate which of the following to determine if unmarked utilities are present:

- a.** manholes
- b.** sewer inlets or outlets
- c.** wiring pedestals
- d.** overhead power lines
- e.** trench lines
- f.** hydrants
- g.** pole risers

12. New exposures are required if:

- a.** Investigation reveals unmarked utilities.
- b.** The actual bore deviates from the originally intended bore path.
- c.** Rain water or snow fills the original exposure holes.

13. If gas lines pass through the exposure:

- a.** They will be wrapped with yellow tape.
- b.** Do not allow smoking near the exposure.
- c.** The planned bore must not cross the gas line.

14. The two types of interference that can affect the bore tracking device are:

- a.** resistive
- b.** passive
- c.** active
- d.** governmental

15. To check the site and bore path for active sources of interference:

- a.** Carry the tracking device along the bore path with the receiver off and the transmitter on.
- b.** Carry the tracking device along the bore path with the receiver on and the transmitter off.
- c.** Contact “One-Call” to mark the active interference sources at the site.
- d.** Watch the bore tracking device for signal strength changes or other unusual readings as you walk the bore path.

On questions 41 through 48, classify the following interference sources:

16. Electronic dog fences:

- a.** active
- b.** passive

17. Transmitters with frequencies at or near the frequency used by the tracking device:

- a.** active
- b.** passive

18. Steel-reinforced concrete:

a. active

b. passive

19. Saltwater:

a. active

b. passive

20. Electrical storms:

a. active

b. passive

21. Traffic sensing loops and traffic signal pads:

a. active

b. passive

22. Trace cables or trace lines on buried utilities that transmit high frequency signals:

- a.** active
- b.** passive

23. Steel or cast iron pipes:

- a.** active
- b.** passive

24. When testing whether an interference source will affect the tracking equipment, place the receiver on the bore path and the transmitter to the side at:

- a.** 1.5 meters.
- b.** the maximum range of the transmitter.
- c.** 1.5 times the distance of the planned depth at that point of the bore.

25. If inaccurate or inconsistent readings are caused by interference:

- a.** Contact the equipment manufacturer or supplier for advice.
- b.** Replace batteries in the transmitter.
- c.** Replace batteries in the receiver.
- d.** Re-plan the bore to avoid the area of interference.

26. While walking the bore, also verify that:

- a.** You have constant communication with the drill operator.
- b.** Electricity and gas service has been shut off to the surrounding area.
- c.** All required exposure holes are present and to the correct depth.

27. When working out radio protocol or hand signals with the drill operator, be sure to include a signal that:

- a.** tells the drill operator to break for lunch.
- b.** confirms to the sender that the recipient received and understood his message.
- c.** tells the tracking operator that the drill rod box is empty and must be refilled.

28. While guiding the bore:

- a.** Anticipate upcoming obstacles.
- b.** Steer the bore to allow adequate clearance for the backreamer past obstacles.
- c.** Keep the drill head higher than the local water table.
- d.** Frequently cross-check depth and pitch readings with previous readings, so you will notice inconsistencies.

29. If inconsistent readings are given by the tracking equipment:

- a.** Pull back the drill head to the last place the reading was consistent and verify the tracking equipment is working.
- b.** The drill head has submerged beneath the local water table.
- c.** Stop the bore and cross-check all the information sources.
- d.** Do not proceed until problems are corrected and tracking equipment is functioning correctly.

30. As the drill head nears an exposure hole:

- a.** Fill the exposure hole before crossing it to avoid exposing the drill head.
- b.** Fill the exposure hole after crossing it with the drill head, but before backreaming through it.
- c.** Ensure your eye protection is in place.
- d.** Avoid being sprayed by high-pressure drilling fluid.

31. Measure the location of the exposed drill head or drill stem in the exposure to ensure that:

- a.** Depth readings given by the tracking equipment are accurate.
- b.** There is enough drill stem on site to complete the bore.
- c.** The largest reamer and installed product will clear the exposed utility during pullback.

32. When the drill head nears the exit pit:

- a.** Ensure all personnel have eye protection in place.
- b.** Keep personnel clear of the rotating drill head to avoid entanglement or high-pressure drilling fluid.
- c.** Check the depth reading to ensure the drill head is above the local water table.

33. If the drill head or backreamer strikes an electrical utility:

- a.** Stand still, since the ground may be charged with varying amounts of voltage and stepping from an area of high voltage to low voltage can induce current to pass through your body.
- b.** Do not touch the machine, the drill stem, the water system or mud mixing system, as they may be charged with high voltages.
- c.** Warn bystanders not to approach, because the ground may be electrified.
- d.** Have someone call the electric utility company to turn off the power.
- e.** Have the drill operator move the drill head or reamer away from the electric line to attempt to break contact.
- f.** Remind all members of the crew that the danger exists until the electric company has confirmed that power has been shut off.

34. If the drill head or backreamer strikes a gas line or any pipeline that may contain flammable materials:

- a.** Shut down the drilling machine and any other engines. DO NOT move the drill head or reamer as it may cause sparks.
- b.** Extinguish any source of ignition, such as smoking materials or running engines.
- c.** Evacuate the crew and public from the area and secure the area.
- d.** Contact the local emergency services (911) and the gas company. DO NOT re-enter the area until cleared to do so by the gas company.

Section 2—Answers and Explanations

Q1: Answers a, b, c, d, e, and f

Q2: Answers a, b, c, and d

Q3: Answer a

Q4: Answer a

Q5: Answer b. Rubber soles alone are not sufficient, properly rated electrically insulated footwear is required.

Q6: Answer a

Q7: Answers a, c, and d

Q8: Answers a, b, and c

Q9: Answers a and b. Never “predict” a utility’s path. Expose it as many places as needed to ensure you will avoid it.

Q10: Answers b, c, and d

Q11: Answers a, b, c, e, f and g

Q12: Answers a and b. Although snow or water may need to be removed to allow the drill head to be seen when crossing the exposure.

Q13: Answer b

Q14: Answer b and c

Q15: Answers b and d

Q16: Answer a

Q17: Answer a

Q18: Answer b

Q19: Answer b

Q20: Answer a

Q21: Answer a

Q22: Answer a

Q23: Answer b

Q24: Answer c

Q25: Answer a

Q26: Answers a and c

Q27: Answer b

Q28: Answers a, b, and d

Q29: Answers a, c, and d

Q30: Answers c and d

Q31: Answers a and c

Q32: Answers a and b

Q33: All answers are correct

Q34: All answers are correct

As with the first section, review the video tape if any of the answers seem unclear.

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