

Materials used in drilling and construction of wells.

(A) Materials used in the drilling process shall meet the following requirements:

- (1) Materials that are in contact with ground water shall be free of matter that may adversely affect the aquifer or water pumped from the well and shall not support microbiological growth.
- (2) All drilling fluids, additives, lubricants shall meet ANSI/NSF standards 60, 61, or be of food grade quality and shall not be discharged to surface water. Drilling fluids or additives that contain guar gum or other biodegradable organic materials shall not be used during the drilling of a well.
- (3) Water that is used for drilling purposes, other than water from the well itself, shall be water from an approved private or public water system and shall be conveyed in containers that are clean and capable of being maintained in a clean condition. Surface water shall not be used for drilling purposes unless it is obtained from a public water supply. Storage tanks used to haul water for drilling shall be periodically disinfected by the registered contractor.
- (4) Drilling cuttings shall not be discharged into a well pit, other wells, surface water, or placed into the annular space of a well.

(B) Materials used in the construction of wells shall meet the following requirements:

- (1) Steel pipe or tubing used as permanent primary or secondary well casing, liners, well screen risers, blanks, or tail pipes which are directly connected to the well screen by welding or threading shall:
 - (a) Be new pipe or tubing or pipe that meets the requirements of paragraph (B)(1)(c) of this rule,
 - (b) Be manufactured in compliance with the standards of ASTM specification A53, A106, A589, A500 or in compliance with the standards of API specification 5L or 5C;
 - (c) Have a minimum wall thickness of .188 inches if the nominal pipe size is five inches through ten inches.
 - (d) Have a minimum wall thickness of .375 inches if the nominal pipe size is twelve through twenty inches. Be standard weight, as set forth in ASTM specifications A53, A106, A589, API specification 5L and 5C, if the nominal pipe size is twenty-one inches or greater.
 - (e) Be legibly marked on each length or provided by written documentation by the manufacturer, with all of the following information:
 - (i) The name of the manufacturer;
 - (ii) The kind of pipe (continuous welded, electric resistance welded or seamless);

- (iii) The weight or schedule;
 - (iv) The nominal or outside diameter;
 - (v) The specification number; and
 - (vi) The heat or lot number.
- (f) Be structurally sound, watertight throughout its length, and shall have threaded and coupled, or welded joints;
- (i) Couplings shall have a design, taper, and type of thread that is consistent with the thread of the pipe. No more than three threads shall be exposed on fourteen thread pipe and no more than two threads shall be exposed on eight thread pipe.
 - (ii) Welded joints shall form a structurally sound and watertight joint and may include the use of butt-welds using a welding collar or guide, band rings, or flared joints. Butt welds shall have a beveled to beveled edge. Steel pipe that is equal to or less than eight inches in diameter shall have a minimum of two weld passes. Steel pipe that is greater than eight inches in diameter shall have a minimum of three weld passes.
- (2) Thermoplastic pipe that is used as permanent primary or secondary well casing, liners, well screen risers, blanks, or tail pipes shall:
- (a) Be new pipe that is manufactured in compliance with the standards of ASTM specifications F480 and NSF standard 14;
 - (b) Be standard dimension ratio (SDR) twenty-one or heavier, except thermoplastic pipes that are larger than eight inches in diameter or installed at depths greater than two-hundred feet which shall be SDR seventeen or heavier. Thermoplastic pipe used as a liner may be less than SDR twenty-one. For purposes of this paragraph standard weight ratio or SDR means the ratio of average outside pipe diameter to minimum pipe wall thickness;
 - (c) Comply with dimensional standards for thermoplastic pipe as specified in ASTM specification F480.
 - (d) Be legibly marked, by the manufacturer, with all of the following information:
 - (i) The nominal pipe size;
 - (ii) The standard dimension ratio;
 - (iii) The type of plastic;
 - (iv) The words "well casing";
 - (v) The impact classification (IC);

- (vi) The specification number;
 - (vii) The manufacturer's name or trademark;
 - (viii) The lot number and date of manufacture; and
 - (ix) A certification mark that verifies compliance with ANSI/NSF standard 14.
- (e) Be structurally sound, watertight throughout its length with casing joints or couplings that conform to one of the following:
- (i) Except as provided in paragraph (B)(2)(e)(ii) of this rule, all thermoplastic casing joints and couplings shall meet the standards of ASTM specification F480 and ANSI/NSF standard 14.
 - (ii) Spline lock joints shall be permitted for use in wells with casing constructed of thermoplastic, and need not meet the standards of ASTM specification F480. For purposes of this rule a spline lock joint is a non-metallic, watertight coupling designed for thermoplastic pipe which incorporates the use of a bell or coupling with machined grooves on the interior of the bell or coupling, and is joined by inserting thermoplastic pipe with an elastomeric sealing gasket which seats into the machined grooves, and is locked in place by insertion of a high-strength flexible thermoplastic spline to provide full three hundred and sixty degree restraint with evenly distributed loading on the joint.
 - (iii) All thermoplastic couplings shall be legibly marked with the nominal well casing pipe coupling size, the type of plastic, designation of compliance with ASTM F480 and ANSI/NSF standard 14, and the manufacturer's name or trademark.
 - (iv) Thermoplastic well casing joints that are solvent welded shall meet the standard of ASTM specification F480 and ANSI/NSF standard 14.
 - (v) Screws may be used to join permanent primary or secondary thermoplastic casing during installation provided the screws are stainless steel, self tapping, and no larger than number ten in size, Screws used to join permanent primary or secondary thermoplastic casing shall not fully penetrate through the inside of the innermost casing where the casing ends overlap, and shall be centered approximately where the casing ends overlap. Pilot holes shall be predrilled prior to joining the casing and shall only be drilled into the outermost casing end.
- (3) Large diameter corrugated fiberglass casing that is used as primary or secondary casing shall meet NSF/ ANSI standard 61 and conform to the following specifications:
- (a) Shall have a minimum wall thickness of 0.18 inches.

- (b) Shall have a vertical load bearing capacity of at least thirty thousand pounds and a horizontal load bearing capacity of at least sixty pounds per square inch.
 - (c) Shall be joined by a bell and spicket joint that is fastened in accordance with the manufacturers instructions and sealed using an NSF approved sealant to provide a watertight seal.
 - (d) Shall have well caps provided by the casing manufacturer that are compression molded with a smooth inner and outer surface. The cap and rim thickness shall provide for a minimum vertical load of thirty thousand pounds. The well cap shall be secured in accordance with the manufacturer's recommendations and shall provide a vermin proof seal.
 - (e) Caps for buried seal construction shall be provided by the manufacturer and shall provide a water tight seal to the primary casing and to the casing used for extension above the natural ground surface. Casing used for extension shall be a minimum of six inches in diameter.
 - (f) Flow sleeves shall be installed over the bottom of submersible pumps placed in large diameter wells as appropriate.
- (C) Defective, visibly damaged, used or reject pipe shall not be used as casing or liner pipe for wells. Pipe withdrawn from a well or test hole during initial construction may be used as casing or liner pipe for another well provided the pipe meets the following requirements:
- (1) The pipe has not become impregnated with any contaminant, including but not limited to natural gas and crude oil, during a previous use;
 - (2) The pipe meets the applicable requirements of paragraph (B) of this rule; and
 - (3) Has been visually inspected by the registered contractor for pinholes, cracks or other defects or damages.
- (D) Couplings used to join well casing of dissimilar materials or sizes shall conform to the following criteria:
- (1) Have the same or better strength and rigidity of the well casings being joined together.
 - (2) Be composed of a cast steel unit joined by a minimum of four steel bolts spaced uniformly around the circumference of the coupling.
 - (3) Use a ramped compression gasket seal that fits between the upper and lower portions of the coupling to ensure a watertight seal.
 - (4) Ensure that a minimum of two inch length of the top and bottom casing end is contained within both the top and bottom pieces of the coupling.

- (5) Ensure that the coupling is centered over the joint.
 - (6) Other products that may be approved by the director.
- (E) Drive shoes attached to the bottom of steel casing shall be a factory manufactured forged steel unit with a cutting edge.
- (F) Cement grout to be used for sealing the annular space in wells or to seal a well shall conform to the following:
- (1) Cement grouts which meet current ASTM standard C150 and NSF standard 60 and include:
 - (a) Type I, general purpose cement;
 - (b) Type II, for use in waters with moderate sulfate content of one hundred and 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 waters with a sulfate content greater than fifteen hundred milligrams per liter;
 - (f) Concrete grout for special sealing conditions identified in rule 3701-28-17 of the Administrative Code.
 - (2) Cement based grouts shall be placed in accordance with rule 3701-28-10 of the Administrative Code and shall meet the the following requirements:
 - (a) Cement grouts shall be mixed using potable water according to the following specifications:
 - (i) Type I, II, IV, and V cement shall be mixed by adding 5.2 gallons of water per ninety-four pounds of cement with a minimum density of fifteen pounds per gallon.
 - (ii) Type III cement shall be mixed by adding 6.3 to seven gallons of water per ninety-four pounds of cement.
 - (iii) Concrete shall be mixed by adding ninety-four pounds of cement, an equal amount of sand, and no more than six gallons of water with a minimum density of 17.5 pounds per gallon.
 - (iv) Cement 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 six gallons of water with a minimum density of fifteen pounds per gallon.

- (v) Cement grouts shall not have greater than five per cent bentonite added to the total volume of grout required. Bentonite added to cement grout shall be free of any polymers.
 - (b) Cement grouts shall be placed into a well by the conductor pipe pumped or Halliburton method of pressure grouting, or may be gravity poured into a dry hole where no water is present in the well or borehole.
 - (3) Cement grout shall be allowed to set a minimum of twenty-four hours when standard type I and type II cement is used or when calcium chloride has been added to the cement grout. Cement grout shall be allowed to set a minimum of twelve hours when high early type III cement grout is used before drilling operations are resumed.
- (G) Bentonite grout to be used for sealing the annular space in wells or for sealing wells shall conform to the following specifications and be placed in accordance with rule 3701-28-10 of the Administrative Code:
- (1) Bentonite grouts shall meet NSF standard 60 and include:
 - (a) High solids bentonite grout using powdered bentonite for use as drilling fluids.
 - (b) Coarse grade bentonite for mixing as a slurry for pressure grouting the annular space or sealing a well or borehole, or for dry-driven grouting of the annular space.
 - (c) Granular bentonite for dry pouring or dry driving in the annular space or for sealing wells and boreholes.
 - (d) Coarse grade or pelletized bentonite for dry pouring into the annular space or for sealing wells or boreholes.
 - (2) When using bentonite grout, the following requirements shall be met:
 - (a) Bentonite based grout slurries shall be mixed according to the manufacturers recommendations to achieve a minimum solids content of twenty percent bentonite by weight of water. Synthetic organic polymers that meet ANSI/NSF standard 60 may be added to bentonite slurries to suppress hydration of the bentonite particles and shall be mixed according to the manufacturer's recommendations.
 - (b) Bentonite grout slurries shall be placed into the well by pressure grouting using the conductor pipe-pumped, grout displacement, grout-shoe continuous injection, or Halliburton method of pressure grouting.
 - (c) Bentonite grout slurries shall not be used when the total dissolved solids of the water in the annular space to be grouted exceeds fifteen-hundred milligrams per liter of total dissolved solids, unless it is determined that the dissolved iron levels are less than fifteen milligrams per liter, chloride levels are less than five hundred milligrams per liter, and calcium levels are less than five hundred milligrams per liter. Coarse grade or pelletized bentonite shall not be used when the total dissolved

solids of water in the borehole or well exceeds fifteen-hundred milligrams per liter.

- (d) Water used for mixing bentonite grout slurries shall be treated to remove excess minerals from the water that may interfere with the proper hydration of the bentonite.
- (H) Coarse grade and pelletized bentonite to be used for sealing the annular space in wells shall conform to the following specifications:
- (1) When using coarse grade or pelletized bentonite the following requirements shall be met:
 - (a) The total volume of sealing materials used shall not be less than eighty per cent of the total volume required for the space to be filled.
 - (b) Coarse grade or pelletized bentonite shall be poured slowly into the top of the well or dry hole to prevent bridging in the casing or borehole, in accordance with the following procedures:
 - (i) Coarse grade or pelletized bentonite shall be poured over a wire mesh screen to keep the fine bentonite powder from entering the well or dry hole.
 - (ii) Coarse grade or pelletized bentonite shall be poured at a continuous rate no faster than three minutes per fifty pounds.
 - (iii) The pouring process shall be halted intermittently to lower a weighted measuring tape into the well to determine the top of the sealing products and confirm that bridging has not occurred. A tamping device shall be used where possible to break any bridges that may form.
 - (iv) Where the borehole or well is dry, the bentonite must be periodically hydrated with water in accordance with the manufacturer's requirements. Pelletized bentonite shall not be hydrated during the pouring process and may only be dry poured into a dry well or borehole.
 - (c) Fine bentonite particles that accumulate in the shipping container shall not be used except to top off a borehole or well at the ground surface.
 - (I) Clean clay, sand, or gravel may only be used for sealing wells in accordance with the special conditions described in rule 3701-28-17 of the Administrative Code.
 - (J) Other materials may be approved for used as a sealing material or in the annular space as determined by the director to have permeability and sealing characteristics sufficient to protect ground water and public health.
 - (K) Well screens used in unconsolidated or incompetent geologic formations shall meet the following criteria:

- (1) Screens shall be factory manufactured and constructed of steel, fiberglass or thermoplastic and shall meet ANSI/NSF standard 61.
 - (2) Screens shall have uniform openings and sufficient length to provide a recommended entrance velocity of 0.1 feet per second under normal pumping conditions. Screen slot sizes shall be properly sized to facilitate proper well development and maintenance, and minimize the entrance of fine materials into the well.
 - (3) Screens shall provide sufficient column and collapse strength to withstand installation and borehole pressures.
 - (4) With the exception of fiberglass casing, hand drilled holes or slots in casing are not permitted for use as well screens. Cut, torched or burned openings in well casing to construct a screen is also prohibited.
 - (5) Screens shall be attached to permanent primary or secondary well casing by welding, threading, coupling or a K packer. The use of a shale trap to join a screen to casing is prohibited.
 - (6) Screens shall be fitted with a solid cap at the bottom unless the bottom of the screen is joined to additional permanent primary or secondary casing. Screens that are placed by telescoping must have a sealed bottom cap.
- (L) Filter packs and formation stabilizer materials installed in the annular space of wells should consist of particles that are:
- (1) Ninety-five per cent siliceous in composition;
 - (2) Smooth, uniform, well-rounded and free of foreign matter;
 - (3) Properly sized, washed and completely disinfected by liquid sodium hypochlorite prior to installation in the well; and
 - (4) Filter packs and formation stabilizers shall be stored to prevent contamination of the materials prior to placement in the well.
 - (5) Packers and shale traps installed in wells shall be constructed of materials that are approved for use by the department. Lead packers shall not be used in wells.

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