

## Classification, Nomenclature, and Specification Definitions for Horizontal Earthboring Machines

## RATIONALE

J2022 has been reaffirmed to comply with the SAE five-year review policy.

1. **Scope**—This SAE Standard applies to horizontal earthboring machines of the following types:
- Auger Boring Machines
  - Rod Pushers
  - Rotary Rod Machines
  - Impact Machines
  - Directional Boring/Drilling Machines

The illustrations used are for classification and are not intended to resemble a particular machine. Only basic working dimensions are given. They may be supplemented by the machine manufacturer. This document is based on existing commercial horizontal earthboring machines.

This document does not apply to specialized mining machinery in SAE J1116, conveyors, tunnel boring machines, pipe jacking systems, and microtunnelers.

- 1.1 **Purpose**—The purpose of this document is to encourage common terminology of machine types, component names, and definitions of working specifications for horizontal earthboring machines.

- 1.2 **Rationale**—This document has been reaffirmed to comply with the SAE 5-Year Review policy.

## 2. References

- 2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

- 2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

SAE TSB 003—Rules for SAE Use of SI (Metric) Units  
 SAE J1116—Categories of Off-Road Self-Propelled Work Machines  
 SAE J1233—Commercial Literature Specifications—Off-Road Work Machines  
 SAE J1234—Specification Definitions—Off-Road Work Machines  
 SAE J1349—Engine Power Test Code—Spark Ignition and Compression Ignition—Net Power Rating

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### 3. Definitions

- 3.1 Horizontal Earthboring Machines**—A machine used to bore horizontally through the earth by means of a rotating tool, or nonrotating pushing or piercing tool.
- 3.2 Bore**—A generally horizontal hole produced underground primarily for the purpose of installing services.
- 3.3 Auger Boring Machine**—A machine used to drill earth horizontally by means of a cutting head and auger or other functionally similar device. The machine may be either cradle or track type.
- 3.4 Rod Pusher**—A machine that pushes or pulls a rod or pipe to produce a bore by means of compaction without rotation or impact.
- 3.5 Rotary Rod Machines**—A machine used to drill earth horizontally by means of a compaction bit or a cutting head attached to a rotating rod (not an auger). Such drilling may include fluid injection to the cutting head through a hollow rod.
- 3.6 Impact Machines**—A type of machine that pierces the earth (piercing tool) or rams an object to produce a bore (ramming machine).
- 3.7 Directional Boring/Drilling Machines**—A machine which can launch a steerable cutting head attached to the end of a rotating drill pipe string used for boring through the earth in a horizontal direction. Boring most generally includes fluid injection to the cutting head through the drill pipe and also generally includes enlarging the bore with a back reamer.

### 4. Machine Classifications

#### 4.1 Auger Boring Machine (Track and Cradle Types)

##### 4.1.1 TRACK TYPE

##### 4.1.1.1 Nomenclature—(Refer to Figure 1.)

NOTE—Some items shown may not be standard equipment.

##### 4.1.1.2 Dimensional Terms—Refer to SAE J1234 for general measurement conditions and description of basic dimensions. Units of measure are to be stated as prescribed in SAE J1233 and TSB 003; e.g., millimeters (inches).

4.1.1.2.1 Overall Machine Length (L)—Distance between the back of the master track vertical plane and the front of the extension track vertical plane.

4.1.1.2.2 Overall Machine Height (H)—Distance between horizontal ground plane of track, to the highest horizontal line on the machine.

4.1.1.2.3 Overall Machine Width (W)—Distance between vertical planes parallel to the machine's longitudinal axis and passing through the farthest point on the sides of the machine.

4.1.1.2.4 Centerline (C)—Distance between the center of drive chuck and the bottom of the track.

4.1.1.2.5 Maximum Diameter (D)—Largest outside casing diameter that can be thrust by the machine.

4.1.1.2.6 Pit Size—Minimum pit width and length for the machine.

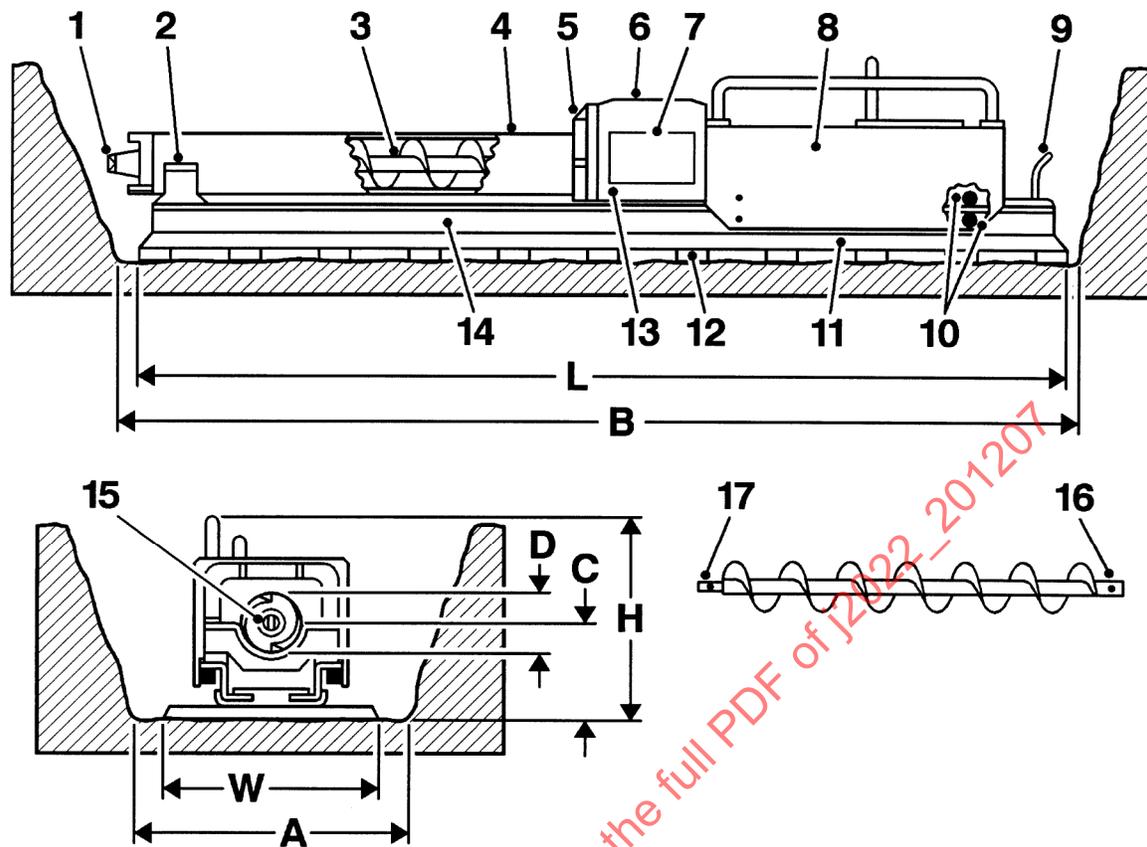


Figure 1—Track-Type Auger Boring Machine

- |                       |                            |
|-----------------------|----------------------------|
| 1. Cutting Head       | 14. Extension Track        |
| 2. Saddle             | 15. Drive Chuck            |
| 3. Auger              | 16. Female Hex Connector   |
| 4. Casing             | 17. Shank                  |
| 5. Casing Adapter     |                            |
| 6. Master Pusher      |                            |
| 7. Spoil Ejector Door |                            |
| 8. Carriage           | (A) Pit Width              |
| 9. Pushbar            | (B) Pit Length             |
| 10. Machine Roller    | (C) Centerline             |
| 11. Master Track      | (D) Maximum Diameter       |
| 12. Cross Member      | (H) Overall Machine Height |
| 13. Spoil Ejector     | (L) Overall Machine Length |
|                       | (W) Overall Machine Width  |

FIGURE 1—TRACK-TYPE AUGER BORING MACHINE

- 4.1.1.2.6.1 Pit Width (A)—Minimum measured width at bottom of pit to theoretical vertical ground planes for a given machine.
- 4.1.1.2.6.2 Pit Length (B)—Measured length of pit from rearmost section of master track to vertical plane of cutting head prior to starting the bore for a given machine, plus specified assembly clearance.

### 4.1.1.3 Performance Terms

4.1.1.3.1 Torque—Measure of the maximum forward rotary force available at drive chuck.

4.1.1.3.2 Thrust—Measure of maximum force available to push the casing into the ground.

4.1.1.3.3 Auger Speed—Maximum revolutions per minute available at the drive chuck based on recommended power source, i.e., governed engine rpm, hydraulic pressure/flow, or electric motor rpm.

### 4.1.2 CRADLE TYPE

4.1.2.1 Nomenclature—(Refer to Figure 2.)

NOTE—Some items shown may not be standard equipment.

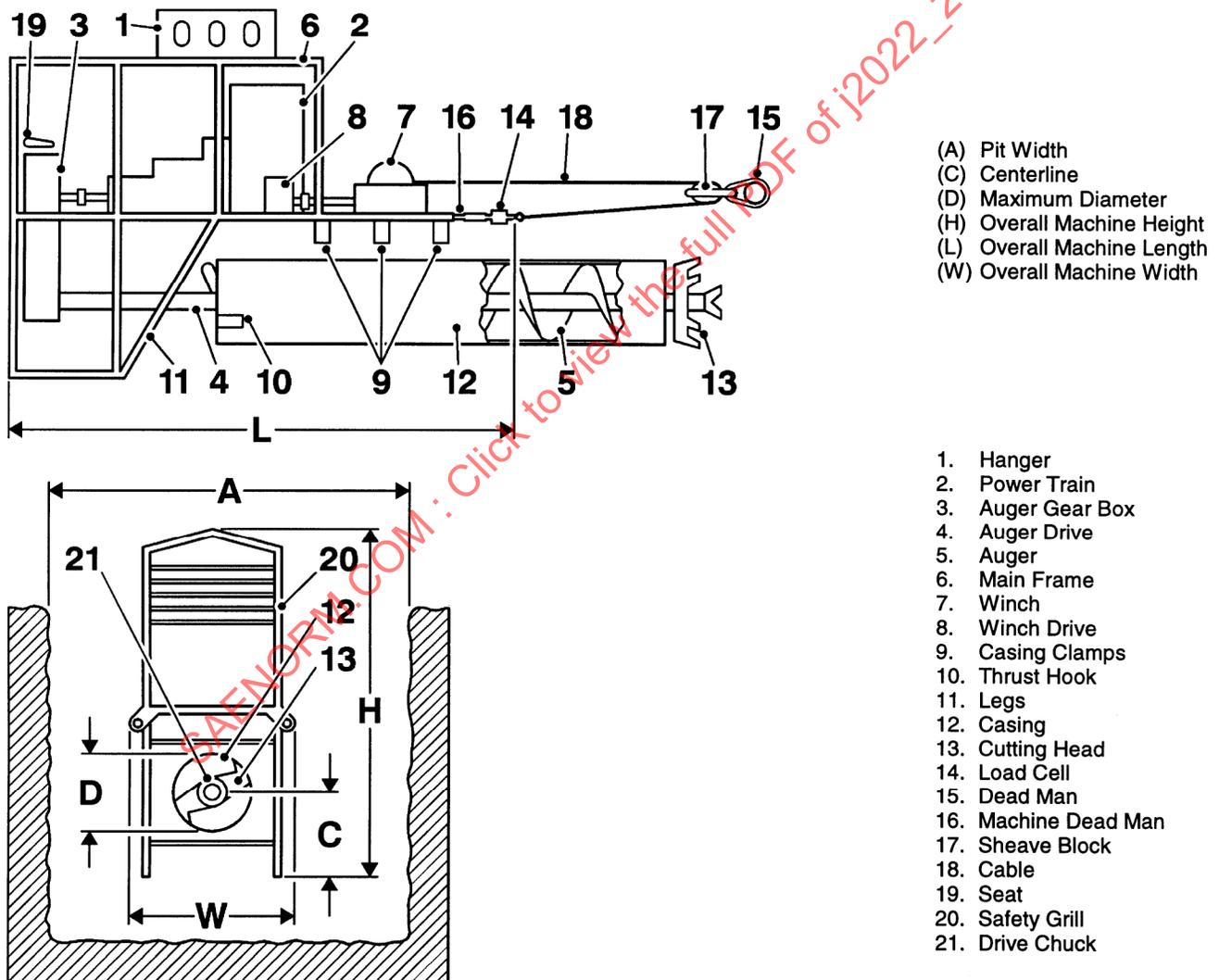


FIGURE 2—CRADLE-TYPE AUGER BORING MACHINE

- 4.1.2.2 *Dimensional Terms*—Refer to SAE J1234 for general measurement conditions and description of basic dimensions. Preferred units of measure are in SAE J1233 and TSB 003.
- 4.1.2.2.1 Overall Machine Length (L)—Distance between the back of the main frame vertical plane and the load cell vertical plane.
- 4.1.2.2.2 Overall Machine Height (H)—Distance between the horizontal plane of the leg and the highest horizontal line on the machine.
- 4.1.2.2.3 Overall Machine Width (W)—Distance between vertical planes parallel to the machine's longitudinal axis and passing through the farthest point on the sides of the machine.
- 4.1.2.2.4 Maximum Diameter (D)—Largest outside casing diameter that can be thrust by the machine.
- 4.1.2.2.5 Centerline (C)—Distance between the center of drive chuck and the horizontal plane passing through the bottom leg of the machine.
- 4.1.2.2.6 Pit Width (A)—Minimum measured width of pit to theoretical vertical ground planes for a given machine.
- 4.1.2.3 *Performance Terms*
- 4.1.2.3.1 Torque—Measure of the maximum forward rotary force available at the drive chuck.
- 4.1.2.3.2 Thrust—Measure of maximum force available to push the casing into the ground.
- 4.1.2.3.3 Auger Speed—Maximum revolutions per minute available at the drive chuck based on power source, i.e., governed engine rpm, hydraulic pressure/flow, or electric motor rpm.
- 4.2 Rod Pushers**
- 4.2.1 NOMENCLATURE—(Refer to Figure 3.)
- NOTE—Some items shown may not be standard equipment.
- 4.2.2 DIMENSIONAL TERMS—Refer to SAE J1234 for general measurement conditions and description of basic dimensions. Preferred units of measure are given in SAE J1233 and TSB 003.
- 4.2.2.1 *Overall Machine Length (L)*—Distance between the back and the front of the pusher frame. For telescoping or adjustable frame units, maximum and minimum overall lengths should be given.
- 4.2.2.2 *Overall Machine Height (H)*—Distance between horizontal ground plane of the pusher frame and the horizontal plane passing through the highest point on the machine.
- 4.2.2.3 *Overall Machine Width (W)*—Distance between the vertical planes parallel to the machine's longitudinal axis and passing through the farthest point on the sides of the machine.
- 4.2.2.4 *Centerline (C)*—Distance from bottom of frame to center of push rod.
- 4.2.2.5 *Diameter of Push Rod (D)*—Largest diameter of push rod.
- 4.2.2.6 *Length of Push Rod (L1)*—Nominal (made up) length of push rod.
- 4.2.2.7 *Length of Push Rod (L2)*—Overall length of push rod.

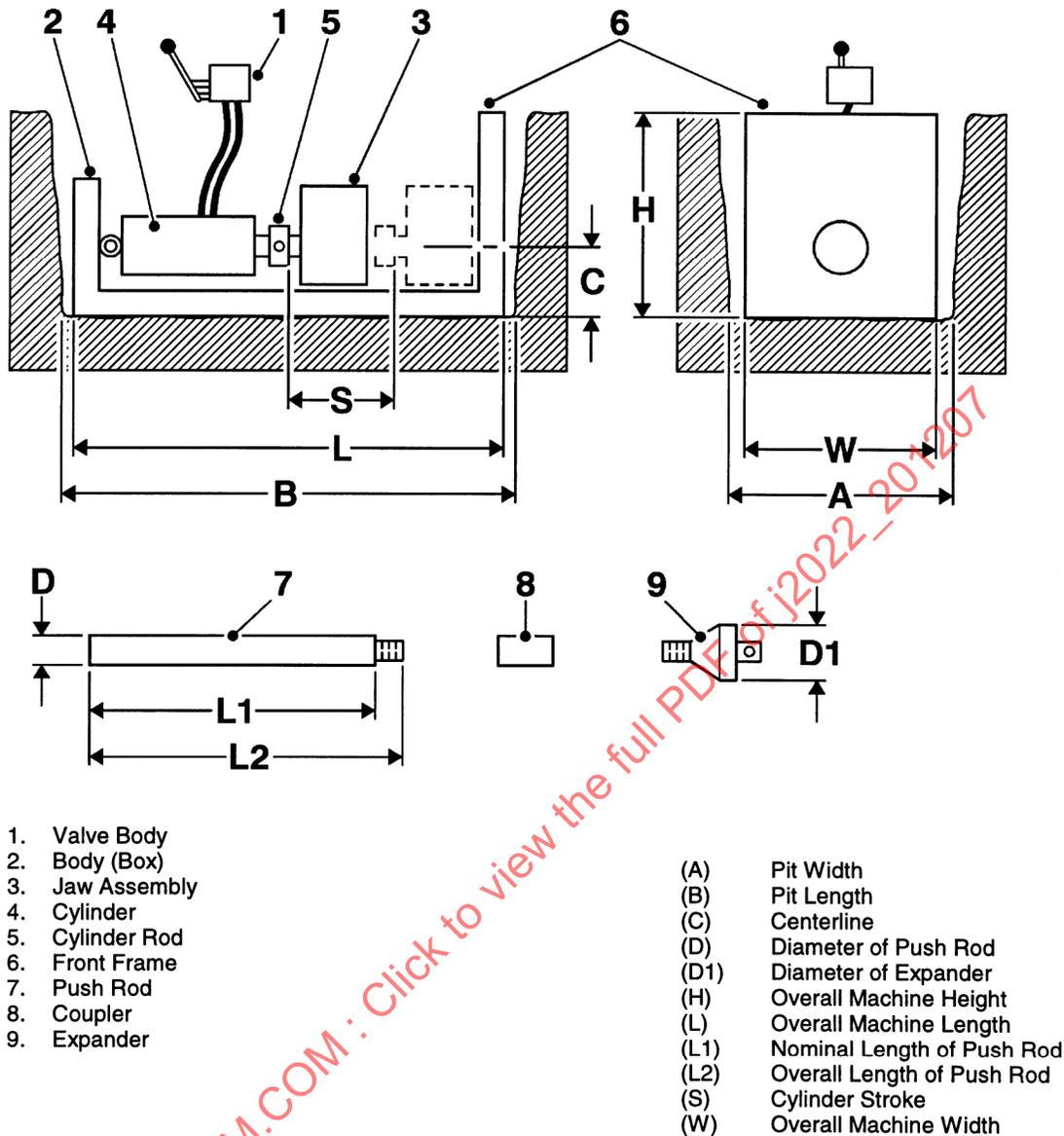


FIGURE 3—ROD PUSHER—SIDE VIEW, END VIEW

4.2.2.8 Diameter of Expander ( $D1$ )—Largest diameter of expander.

4.2.2.9 Cylinder Stroke ( $S$ )—Distance the cylinder rod moves from fully retracted to fully extended.

4.2.2.10 Pit Size—Minimum pit width and length.

4.2.2.10.1 Pit Width ( $A$ )—Minimum measured width at bottom of pit to theoretical vertical ground planes for a given machine.

4.2.2.10.2 Pit Length ( $B$ )—Minimum measured length at the bottom of the pit to the theoretical ground planes for a given machine.

### 4.2.3 PERFORMANCE TERMS

4.2.3.1 *Thrust Pushing*—Maximum force at manufacturer's recommended pressure.

4.2.3.2 *Thrust Pulling*—Maximum force at manufacturer's recommended pressure.

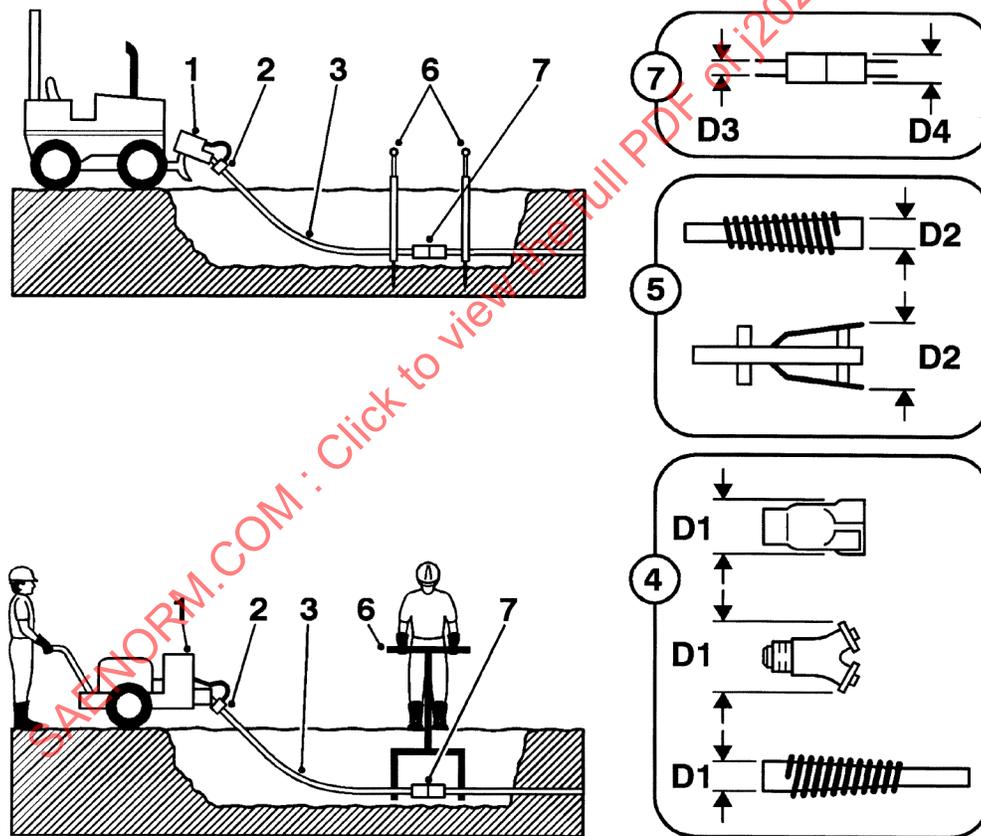
4.2.3.3 *Cycle Time*—Time in seconds to fully extend and retract cylinder rod at manufacturer's recommended pressure/flow.

4.2.3.4 *Maximum Pressure*—Relief valve pressure recommended by the manufacturer.

### 4.3 Rotary Rod Machines

4.3.1 NOMENCLATURE—(Refer to Figure 4.)

NOTE—Some items shown may not be standard equipment.



1. Drill Rod Drive
2. Water Swivel
3. Drill Rod
4. Boring Bits
5. Reamers
6. Rod Guide
7. Drill Rod Coupler

- (D1) Diameter of Standard Bit  
 (D2) Diameter of Reamer  
 (D3) Diameter of Drill Rod  
 (D4) Diameter of Drill Rod Coupler

FIGURE 4—ROTARY ROD MACHINE

4.3.2 DIMENSIONAL TERMS—Refer to SAE J1234 for general measurement conditions and description of basic dimensions. Preferred units of measure are given in SAE J1233 and TSB 003.

4.3.2.1 *Diameter of Drill Rod (D3)*—Minimum diameter of drill rod.

4.3.2.2 *Diameter of Drill Rod Coupler (D4)*—Maximum outside diameter of drill rod coupler.

4.3.2.3 *Diameter of Standard Bit (D1)*—Maximum outside diameter of standard bit.

4.3.2.4 *Length of Drill Rod*—Nominal length of drill rod.

4.3.2.5 *Diameter of Reamer (D2)*—Largest diameter of reamer.

4.3.3 PERFORMANCE TERMS

4.3.3.1 *Torque*—Output torque from the drive unit at rated input parameters.

4.3.3.1.1 Input Parameter for Hydraulic or Pneumatic Drive—Maximum continuous rated flow and pressure.

4.3.3.1.2 Input Parameter for Electrical Drive—Maximum continuous rated voltage and amperage.

4.3.3.1.3 Input Parameter for Mechanical Drive—Maximum continuous rated torque and shaft speed.

4.3.3.2 *Shaft Speed*—Output speed at the input parameters defined in 4.3.3.1.

#### 4.4 Impact Machines

4.4.1 NOMENCLATURE—(Refer to Figure 5 for Piercing Tool and refer to Figure 6 for Ramming Machine)

NOTE—Some items shown may not be standard equipment.

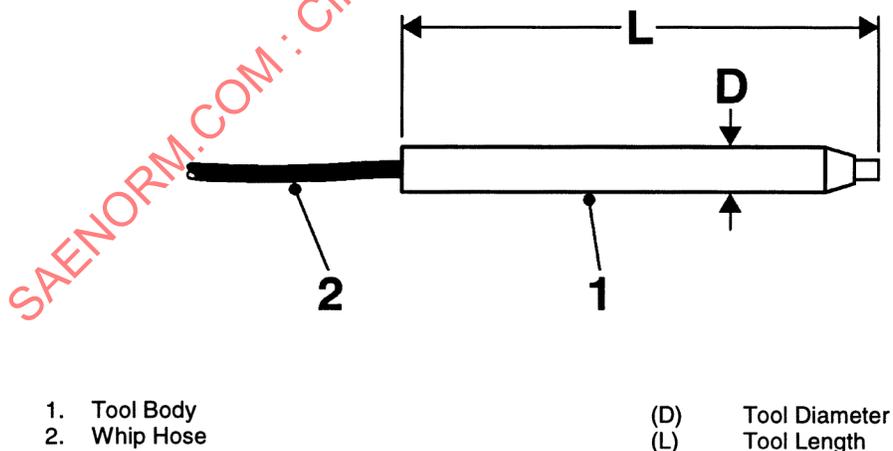


FIGURE 5—PIERCING TOOL

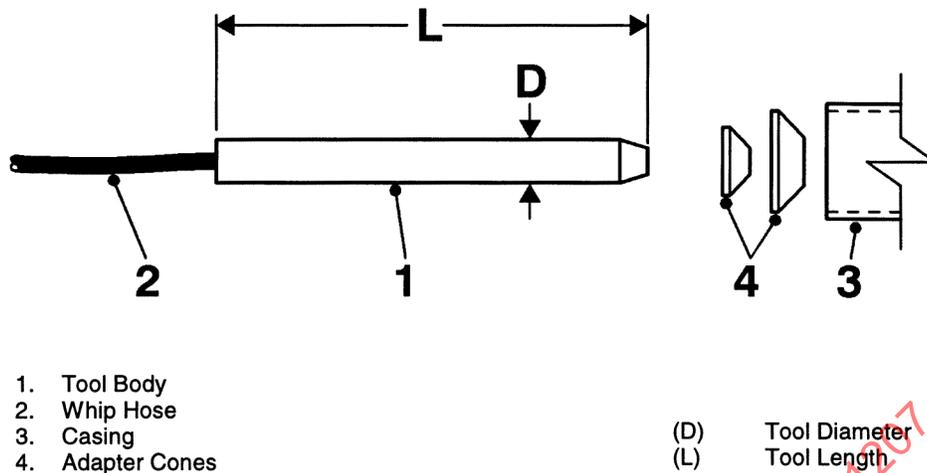


FIGURE 6—RAMMING MACHINE

4.4.2 DIMENSIONAL TERMS—Refer to SAE J1234 for general measurement conditions and description of basic dimensions. Preferred units of measure are given in SAE J1233 and TSB 003.

4.4.2.1 *Tool Diameter (D)*—Maximum diameter of tool body.

4.4.2.2 *Tool Length (L)*—Distance between tip and end of tool, not including whip hose.

4.4.3 PERFORMANCE TERMS

4.4.3.1 *Power Requirements*—Manufacturer's recommended maximum flow and pressure engaged.

4.4.3.2 *Cycles Per Minute*—Measured at maximum flow and pressure recommended by manufacturer with tool fully engaged.

4.4.3.3 *Reversing Procedure*—Procedure for reversing, if applicable.

## 4.5 Directional Boring/Drilling Machines

4.5.1 NOMENCLATURE

NOTE—Some items shown may not be standard equipment.

4.5.1.1 *Walk-along Units*—Refer to Figure 7.

4.5.1.2 *Ride-On Units*—Refer to Figure 8.

4.5.1.3 *Pit-Launched Units*—Refer to Figure 9.

4.5.1.4 *Attachment-Mounted Units*—Refer to Figure 10.

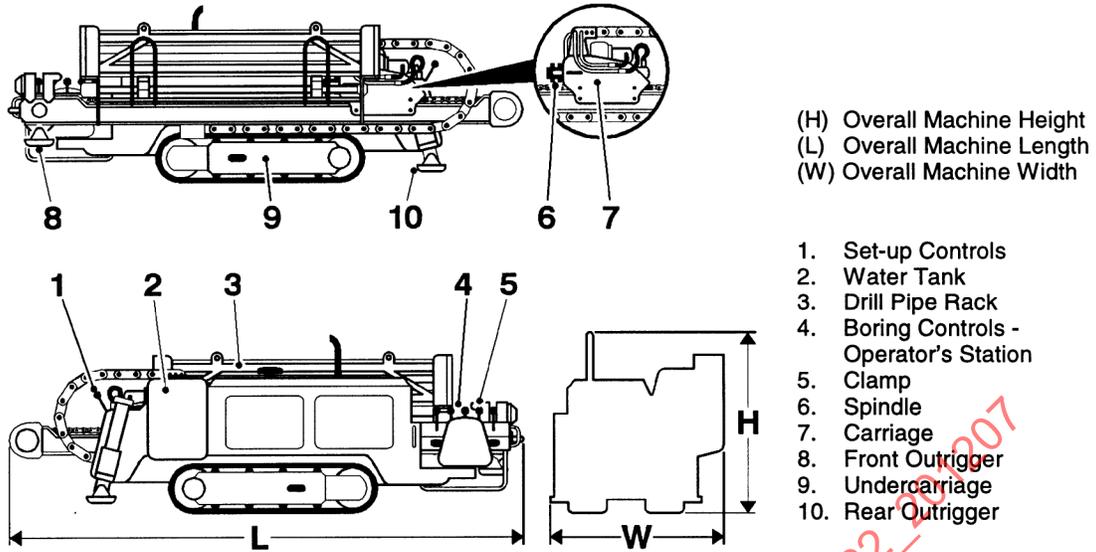


FIGURE 7—DIRECTIONAL BORING/DRILLING MACHINES—WALK-ALONG UNITS

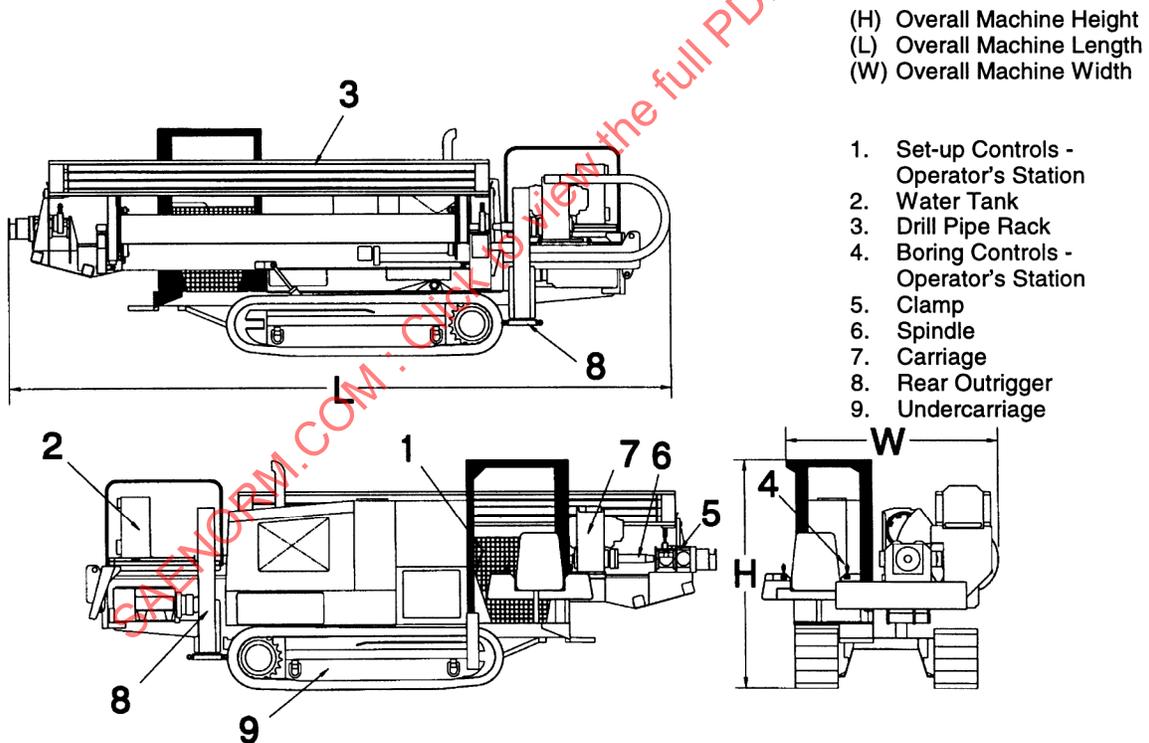
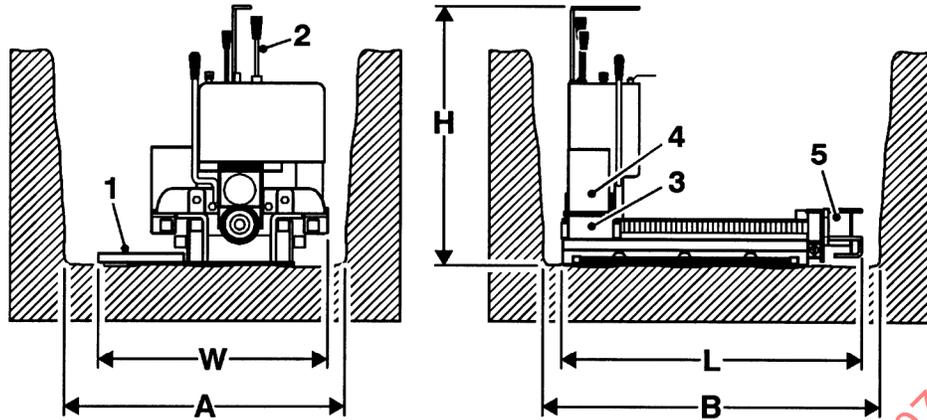


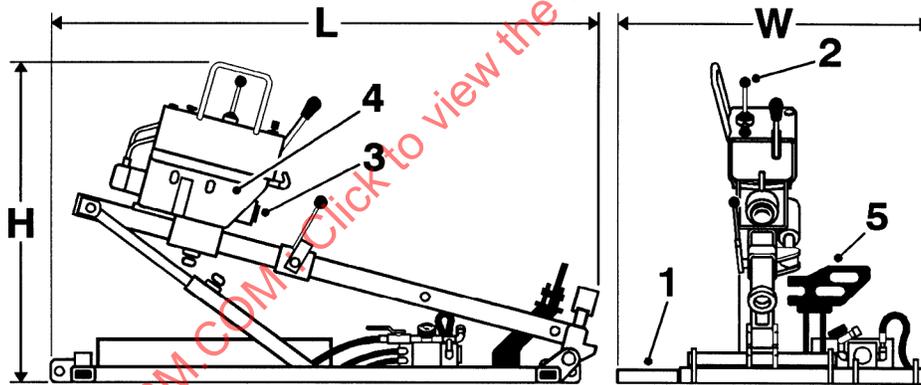
FIGURE 8—DIRECTIONAL BORING/DRILLING MACHINES—RIDE-ON UNITS



1. Operator's Station
2. Boring Controls
3. Spindle
4. Carriage
5. Clamp

- (A) Pit Width
- (B) Pit Length
- (H) Overall Machine Height
- (L) Overall Machine Length
- (W) Overall Machine Width

FIGURE 9—PIT LAUNCHED MACHINE



1. Operator's Station
2. Boring Controls
3. Spindle
4. Carriage
5. Clamp

- (H) Machine Working Height
- (L) Overall Machine Length
- (W) Overall Machine Width

FIGURE 10—ATTACHMENT-MOUNTED MACHINE—(SHOWN IN WORKING POSITION)

- 4.5.2 DIMENSIONAL TERMS—Refer to SAE J1234 for general measurement conditions and description of basic dimensions. Preferred units of measure are given in SAE J1233 and TSB 003.

Refer to Figures 7 to 11.

- 4.5.2.1 *Overall Machine Length (L)*—The longitudinal distance between the planes of the outer extremities in the transport position.
- 4.5.2.2 *Overall Machine Height (H)*—Distance from the ground to the highest extremity in transport position.
- 4.5.2.3 *Overall Machine Width (W)*—The transverse distance between the planes of the outer extremities in transport position.
- 4.5.2.4 *Boring Unit Operating Mass*—Measured with hydraulic tank full, fuel tank full, drilling fluid system full (if so equipped), pipe storage rack on the machine full (if so equipped).
- 4.5.2.5 *Ground Bearing Pressure*—Boring unit operating mass divided by ground contact area.
- 4.5.2.6 *Entry Angle*—Angle in degrees between the drill pipe and the ground plane with the machine in operating (work) position.
- 4.5.2.7 *Diameter of Drill Pipe (D1)*—Minimum outside diameter of drill pipe excluding tool joint end.
- 4.5.2.8 *Diameter of Drill Pipe Tool Joint End (D2)*—Maximum outside diameter of drill pipe tool joint end.
- 4.5.2.9 *Length of Drill Pipe (L1)*—Nominal (made-up) length of drill pipe.
- 4.5.2.10 *Length of Drill Pipe (L2)*—Overall length of drill pipe.
- 4.5.2.11 *Wall Thickness of Drill Pipe (T)*—Nominal wall thickness of pipe section excluding tool joint end.

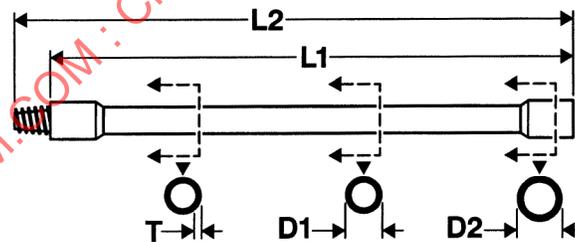


FIGURE 11—DRILL PIPE

- 4.5.2.12 *Weight of Drill Pipe*—Measured weight of an empty drill pipe.
- 4.5.2.13 *Fluid Capacity of Drill Pipe*—Maximum measured volume of water the drill pipe can store internally per meter of length.