

## Classification, Nomenclature, and Specification Definitions for Directional Drilling Tracking Equipment

1. **Scope**—This SAE Standard applies to directional drilling electronics and tracking equipment of the following types:

- a. Tracking Transmitter
- b. Tracking Receiver
- c. Telemetry Device
- d. Remote Display

This type of tracking equipment is typically used with Horizontal Earthboring Machines as defined in SAE J2022.

- 1.1 **Purpose**—The purpose of this document is to define common terms and commercial specifications associated with tracking equipment used in the horizontal earthboring industry.

## 2. Reference

- 2.1 **Applicable Publication**—The following publication(s) forms 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 PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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

## 3. Definitions

- 3.1 **Pilot Bore Path**—The centerline location of the pilot bore.
- 3.2 **As-Built**—The actual map derived from measurements received by tracking receiver.
- 3.3 **Bore Path Length**—The distance from the entry point to the exit point along the actual bore path.
- 3.4 **Depth**—The vertical distance from the surface to the transmitter.
- 3.5 **Drill String Communication**—Data that is communicated, at least in part, through the drill string.

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SAE WEB ADDRESS:

- 3.6 Heading**—An angle of direction in the horizontal plane relative to true or magnetic north.
- 3.7 Installed Path**—The centerline of the completed bore.
- 3.8 Planned Path**—The planned location for the bore.
- 3.9 Left and Right Deviation**—The distance measured perpendicular to the reference line when facing the direction the drill rig is heading.
- 3.10 Left and Right Steering Indicator**—Display indicating amount of left/right steering required to proceed on the intended path to a target point given in degrees, distance or means of steering indication.
- 3.11 Logging Function**—Hardware and/or software used for collecting the data about the drilling operation.
- 3.12 Pitch**—The angle of the tracking transmitter relative to the horizontal plane.
- 3.13 Planning Function**—A system used for planning and displaying the projected bore path in relation to known points above and/or below ground.
- 3.14 Reference Line**—A predetermined line or set of surface characteristics used to measure and document the location of the planned path, actual bore or installed path.
- 3.15 Remote Display**—A device at or near the drilling unit, used to display information communicated from the tracking receiver.
- 3.16 Roll**—Rotation about the longitudinal axis of the transmitter shown in degrees or segmented displays, usually starting from a twelve o'clock position.
- 3.17 Survey Path Distance**—Horizontal distance measured along the reference line to the point of interest.
- 3.18 Telemetry Receiver**—A device that receives data and converts it into electric output.
- 3.19 Telemetry Transceiver**—A device that has the ability to send and receive data.
- 3.20 Telemetry Transmitter**—A device that sends data to the telemetry receiver above ground.
- 3.21 Tracking Receiver**—A portable device used above ground that detects the signal from the tracking transmitter. Note that the terms receiver, tracker, and locator are often used interchangeably.
- 3.22 Tracking Transmitter**—A removable device that fits in the drill pipe and measures parameters about the drill bit and the drilling process and emits electromagnetic signals. Note that the terms transmitter, beacon, sonde and probe are often used interchangeably.
- 3.23 Yaw**—The intended angle of a heading relative to the reference path of a horizontal plane.
- 3.24 Update Rate**—The delay in updating changed parameters, measured in seconds.

#### **4. Specification Guidelines**

##### **4.1 Standard Drill Head for Tracking Transmitter Specifications**

4.1.1 Tracking Transmitter specifications shall be determined in the following standard drill head housing configuration:

4.1.1.1 Steel housing of drill head is 76 mm.

4.1.1.2 The drill head has a minimum of 4 symmetrical slots.

4.1.1.3 If the standard drill head housing is not used, the manufacturer shall specify the housing used.

##### **4.2 Tracking Transmitter Range - in standard drill head, unless specified**

4.2.1 Range specifications will be derived from horizontal measurements taken while transmitter is inside standard drill head and above ground.

4.2.2 Maximum distance capacity, measured in meters:

4.2.2.1 *Maximum Depth*—The distance reached where loss of depth reading occurs.

4.2.2.2 *Maximum Data Signal Depth*—The distance reached where loss of data occurs.

##### **4.3 Tracking Transmitter Battery Life - in standard drill head, unless specified**

4.3.1 Battery life is measured in hours.

4.3.2 Battery life is specified after meeting the following test conditions:

4.3.2.1 Battery life is measured while the transmitter is inside the standard drill head housing.

4.3.2.2 Battery life duration is measured while the transmitter is in continuous operation.

4.3.2.3 Temperature of the transmitter and surrounding drill head is maintained at  $21\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ .

##### **4.4 Tracking Transmitter / Receiver Depth Accuracy -- in standard drill head, unless specified**

4.4.1 Depth accuracy is specified when the following conditions are met:

4.4.1.1 The transmitter is out of the ground and inside the standard drill head housing.

4.4.1.2 Depth readings obtained while head is positioned approximately 1 m above ground while a horizontal distance measurement is taken.

4.4.1.3 Test measurements taken at 1.5 m intervals showing range of accuracy at each interval indicated by dividing the difference between the actual and measured depth by the actual depth or as specified by the manufacturer.

##### **4.5 Tracking Transmitter / Receiver Location Accuracy**

4.5.1 If specified by the manufacturer, conditions of the tests should be disclosed.

#### 4.6 Tracking Transmitter Pitch Accuracy

4.6.1 The following test conditions must be met when determining pitch accuracy:

4.6.1.1 The transmitter pitch is measured on an inclinometer at a temperature of  $21\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ .

4.6.1.2 Pitch accuracy measurements are taken in all roll positions.

4.6.1.3 Specify accuracy variations at given pitch angles over the operating range. (Individual manufacturers present their own angles and variations.)

#### 4.7 Tracking Transmitter / Receiver Update Rate

4.7.1 Manufacturer will list the following data parameters that are updated:

4.7.1.1 Roll of the transmitter, read from the tracking receiver.

4.7.1.2 Pitch of the transmitter, read from the tracking receiver.

4.7.1.3 Temperature of the transmitter, read from the tracking receiver.

4.7.1.4 Location of the transmitter, displayed on the tracking receiver.

4.7.1.5 Depth of the transmitter, shown on the tracking receiver.

4.7.1.6 Battery Status of the transmitter, read from the tracking receiver.

#### 4.8 Tracking Transmitter Dimensions

4.8.1 Physical dimensions of the transmitter are shown including the following:

(Refer to Figure 1)

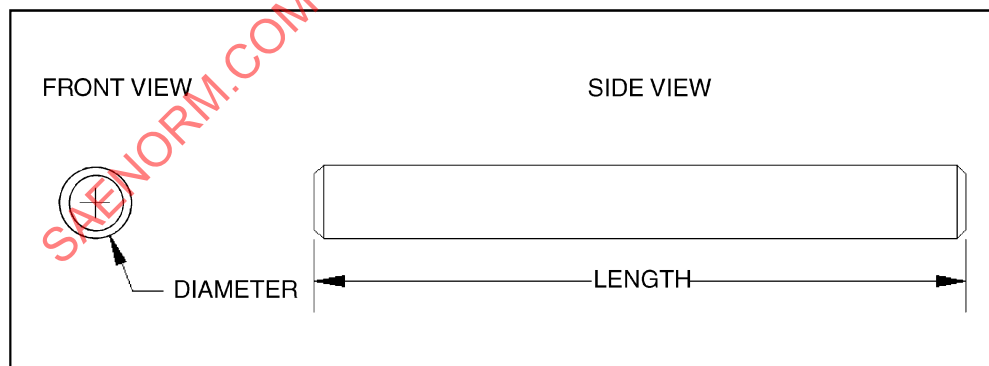


FIGURE 1—TRACKING TRANSMITTER DIMENSIONS

4.8.1.1 *Length*—The longitudinal distance between the outer extremities of the transmitter housing. Tolerances shall be included.

4.8.1.2 *Diameter*—The maximum outside diameter of the transmitter housing, tolerances shall be included.

4.8.1.3 *Weight*—The measured weight of a fully operational transmitter including the battery.

#### 4.9 Temperature Operating Range -- Tracking Transmitter and Receiver

4.9.1 The temperature operating range is determined by the following:

4.9.1.1 The minimum and maximum temperature for an infinite time range where shutdown occurs without permanent damage.

4.9.1.2 The minimum and maximum temperature where permanent damage to the transmitter occurs .

#### 4.10 Tracking Receiver Battery Life

4.10.1 Battery life is measured in hours.

4.10.2 Battery life of the receiver is determined under the following conditions:

4.10.2.1 While the receiver is turned "On"

4.10.2.2 While the receiver is transmitting data (telemetry "On")

4.10.2.3 While the receiver's Back Light is "ON" (if applicable). A battery life may also be provided with the Back Light "Off"

4.10.2.4 While testing at a temperature of  $21^{\circ}\text{C} \pm 2^{\circ}\text{C}$

4.10.2.5 The type of battery used in the test shall be specified

#### 4.11 Tracking Receiver Weight

4.11.1 The weight of the receiver in operating configuration (including batteries).

#### 4.12 Tracking Receiver Dimensions

4.12.1 Physical dimensions of the receiver are shown including the following:

(Refer to Figure 2)

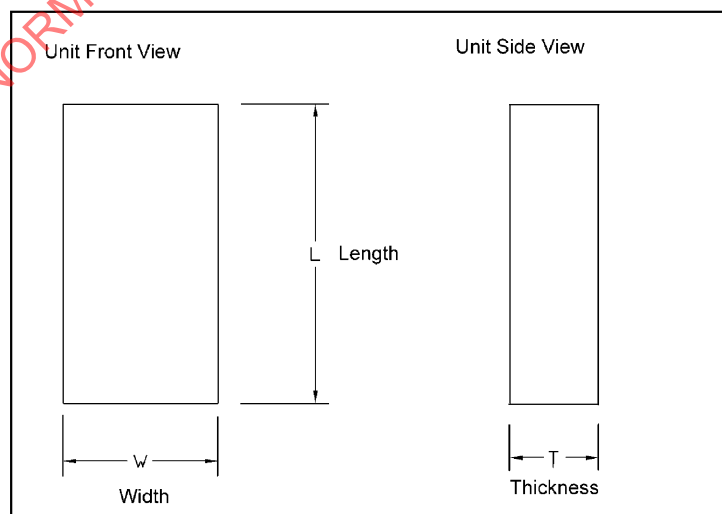


FIGURE 2—TRACKING RECEIVER DIMENSIONS