

3745-9-07 **Well grouting for construction or sealing.**

(A) One of the following grouts shall be used for sealing a well, test hole, dry hole or annular space:

- (1) Cement grouts that meet standard ASTM C150-00, Standard Specification for Portland Cement, have standard ANSI/NSF 61 certification, and include one of the following types of cement:
 - (a) Type I, general purpose cement.
 - (b) Type II, for use in water with moderate sulfate content between one hundred fifty to fifteen hundred milligrams per liter, and conditions requiring lower heat of hydration.
 - (c) Type III, for use in conditions requiring high early strength.
 - (d) Type IV, for use in conditions requiring low heat of hydration.
 - (e) Type V, for use in ground water with a high sulfate content greater than fifteen hundred milligrams per liter.
- (2) Bentonite grouts that have standard ANSI/NSF 60 certification, and include one of the following:
 - (a) High solids bentonite grout using powdered bentonite clay or granular bentonite.
 - (b) Coarse grade or pelletized bentonite.

Bentonite grout shall not contain bentonite drilling mud or cuttings.

(B) Grout shall be processed and placed in a well, test hole, dry hole or annular space in accordance with the following:

- (1) Cement grout shall be mixed using potable water and cured according to the following specifications:
 - (a) Type I, II, IV and V cement shall be mixed by adding not more than 5.2 gallons of water per ninety-four pounds of cement, with a minimum density of fifteen pounds per gallon.
 - (b) Type III cement shall be mixed by adding 6.3 to seven gallons of water per ninety-four pounds of cement.
 - (c) Concrete with a minimum density of 17.5 pounds per gallon shall be mixed by adding ninety-four pounds of cement, an equal amount of sand, and not more than six gallons of water.
 - (d) Cement with a minimum density of fifteen pounds per gallon that has calcium chloride added as an accelerator to speed up the rate of curing shall be mixed by adding two to four pounds of calcium chloride per ninety-four pounds of cement

and not more than six gallons of water.

- (e) Cement grout shall cure a minimum of twenty-four hours before drilling operations are resumed either when standard type I and type II cement is used or when calcium chloride additive is used. Cement grout shall cure a minimum of twelve hours before drilling operations are resumed when high early type III cement grout is used.
- (2) Bentonite grout shall be mixed according to the manufacturer's recommendations to achieve at least twenty per cent solids. Synthetic organic polymers that have standard ANSI/NSF 60 certification may be added to bentonite grout to suppress hydration of the bentonite particles and shall be mixed according to the manufacturer's recommendations.
- (3) When using coarse grade or pelletized bentonite, the bentonite shall be poured slowly into the top of the well to prevent bridging in the casing or borehole, in accordance with the following procedures:
 - (a) Coarse grade or pelletized bentonite shall be poured over a wire one fourth inch mesh screen to keep the fine bentonite powder from entering the well. Fine bentonite particles that accumulate in the shipping container shall not be used.
 - (b) Coarse grade or pelletized bentonite shall be poured at a continuous rate, no faster than fifty pounds per three minutes.
 - (c) The pouring process shall be halted intermittently in order to lower a weighted measuring tape into the well to determine the top of the grout and confirm that bridging has not occurred. Where possible, a tamping device shall be used to break any bridges that may form.
 - (d) Coarse grade or pelletized bentonite shall be periodically hydrated when poured above the static water level.
- (4) When pressure grouting, the grout shall be placed in a continuous operation without interruption until the cement or bentonite grout of approximately the same density as the grout being placed into the borehole is coming out of the annular space.
- (5) After grout has been placed, the grout shall cure a minimum of twelve hours to assess whether any settling of the grout has occurred. If settling has occurred, then additional grout shall be placed.
- (C) An annular space shall be completely filled with grout from the bottom of the annular space, or from the top of the filter pack or formation stabilizer, upward to the ground surface. (See the appendix to this rule for the volume of annular space between casing and borehole.) The annular space shall be completely filled in accordance with the following:
 - (1) If a pitless adapter or pitless unit will be installed and if well construction is not completed when casing is set, compacted clean clay may be temporarily used from

the expected point of attachment to the ground surface.

- (2) Except as otherwise provided in this rule, and rule 3745-9-06 of the Administrative Code, the annular space shall be filled with cement grout or bentonite grout, which shall be placed in the annular space of a well by pressure grouting.
- (3) An annular space between a permanent casing and a temporary casing shall be filled with grout during temporary casing removal. Where temporary casing removal is not possible or practical, temporary casing shall be withdrawn at least five feet to ensure grout contact with the formation.
- (4) Cement grout may be placed into the annular space of a well using the conductor pipe-gravity method where the annular space is greater than or equal to two inches, no greater than fifty feet below ground surface, and where a minimal amount of water is in the borehole. The conductor pipe shall be lowered to the bottom of the annular space and the grout placed from the bottom up with the conductor pipe submerged at all times.
- (5) Coarse grade or pelletized bentonite may be poured into the annular space where the annular space is greater than or equal to two inches, no greater than fifty feet below ground surface, and where a minimal amount of water is in the borehole. Coarse grade bentonite may be poured into the annular space between a permanent casing and temporary casing during temporary casing removal.
- (6) The dry driven grouting method may be used. Well construction using a cable tool, driven casing hammer or any other method where the permanent casing is driven, and where temporary outer casing or an oversized borehole is not used, a collar, flared joint or well bead shall extend beyond the outside diameter of the permanent casing and dry granular bentonite shall be poured around the permanent casing as it is being driven. The well site shall be where thick deposits of low permeable clayey glacial till or other low permeable materials overlie the aquifer and where the well site is not located in an area of microbiological or chemical contamination. The dry driven grouting method may be used for a public water system well only with prior acceptance by the director.

[Comment: "Standard ASTM C150-00, Standard Specification for Portland Cement." This rule incorporates this standard or specification by reference. A copy may be obtained from "ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959," (610) 832-9500, www.astm.org. The standard is available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."]

[Comment: "Standard ANSI/NSF 60, Drinking Water Treatment Chemicals - Health Effects," December 11, 2009, Document Number NSF/ANSI 60-2009a; and "Standard ANSI/NSF 61, Drinking Water System Components - Health Effects," February 15, 2010, Document Number NSF/ANSI 61-2010. This rule incorporates these standards or specifications by reference. A copy may be obtained from "NSF International, 789 N. Dixboro Road, P.O. Box 130140, Ann Arbor, MI 48105,"

(734) 769-8010, www.nsf.org. These standards are available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."]

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Table 1: Volume of Annular Space Between Casing and Borehole

Nominal Pipe Size (inch)	Borehole Size (inch)	Volume per Foot of Well Depth (cubic feet)	Volume per Foot of Well Depth (gallon)
5 (5.563 OD)	8	0.18	1.38
5	9	0.28	2.07
6 (6.625 OD)	9	0.20	1.51
6	10	0.31	2.29
8 (8.625 OD)	11	0.25	1.90
8	12	0.38	2.84
10 (10.75 OD)	13	0.29	2.18
10	14	0.44	3.28
12 (12.75 OD)	16	0.51	3.81
14 (14.0 OD)	18	0.70	5.22
16 (16.0 OD)	20	0.79	5.87

This calculation does not include the volume occupied by couplings.