SAE International™

SURFACE VEHICLE STANDARD

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Hazard Reduction for Horizontal Earthboring Machines

RATIONALE

This revision of SAE J2305 consists of the updating of reference standards, editorial changes, updating of terminology to reflect current practice and the addition of Appendix A – Informative Guideline for exit side immobilization of drill string of horizontal directional drilling machines.

1. SCOPE

This SAE standard applies to horizontal earthboring machines (SAE J2022) of the following types:

a. Auger boring machines;

b. Rod pushers;

c. Rotary rod machines;

d. Impact machines;

e. Horizontal Directional Drilling machines.

This document does not apply to specialized mining machines, conveyors, tunnel boring machines, pipe jacking systems, micro tunnelers, or well drilling machines.

1.1 Purpose

This document is a guide for reducing hazards for the operators and others during normal operation and maintenance of horizontal earthboring machines.

2. REFERENCES

2.1 Applicable Publications

The following publications form part of this specification to the extent specified herein. Unless otherwise specified, the latest version of SAE publications shall apply.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

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.

SAE J1362 Graphical Symbols for Operator Controls and Displays on Off-Road Self-Propelled Work Machines

SAE J2022 Classification, Nomenclature, and Specification Definitions for Horizontal Earthboring Machines

2.1.2 ISO Publications

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 2867 Earthmoving machinery—Access Systems

ISO 3450 Earthmoving machinery—Braking systems of rubber-tired machines—Systems and performance requirements and test procedures

ISO 3457 Earthmoving machinery—Guards and shields—Definitions and specifications

ISO 3471 Earthmoving machinery—Roll over protective structures

ISO 9244 Earthmoving machinery—Safety signs and hazard pictorials—General principles

ISO 10265 Earthmoving machinery—Crawler machines—Performance requirements and test procedures for braking systems

ISO 13766 Earthmoving machinery—Electromagnetic compatibility

ISO 17063 Earthmoving machinery—Braking systems of pedestrian controlled machines

ISO 21467 Earthmoving machinery—Horizontal directional drills—Definitions and specifications

3. DEFINITIONS

All definitions contained in SAE J2022 and ISO 21467 are included herein by reference.

3.1 Normal Operation

Normal operation is the reasonable use of a horizontal earthboring machine by a trained person using equipment and procedures specified by the manufacturer.

3.2 Electric Job Site

A job site which has been properly investigated for underground utilities and where an energized underground electric line has been determined to be within 3 m of the intended bore path.

4. GUARDS AND SHIELDS

Guards and shields shall conform to ISO 3457, except as specified in Section 9.

5. INSTRUCTIONS

Safety instructions shall be supplied with the machine.

5.1 Operator's Manual

5.1.1 Operator manuals shall provide safety instructions for normal operation and maintenance.

5.1.2 Operator manuals shall include the following specific precautions and those specified in Section 9.

5.1.2.1 Identification and avoidance of potential hazards of contact with underground utilities.

5.1.2.2 Wearing of personal protective equipment.

5.1.2.3 Identification and avoidance of potential hazards of excavation wall collapse, if applicable.

5.2 Safety Signs

5.2.1 Safety signs shall conform to ISO 9244.

5.2.2 Safety sign(s) shall provide information regarding identification and avoidance of potential hazards of contacting underground utilities.

6. CONTROLS

6.1 Where confusion may result from the motion of the control, the effect from movement of the control shall be clearly identified. If symbols are used, they shall be consistent with SAE J1362, unless defined in the operator's manual.

6.2 Control design shall be based on the principle that a given direction of movement of any control produces a consistent and expected effect.

7. ACCESS

7.1 Access systems of machines shall comply with ISO 2867.

8. ELECTRIC SHOCK PRECAUTIONS

8.1 Machines used on electric job sites shall have the following provisions:

8.1.1 A means to determine tool head position while boring.

8.1.2 A means of helping to protect personnel from electrical shock.

9. PRODUCT SPECIFIC REQUIREMENTS

All horizontal earthboring machine types shall meet the requirements of Sections 4, 5, 6, 7, and 8 as applicable. In addition, the following applicable subsections shall be met:

9.1 Auger Boring Machines

9.1.1 Instructions

The operator's manual and safety signs on the machine shall have instructions regarding identification and avoidance of potential hazards involving:

9.1.1.1 Auger entanglement.

9.1.1.2 Machine upset while operating the auger.

9.1.1.3 Inadvertent engagement of the drive train during auger coupling.

9.1.2 Controls

Auger rotation and thrust controls shall be hold-to-run type. In the alternative, an engine stop control shall be easily accessible to the operator.

9.1.3 Guards

9.1.3.1 Guards and shields shall conform to ISO 3457, excluding auger and tool attachments.

9.1.3.2 All casing pushers shall be equipped with self-closing spoil ejection doors.

9.1.4 Lifting

There shall be designated lifting points or devices for lifting the machine.

9.2 Rod Pushers

9.2.1 Instructions

The operator's manual and/or safety signs shall have instructions regarding identification and avoidance of potential hazards involving:

9.2.1.1 Pinch points on the machine for hands and feet.

9.2.1.2 Relieving the hydraulic system pressure before servicing the machine.

9.2.1.3 Pit preparation.

9.2.2 Controls

Thrust controls shall be hold-to-run type.

9.2.3 Lifting

There shall be designated lift points or devices for lifting the machine.

9.3 Rotary Rod Machines

9.3.1 Instructions

9.3.1.1 The operator's manual and safety signs on the machine shall provide information regarding identification and avoidance of potential hazards of rod entanglement. Attempting to guide or control the rotating drill rod by bodily contact shall be specifically prohibited.

9.3.1.2 Operator precautions shall be placed in the operator's manual regarding proper coupling and uncoupling of rod sections and tool attachments.

9.3.2 Drill Rods

Rods and rod couplers shall have no projecting bolts, keys, pins, set screws, or similar projections that are capable of snagging clothing.

9.3.3 Guards

Guards and shields shall comply with ISO 3457, excluding drill rod and tool attachments. A universal joint, if used at the rotary power source, shall be guarded.

9.3.4 Controls

Drill rod rotation function shall be hold-to-run type.

9.4 Impact Machines

9.4.1 Instructions

9.4.1.1 Instructions for proper lifting shall be provided in the operator's manual when mechanical lifting accessories are required.

9.4.1.2 Machines used for pushing open pipe shall have accompanying instructions in the operator's manual regarding proper removal of spoil from the pipe.

9.4.2 Supply Hose

A means shall be used to connect the supply hose to the tool to prevent inadvertent disconnection from the tool during normal operation.

9.5 Horizontal Directional Drilling Machines

9.5.1 Instructions

9.5.1.1 Operator precautions shall be placed in the operator's manual regarding proper coupling and uncoupling of pipe sections and tool attachments.

9.5.1.2 The operator's manual shall provide instructions regarding identification and avoidance of potential hazards of pipe entanglement.

9.5.1.3 The operator's manual shall provide information about precautions to be taken when handling chemicals such as drilling fluid additives.

9.5.1.4 The operator's manual shall provide instructions to shut off the engine/power source when personnel are working on the drill string or attachment to the drill string. Also see section 9.5.9.

9.5.1.5 The operator’s manual shall provide instructions advising the operator to clear away vegetation from near the operator’s station when operating on an electrical jobsite.

9.5.1.6 The operator's manual shall provide instructions prohibiting the use of spindle torque with hand tools for making or breaking drill string tool joints.

9.5.2 Controls

9.5.2.1 The machine ground travel function on self propelled walk-along machines shall be hold-to-run type.

9.5.2.2 A means shall be provided to assure the operator is at the operator’s station while the drill pipe rotation or thrust functions are engaged.

9.5.3 Guards

9.5.3.1 Guards and shields shall conform to ISO 3457, excluding drill pipe, tool attachments, and carriage drive spindle.

9.5.3.2 Pipe and pipe couplers shall have no projecting bolts, keys, pins, set screws, or similar projections that are capable of snagging clothing.

9.5.3.3 A means shall be provided to prevent injury to the operator in the event of an ejected drill pipe from a powered loading system.

9.5.4 Brakes

9.5.4.1 Ride-on machines shall be equipped with brakes conforming to ISO 10265 (Crawler Track Machines) or ISO 3450 (Rubber Tired Machines).

9.5.4.2 Self-propelled, walk-along machines shall be equipped with brakes conforming to ISO 17063.

9.5.4.3 Machines which are not self-propelled do not require brakes. The operator's manual shall contain instructions regarding proper movement of non self-propelled machines to and from the bore site.

9.5.5 Rollover Protective Structure (ROPS)

Self-propelled machines with machine travel controls at a riding operator's station shall be equipped with a rollover protective structure conforming to ISO 3471.

9.5.6 Travel Speed

Self-propelled, walk-along machines shall have a maximum forward speed ≤6 km/h. Where control positions require the operator to walk backwards, the maximum speed in that direction shall be ≤2.5 km/h.

9.5.7 Drill Frame Support Device

A means shall be provided to secure the drill frame in a raised position if maintenance is required underneath the drill frame.

9.5.8 Backup Alarm/Signal

Ride on machines with an obstructed view to the rear shall have an automatically activated backup alarm/signal.

9.5.9 Exit Side Immobilization of Drill String

See Appendix A.

10. NOTES

10.1 Marginal Indicia

The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

PREPARED BY THE SAE MACHINE TECHNICAL COMMITTEE SC 9—
TRENCHING AND HORIZONTAL EARTHBORING MACHINERY

APPENDIX A - INFORMATIVE GUIDELINE

Exit Side Immobilization of Drill String of Horizontal Directional Drilling Machines – Performance Requirements and Test Procedures

RATIONALE

Exit side immobilization can provide a more convenient method of allowing personnel remote from the horizontal directional drill to disable drill string movement without having to travel to the drill or to depend upon voice communication. Exit side immobilization is not a substitute for drill team training, organization, two-way communication and established procedures, but is a supplement to them. This appendix provides designers of wireless exit side immobilization devices guidance by providing definitions, performance and test criteria. Criteria for the use of an exit side immobilization system are beyond the scope of this document. Means of overriding the immobilization system by design may be provided.

A.1 SCOPE

This guideline specifies minimum performance and test criteria for exit side immobilization of the drill string. It is not intended to define the only acceptable means of immobilization of the drill string.

A.2 DEFINITIONS

For the purpose of this guideline, the following definitions apply:

A.2.1 Exit Side Control

Control device used at the drill string exit side for communication with the machine control interface to immobilize the drill string.

A.2.2 Receiving Unit

Control on machine for receiving signal from the exit side control for either immobilizing or enabling drill string movement and providing status indication.

A.2.3 Signal Transmission Range

Reliable communication distance specified by the manufacturer.

A.3 GENERAL REQUIREMENTS

An immobilization system shall allow at least one person distant from the machine to immobilize the drill string. Once the drill string has been immobilized, the system shall assure that drill string movement cannot resume until the exit side control enables a run condition and the machine operator resumes drill string operation. The exit side control system is not intended for use as an emergency stop for the drill string. The exit side control system does not replace reliable voice communication between the machine operator and exit side personnel.

A.3.1 Exit Side Control

A.3.1.1 Mode of operation and configuration shall be designed for use by personnel at the drill string exit side.

A.3.1.2 Drill string immobilization shall be accomplished by actuating one exit side control.

A.3.2 Machine Control Interface

The machine control interface shall be capable of disabling machine functions which cause movement of the drill string and recognizing only authorized exit side control signals.