



Designation: D6914/D6914M – 16 (Reapproved 2024)

Standard Practice for Sonic Drilling for Site Characterization and the Installation of Subsurface Monitoring Devices¹

This standard is issued under the fixed designation D6914/D6914M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers procedures for using sonic drilling methods in the conducting of subsurface exploration for site characterization and in the installation of subsurface monitoring devices.

1.2 The use of the sonic drilling method for exploration and monitoring-device installation may often involve preliminary site research and safety planning, administration, and documentation.

1.3 Soil or Rock samples collected by sonic methods are classed as group A or group B in accordance with Practices D4220/D4220M. Other sampling methods (Guide D6169/D6169M) may be used in conjunction with the sonic method to collect samples classed as group C and Group D. Other drilling methods are summarized in Guide D6286/D6286M.

1.4 *Units*—The values stated in either inch-pound units or SI units [presented in brackets] are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Reporting of test results in units other than in-pound shall not be regarded as nonconformance with this practice.

1.5 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026, unless superseded by this standard.

1.6 This practice offers a set of instructions for performing one or more specific operations. It is a description of the present state-of-the-art practice of sonic drilling. It does not recommend this method as a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all

aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.

1.6.1 This practice does not purport to comprehensively address all the methods and the issues associated with drilling practices. Users should seek qualified professionals for decisions as to the proper equipment and methods that would be most successful for their site investigation. Other methods may be available for drilling and sampling of soil, and qualified professionals should have the flexibility to exercise judgment as to possible alternatives not covered in this practice. This practice is current at the time of issue, but new alternative methods may become available prior to revisions, therefore, users should consult manufacturers or sonic drilling services providers prior to specifying program requirements.

1.7 *This practice does not purport to address all the safety concerns, if any, associated with its use and may involve use of hazardous materials, equipment, and operations. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory requirements prior to use.* For good safety practice, consult applicable OSHA regulations and drilling safety guides.^{2,3,4}

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Groundwater and Vadose Zone Investigations.

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² "Drilling Safety Guide," National Drilling Association.

³ "Drillers Handbook," Thomas C. Ruda and Peter Bosscher, National Drilling Association.

⁴ "Innovative Technology Summary Report," April 1995, U.S. Department of Energy.

2. Referenced Documents⁵

2.1 ASTM Standards—Soil Classification:

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D2113 Practice for Rock Core Drilling and Sampling of Rock for Site Exploration (Withdrawn 2023)⁶

D2488 Practice for Description and Identification of Soils (Visual-Manual Procedures)

D5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock (Withdrawn 2021)⁶

2.2 ASTM Standards—Drilling Methods and Installation Methods:

D1452/D1452M Practice for Soil Exploration and Sampling by Auger Borings

D5088 Practice for Decontamination of Field Equipment Used at Waste Sites

D5299/D5299M Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities

D5782 Guide for Use of Direct Air-Rotary Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices

D5783 Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices

D5784/D5784M Guide for Use of Hollow-Stem Augers for Geoenvironmental Exploration and the Installation of Subsurface Water Quality Monitoring Devices

D5791 Guide for Using Probability Sampling Methods in Studies of Indoor Air Quality in Buildings

D6286/D6286M Guide for Selection of Drilling and Direct Push Methods for Geotechnical and Environmental Subsurface Site Characterization

2.3 ASTM Standards—Soil Sampling:

D1586/D1586M Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

D1587/D1587M Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes (Withdrawn 2024)⁶

D3550/D3550M Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils

D4220/D4220M Practices for Preserving and Transporting Soil Samples (Withdrawn 2023)⁶

D4700 Guide for Soil Sampling from the Vadose Zone (Withdrawn 2024)⁶

D6169/D6169M Guide for Selection of Subsurface Soil and Rock Sampling Devices for Environmental and Geotechnical Investigations

D6640 Practice for Collection and Handling of Soils Obtained in Core Barrel Samplers for Environmental Investigations

2.4 ASTM Standards—Aquifer Testing:

D4044/D4044M Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers (Withdrawn 2024)⁶

D4050 Test Method for (Field Procedure) for Withdrawal and Injection Well Testing for Determining Hydraulic Properties of Aquifer Systems

D5092/D5092M Practice for Design and Installation of Groundwater Monitoring Wells

2.5 ASTM Standards—Other:

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D6026 Practice for Using Significant Digits and Data Records in Geotechnical Data

3. Terminology

3.1 Definitions:

3.1.1 For common definitions of technical terms in this standard refer to Terminology **D653**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *hydraulic extraction, n*—the removal of the sample specimen from the solid sampling barrel by the application of fluid.

3.2.2 *natural frequency, n*—the frequency or frequencies at which an object tends to vibrate when disturbed.

3.2.3 *resonance, n*—when one object (sine generator) vibrating at the natural frequency of a second object (drill pipe or casing) forces the second object into vibrational motion.

3.2.4 *sine wave generator, n*—a drill head that imparts forces in wave forms corresponding to single-frequency periodic oscillations to create resonance of the drill rods and casings to advance the drill hole.

3.2.4.1 *Discussion*—This drill head is referred to as a sonic drill head, or resonant sonic drill head throughout this standard. This drill head is attached to the drill rods and casings and can be used to lift rods for sample extrusion.

3.2.5 *sonic drilling, n*—the practice of using high frequency vibration as the primary force to advance drill tools through subsurface formations.

3.2.5.1 *Discussion*—While vibration is the primary force for drilling, the drilling process also requires rotation of the drill rods with applied downforce reaction from the drill

4. Summary of Practice

4.1 Sonic drilling is the utilization of high frequency vibration aided by down pressure and rotation to advance drilling tools through various subsurface formations. All objects have a natural frequency or set of frequencies at which they will vibrate when disturbed. The natural frequency is dependent upon the properties of the material the object is made of and the length of the object. The sonic drill head provides the disturbance to the drilling tools causing them to vibrate. To achieve penetration of the formation the strata is fractured, sheared, or displaced. The high frequency vibration can cause the soil in contact with the drill bit and drilling casing string to liquefy and flow away allowing the casing to pass through with

⁵ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

⁶ The last approved version of this historical standard is referenced on www.astm.org.