



SURFACE VEHICLE STANDARD

J2022™

DEC2024

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Superseding J2022 JUL2012

(R) Classification, Nomenclature, and Specification Definitions
for Horizontal Earthboring Machines

RATIONALE

SAE J2022 had not been reviewed since it was last reaffirmed in 2012. It was felt that a thorough review was needed as well as some updates to the terms used and figures. Also, HDD machines needed to be removed as they are now covered by ISO 21467.

1. SCOPE

This SAE Standard applies to horizontal earthboring machines of the following types:

- a. Auger boring machines
- b. Rod pushers
- c. Rotary rod machines
- d. Impact machines
- e. Horizontal directional drilling (HDD) machines (tools only)

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 HDD machines as defined in ISO 21467. It only covers tools used with HDD machines. It also does not apply to specialized mining machinery covered in SAE J1116, Table 1, nor does it apply to conveyors, tunnel boring machines, pipe jacking systems, microtunnelers, or well-drilling machines.

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.

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For more information on this standard, visit
https://www.sae.org/standards/content/J2022_202412/

2. REFERENCES

2.1 Applicable Documents

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 International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1116 Categories of Off-Road Self-Propelled Work Machines

SAE J1233 Commercial Literature Specifications - Off-Road Work Machines

SAE TSB 003 Rules for SAE Use of SI (Metric) Units

2.1.2 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org>.

ISO 6746-1 Earth-Moving Machinery – Definitions of Dimensions and Codes – Part 1: Base Machine

ISO 21467 Drilling and Foundation Machines – Horizontal Directional Drilling (HDD) Machines – Commercial Specifications

3. DEFINITIONS

3.1 HORIZONTAL EARTHBORING MACHINES

Machines that create a bore in a horizontal direction through the earth by means of a rotating tool, or non-rotating pushing or piercing tool.

3.2 BORE

A hole produced underground by a horizontal earthboring machine used primarily for the installation of services.

3.3 AUGER BORING MACHINES

Machines that drill earth in a horizontal direction by means of a cutting head and auger or other functionally similar device. The machine can be either cradle or track type.

3.4 ROD PUSHERS

Machines that push or pull a rod or pipe to produce a bore by means of compaction without rotation or impact.

3.5 ROTARY ROD MACHINES

Machines that drill earth in a horizontal direction by means of a compaction bit or a cutting head attached to a rotating rod (not an auger). Such drilling can include fluid injection to the cutting head through a hollow rod.

3.6 IMPACT MACHINES

Machines that pierce the earth (piercing tool) or rams an object to produce a bore (ramming machine).

3.7 DIRECTIONAL BORING/DRILLING MACHINES

Refer to ISO 21467.

4. MACHINE CLASSIFICATIONS

4.1 Auger Boring Machines

4.1.1 Track Type

For an example, see Figure 1.

4.1.1.1 Nomenclature

NOTE: Not all items shown are standard equipment.

4.1.1.2 Dimensional Terms

Refer to ISO 6746-1 for general measurement conditions and description of basic dimensions. Units of measure are to be stated as prescribed in SAE J1233 and SAE TSB 003, e.g., millimeters (inches).

4.1.1.2.1 Overall Machine Length (L)

Longitudinal distance between the planes of the outer extremities of the machine in transport position.

4.1.1.2.2 Overall Machine Height (H)

Distance measured from the ground reference plane and a horizontal plane passing through the highest point on the machine in transport position.

4.1.1.2.3 Overall Machine Width (W)

Transverse distance between the planes of the outer extremities of the machine in transport position.

4.1.1.2.4 Centerline (C)

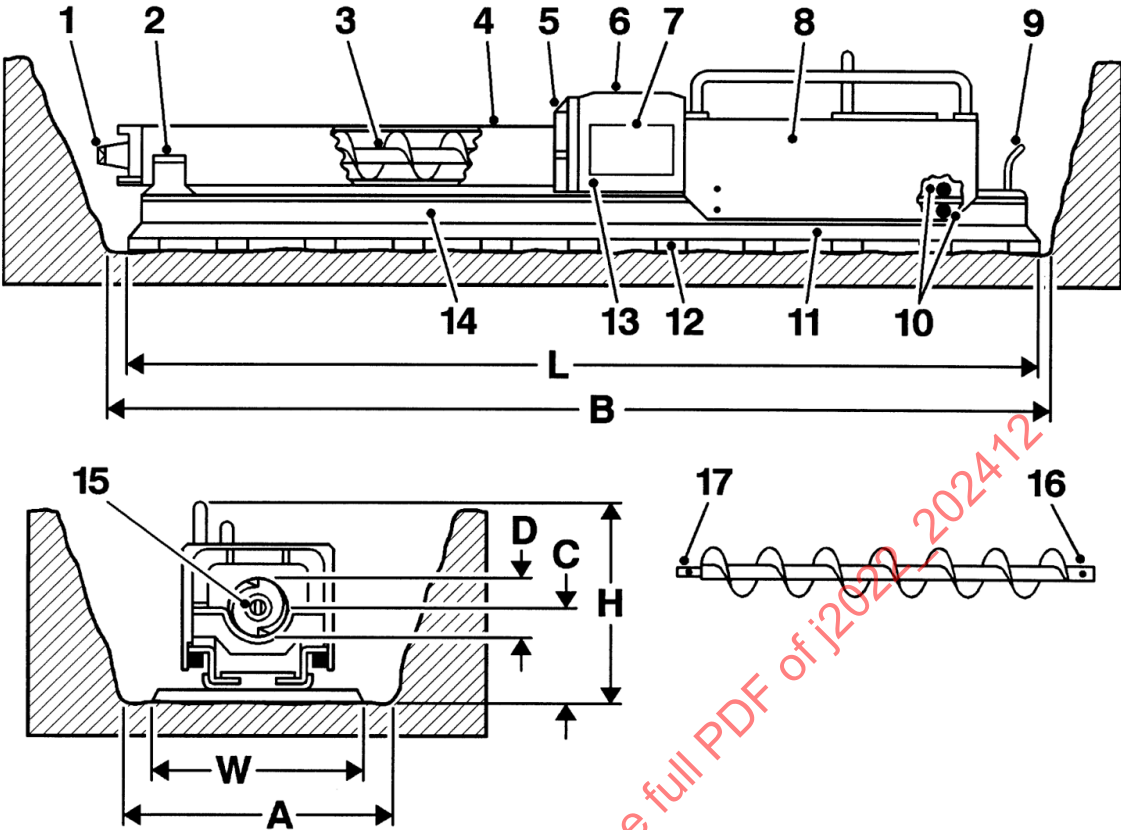
Distance between the center of drive chuck and the bottom of the track.

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.



Nomenclature

- | | | |
|-------------------|-----------------------|--------------------------|
| 1. Cutting Head | 7. Spoil Ejector Door | 13. Spoil Ejector |
| 2. Saddle | 8. Carriage | 14. Extension Track |
| 3. Auger | 9. Pushbar | 15. Drive Chuck |
| 4. Casing | 10. Machine Roller | 16. Female Hex Connector |
| 5. Casing Adapter | 11. Master Track | 17. Shank |
| 6. Master Pusher | 12. Cross Member | |

Dimensional Terms

- | | | |
|----------------|----------------------------|---------------------------|
| (A) Pit Width | (D) Maximum Diameter | (W) Overall Machine Width |
| (B) Pit Length | (H) Overall Machine Height | |
| (C) Centerline | (L) Overall Machine Length | |

Figure 1 - Example of 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.

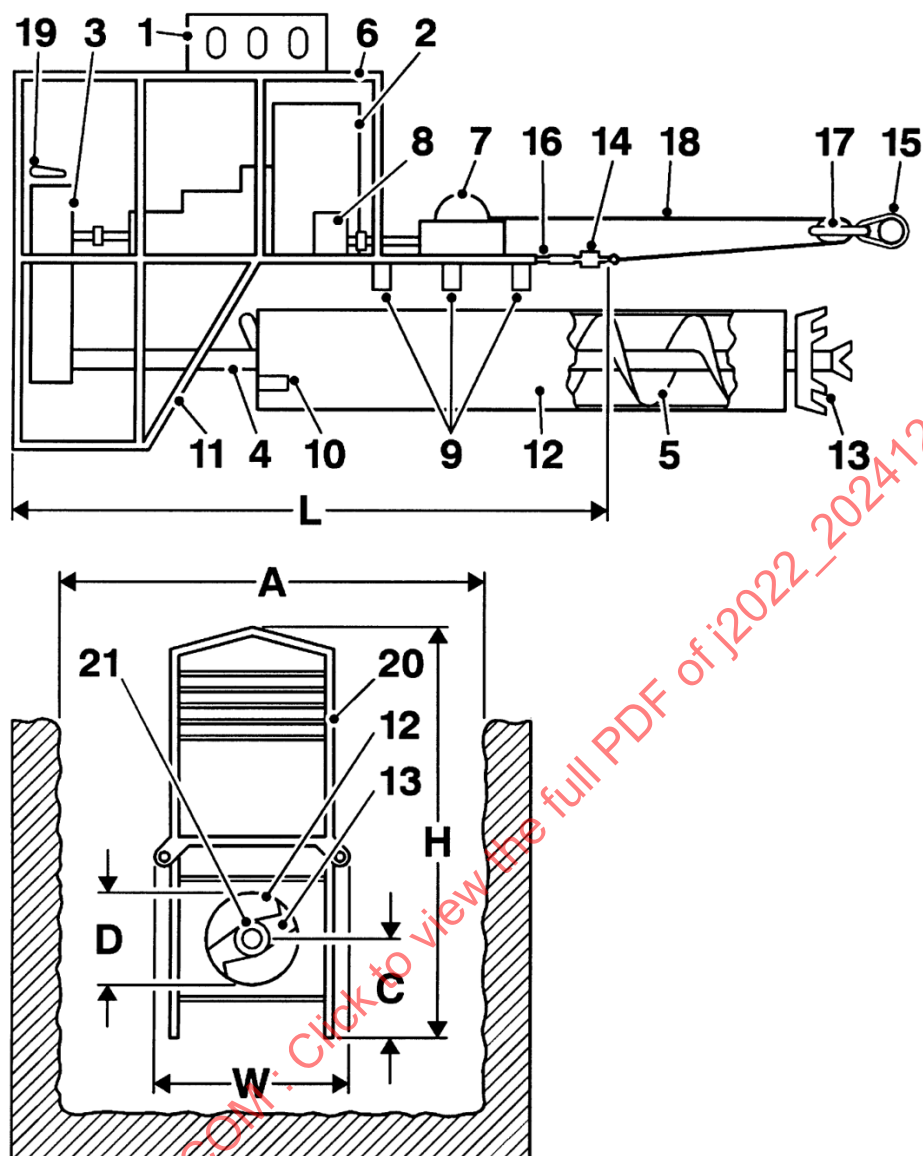
4.1.2 Cradle Type

For an example, see Figure 2.

4.1.2.1 Nomenclature

NOTE: Not all items are standard equipment.

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Nomenclature

- | | | |
|-------------------|------------------|----------------------|
| 1. Hanger | 8. Winch Drive | 15. Dead Man |
| 2. Power Train | 9. Casing Clamps | 16. Machine Dead Man |
| 3. Auger Gear Box | 10. Thrust Hook | 17. Sheave Block |
| 4. Auger Drive | 11. Legs | 18. Cable |
| 5. Auger | 12. Casing | 19. Seat |
| 6. Main Frame | 13. Cutting Head | 20. Safety Grill |
| 7. Winch | 14. Load Cell | 21. Drive Chuck |

Dimensional Terms

- | | | |
|----------------|----------------------------|---------------------------|
| (A) Pit Width | (D) Maximum Diameter | (W) Overall Machine Width |
| (B) Pit Length | (H) Overall Machine Height | |
| (C) Centerline | (L) Overall Machine Length | |

Figure 2 - Example of cradle-type auger boring machine

4.1.2.2 Dimensional Terms

Refer to ISO 6746-1 for general measurement conditions and description of basic dimensions. Preferred units of measure are in SAE J1233 and SAE TSB 003.

4.1.2.2.1 Overall Machine Length (L)

Longitudinal 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 a horizontal plane passing through the highest point on the machine.

4.1.2.2.3 Overall Machine Width (W)

Transverse distance between the planes of the outer extremities of the machine in transport position.

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

For an example, see Figure 3.

4.2.1 Nomenclature

NOTE: Not all items shown are standard equipment.

4.2.2 Dimensional Terms

Refer to ISO 6746-1 for general measurement conditions and description of basic dimensions. Preferred units of measure are given in SAE J1233 and SAE 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.

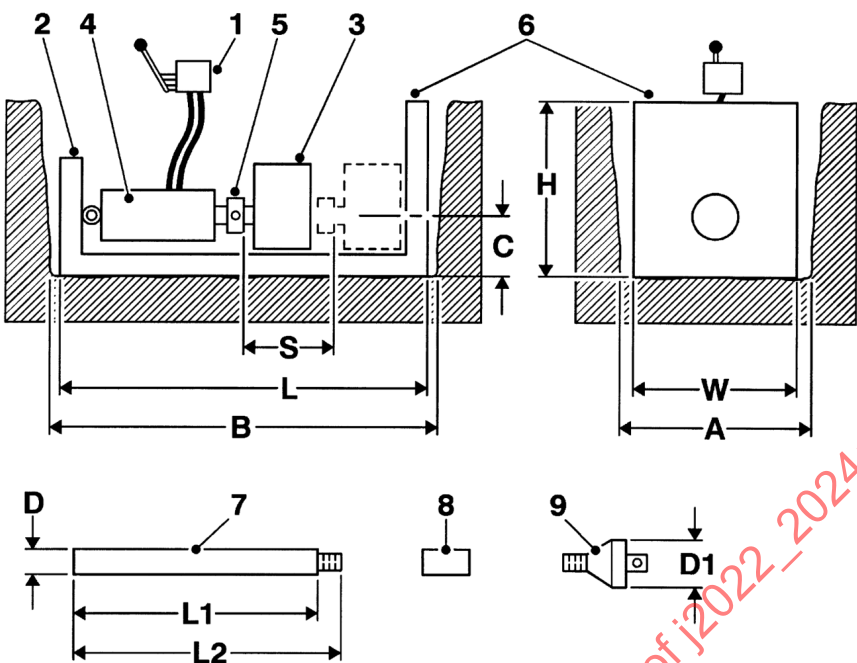
4.2.2.6 Length of Push Rod (L1)

Nominal (made up) length of push rod.

4.2.2.7 Length of Push Rod (L2)

Overall length of push rod.

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Nomenclature

- | | | |
|-----------------|-----------------|-------------|
| 1. Valve Body | 4. Cylinder | 7. Push Rod |
| 2. Body (Box) | 5. Cylinder Rod | 8. Coupler |
| 3. Jaw Assembly | 6. Front Frame | 9. Expander |

Dimensional Terms

- | | | |
|--------------------------|---------------------------------|---------------------------------|
| (A) Pit Width | (D1) Diameter of Expander | (L2) Overall Length of Push Rod |
| (B) Pit Length | (H) Overall Machine Height | (S) Cylinder Stroke |
| (C) Centerline | (L) Overall Machine Length | (W) Overall Machine Width |
| (D) Diameter of Push Rod | (L1) Nominal Length of Push Rod | |

Figure 3 - Example of rod pusher – (side view and end view shown)

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.

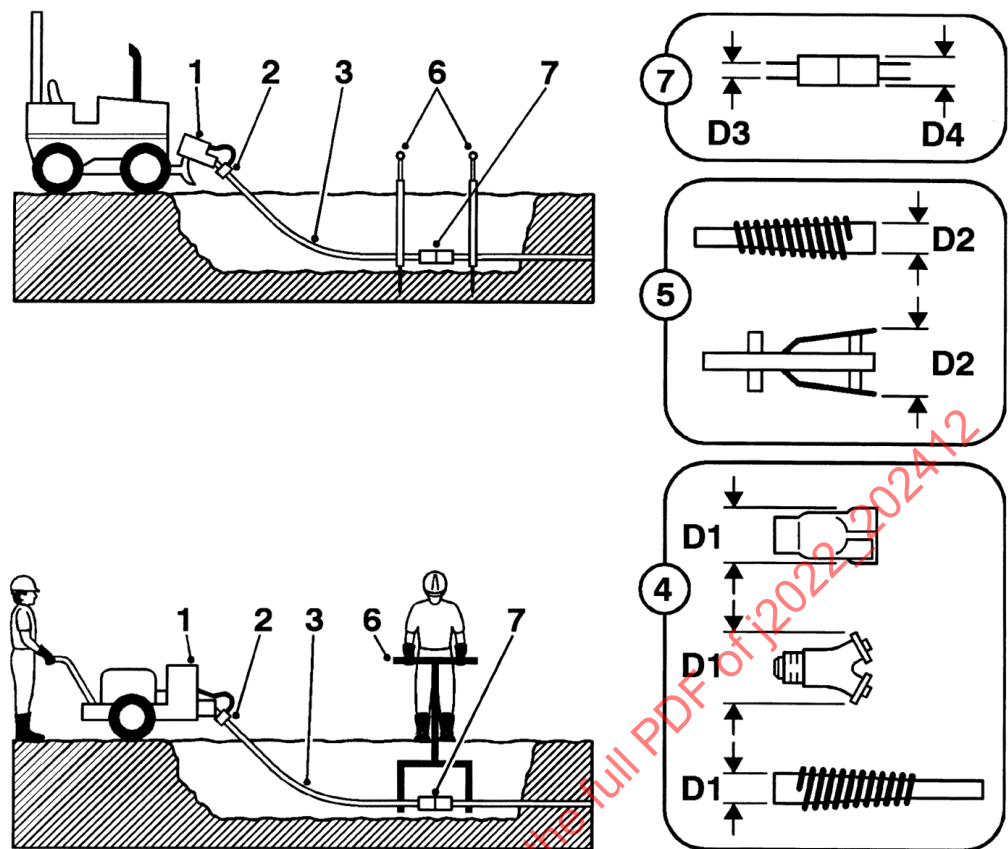
4.3 Rotary Rod Machines

For examples, see Figure 4.

4.3.1 Nomenclature

NOTE: Not all items shown are standard equipment.

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Nomenclature

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

Dimensional Terms

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

Figure 4 - Examples of rotary rod machines

4.3.2 Dimensional Terms

Refer to ISO 6746-1 for general measurement conditions and description of basic dimensions. Preferred units of measure are given in SAE J1233 and SAE 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.

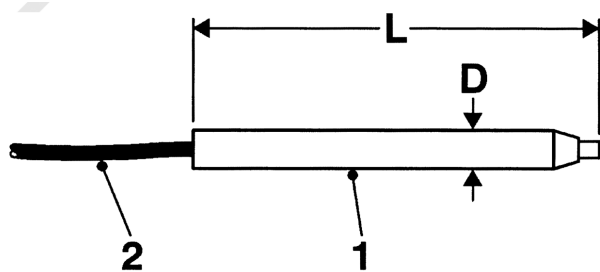
4.4 Impact Tools

For an example of a piercing tool, see Figure 5

For an example of a ramming tool, see Figure 6.

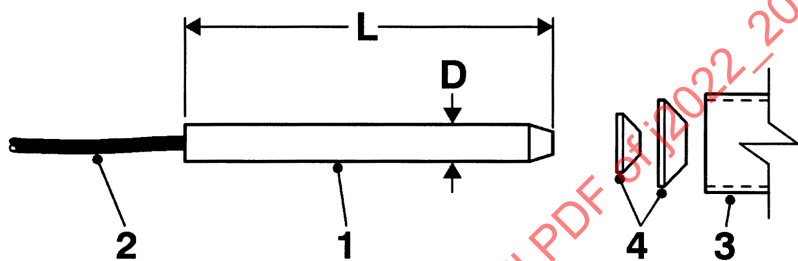
4.4.1 Nomenclature

NOTE: Not all items shown are standard equipment.



- | Nomenclature | | Dimensional Terms | |
|--------------|-----------|-------------------|---------------|
| 1. | Tool Body | (D) | Tool Diameter |
| 2. | Whip Hose | (L) | Tool Length |

Figure 5 - Example of piercing tool



- | Nomenclature | | Dimensional Terms | | | |
|--------------|-----------|-------------------|---------------|-----|---------------|
| 1. | Tool Body | 3. | Casing | (D) | Tool Diameter |
| 2. | Whip Hose | 4. | Adapter Cones | (L) | Tool Length |

Figure 6 - Example of ramming tool

4.4.2 Dimensional Terms

Refer to ISO 6746-1 for general measurement conditions and description of basic dimensions. Preferred units of measure are given in SAE J1233 and SAE 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.