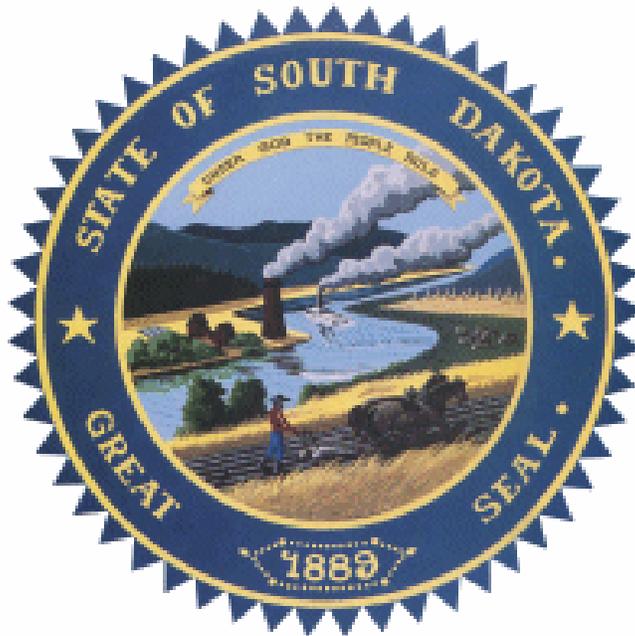


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# WELL CONSTRUCTION STANDARDS STATE OF SOUTH DAKOTA



## Chapter 74:02:04

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**CHAPTER 74:02:04****WELL CONSTRUCTION STANDARDS**

## Section

- 74:02:04:01 to 74:02:04:08 Transferred.
- 74:02:04:09 Repealed.
- 74:02:04:10 to 74:02:04:12 Transferred.
- 74:02:04:13 to 74:02:04:19 Repealed.
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- 74:02:04:21 Permits required before construction of certain wells.
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- 74:02:04:31 Driven well casing to be sealed with bentonite.
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- 74:02:04:34 Locations of aquifers and formations.
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**74:02:04:01. Transferred to § 74:02:04:20.**

**74:02:04:02. Transferred to § 74:02:04:22.**

**74:02:04:03. Transferred to § 74:02:04:41.**

**74:02:04:04. Transferred to § 74:02:04:42.**

**74:02:04:05. Transferred to § 74:02:04:50.**

**74:02:04:06. Transferred to § 74:02:04:51.**

**74:02:04:07. Transferred to § 74:02:04:58.**

**74:02:04:08. Transferred to § 74:02:04:60.**

**74:02:04:09. Requirements for water surface measuring devices.** Repealed.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:09, effective July 1, 1979; repealed, 12 SDR 50, effective September 29, 1985.

**74:02:04:10. Transferred to § 74:02:04:61.**

**74:02:04:11. Transferred to § 74:02:04:64.**

**74:02:04:12. Transferred to § 74:02:04:65.**

**74:02:04:13. Pump installers to make and file pump installation records.** Repealed.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:13, effective July 1, 1979; repealed, 12 SDR 50, effective September 29, 1985.

**74:02:04:14. Pump installers to make and file measuring tube records.** Repealed.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:14, effective July 1, 1979; repealed, 12 SDR 50, effective September 29, 1985.

**74:02:04:15. Additional requirements for artesian wells.** Repealed.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:15, effective July 1, 1979; repealed, 12 SDR 50, effective September 29, 1985.

**74:02:04:16. Requirements for grouting of casing in artesian wells.** Repealed.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:16, effective July 1, 1979; repealed, 12 SDR 50, effective September 29, 1985.

**74:02:04:17. Requirements for placement of screens in artesian wells.** Repealed.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:17, effective July 1, 1979; repealed, 12 SDR 50, effective September 29, 1985.

**74:02:04:18. Requirements for placement of pumps in artesian wells.** Repealed.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:18, effective July 1, 1979; repealed, 12 SDR 50, effective September 29, 1985.

**74:02:04:19. Wells to be constructed to have reasonable life of 20 years.** Repealed.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:19, effective July 1, 1979; repealed, 12 SDR 50, effective September 29, 1985.

**74:02:04:20. Definitions.** Terms defined by SDCL chapters 46-1 to 46-6, inclusive, have the same meanings when used in this chapter. In addition, terms used in this chapter mean:

- (1) "ANSI," American National Standards Institute, Inc.;
- (2) "ASTM," American Society for Testing Materials;
- (3) "AWWA," American Water Works Association;
- (4) "Abandoned well or test hole," a well or test hole whose original purpose and use has been permanently discontinued, which is in such a state of disrepair that its original purpose cannot be reasonably achieved, or which is abandoned pursuant to SDCL 46-6-27;
- (5) "Acidizing," the process of introducing acid into an acid-soluble formation for the purpose of enlarging the pore space by dissolving the surrounding formation, removing encrustants from well screen and gravel pack, and dissolving cemented materials;
- (6) "Adequate well," a well constructed or rehabilitated to allow various withdrawal methods to be used, to allow the inlet to the pump to be placed not less than 20 feet into the saturated aquifer or formation material when the well is constructed, or to allow the pump to be placed as near to the bottom of the aquifer as is practical if the aquifer thickness is less than 20 feet;
- (7) "Adversely impacted domestic well," a well in which the pump intake was set at least 20 feet below the top of the aquifer at the time of construction or, if the aquifer is less than 20 feet thick, is as near to the bottom of the aquifer as is practical and the water level of the aquifer has declined to a level that the pump will no longer deliver sufficient water for the well owner's needs;
- (8) "Annular space," "annulus," the space between two concentric cylinders or circular objects, such as the space between the borehole wall and the casing or between two casings;
- (9) "Approved," acceptable under an applicable standard of this chapter or accepted as suitable for the proposed use by the water management board or chief engineer;
- (10) "Aquifer," a geologic formation, a group of geologic formations, or part of a geologic formation that contains sufficient saturated permeable material to yield quantities of groundwater to wells and springs;
- (11) "Artesian aquifer," a confined aquifer;
- (12) "Artesian pressure," the natural force which causes water in a well penetrating an aquifer to rise above the top of the aquifer and produces flowing wells when the pressure is sufficient to force the water above the land surface;
- (13) "Bedrock," any geologic formation or sediment of Pliocene age or older, including the following formations: Ogallala, Arikaree, Hell Creek, Fox Hills, Niobrara, Codell, Dakota, Inyan Kara, Minnelusa, Madison, and Deadwood;
- (14) "Bentonite," a highly plastic, colloidal clay composed largely of the mineral montmorillonite;

(15) "Bentonite grout," a mixture consisting of a high solids, sodium bentonite material, approved by the chief engineer, which has been commercially manufactured and specially formulated for use as a well casing seal or to plug a borehole or abandoned well;

(16) "Casing," a tubular structure, generally of metal, concrete, or thermoplastic, which is installed in the hole to maintain the well opening;

(17) "Centralizer," a device used to center the casing in the hole;

(18) "Cement grout," a mixture consisting of a high-sulfate-resistant type Portland cement and no more than six gallons of water for each 94-pound sack of cement;

(19) "Cementing," the process of mixing and placing cement grout in a hole to prevent the vertical movement of fluids in the hole or the annulus;

(20) "Clay," a fine-grained inorganic material, less than 0.0002 inches or less than 0.004 millimeters in diameter, which has very low permeability;

(21) "Confined aquifer," "artesian aquifer," an aquifer in which the groundwater is isolated from the atmosphere by geologic formations of low permeability and in which the water levels of wells completed into the aquifer rise above the top of the aquifer;

(22) "Diameter," the commercially designated nominal inside dimension for pipe sizes 1/8 to 12 inches, inclusive, and the outside dimension of pipe 14 inches and larger;

(23) "Drawdown," the difference in levels between the static water level and the pumping or dynamic water level in a well;

(24) "Driven well," a well constructed in an unconsolidated formation by driving the casing from the ground surface to the final casing depth as the well is deepened;

(25) "Geophysical logging," a technique that measures a physical, chemical, or radioactive property of the subsurface, either characteristic of the formation fluid or of the formation in which the fluid occurs, such as resistivity and self-potential logging (electric logging), gamma and neutron logging (radiation logging), caliper logging, temperature logging, and photographic logging;

(26) "Gravel-packed well," a well in which filter material is placed in the annular space to help prevent fine-grain sediments from entering the well and to stabilize the sediments around the well screen;

(27) "Grout," a slurry which is used to form a permanent, impervious seal in the annular space or to fill and seal abandoned holes or wells;

(28) "Heat of hydration," the heat evolved during the setting and hardening of Portland cement or cement grout;

(29) "Horizontal closed-loop system," a continuous length of sealed pipe that is installed in trenches or ditches with the ends connected to a water-to-air heat pump allowing the system to

transfer heat from the ground to the liquid in the pipe or to transfer heat from the liquid to the ground;

(30) "Hydraulic collapse resistance," the capability of well casing to withstand collapsing pressure under external loads;

(31) "Low permeability," permeability of .000001 centimeters per second or less;

(32) "Minimum well," a well that at least meets the provisions of SDCL chapter 46-6 and this chapter;

(33) "NSF," National Sanitation Foundation;

(34) "Observation or monitoring well," a cased well used for measuring groundwater levels or collecting water samples;

(35) "Packer," a device placed in a well for the purpose of sealing an annular space;

(36) "Perforations," a series of openings in a well casing made either before or after installation of the casing to permit the entrance of water into the well;

(37) "Pitless unit" or "pitless adapter," a unit or adapter designed to permit water service pipes to pass through the wall of the well casing below the frostline, to prevent entrance of contaminants, and to provide full access to the water system components within the well;

(38) "Pollution source," anything that causes groundwater pollution, including the following:

(a) Wastes, point source, and pollutant as defined by SDCL 34A-2-2;

(b) Wastewater absorption, evapotranspiration, and graywater systems;

(c) Seepage pits, cesspools, NoDak systems, mounds, and pit privies as described by chapter 74:53:01; and

(d) Barnyards, barn gutters, feedlots, animal pens, and farm silos;

(39) "Portland cement," a substance defined by ASTM standard C150-89 "Standard Specification for Portland Cement";

(40) "Pressure grouting," the positive placement of grout by introducing the grout at the bottom of the void to be grouted;

(41) "psi," a unit of pressure, pounds per square inch;

(42) "Public water supply well," a well that supplies water to one or more of the following:

(a) Water distribution systems as defined by SDCL46-1-6(17);

(b) Community water systems as defined by subdivision 74:04:05:01(3);

- (c) Water supplied from other than a common water distribution system to the public from such facilities as campgrounds, tourist attractions, roadside parks, rest areas, churches, hospitals, nursing homes, schools, or eating, drinking, lodging, and other commercial business establishments or for commercial use as defined by subdivision 74:02:01:01(1) or for manufacturing or industrial operations; and
- (d) Noncommunity water systems as defined by subdivision 74:04:05:01(27);
- (43) "Pump," equipment installed at ground surface or in a well which delivers water from an aquifer or storage unit;
- (44) "Sack of cement," 94 pounds, dry weight, of an approved Portland cement;
- (45) "Saturated material," a material whose openings or pores are filled with water;
- (46) "Sewer lines," buried pipe constructed and tested in compliance with ANSI/AWWA Standard C600-87, C603-90, or C900-89;
- (47) "Specific capacity," well yield in gallons per minute per foot of drawdown;
- (48) "Static water level," the depth to water measured from the ground surface; shut-in pressure measured at the ground surface;
- (49) "Surge," waves of pressure that are either positive, higher than the normal pressure level, or negative, below the normal pressure level;
- (50) "Test hole," a hole designed to obtain information on groundwater quality or geological and hydrological conditions, or both;
- (51) "Test well," a well constructed for aquifer testing;
- (52) "Thermoplastic casing," water well casing made from acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC), or styrene rubber (SR);
- (53) "Till," unstratified glacial sediment consisting of mostly clay and silt as a matrix, with varying amounts of sand, gravel, and boulders;
- (54) "Top of the aquifer," the uppermost point at which saturated conditions are found;
- (55) "Tremie pipe," a pipe that carries grout to the bottom of the hole or well and allows placement of the grout under pressure from the bottom to the top of the hole or well; a pipe that carries gravel pack to the screened area of the well;
- (56) "Unconfined aquifer," "water table aquifer," an aquifer in which the uppermost groundwater surface is at atmospheric pressure;
- (57) "Vertical closed-loop system," a continuous length of sealed pipe that is installed in one or more drill holes for the purpose of utilizing geothermal heat;

(58) "Wastewater system components," septic tank, aerobic system, vault privy, holding tank, sewer lines of tightly jointed tile or equivalent material, or nonconventional systems described or defined by chapter 74:53:01;

(59) "Water/cement ratio," the gallons of mixing water used for each sack of cement;

(60) "Water hammer," a momentary increase in flow or a positive surge in pressure that passes lengthwise along a pipe, usually due to sudden changes in velocity or quantity of fluid in the pipe. **NOTE:** Water hammer in a flowing well can occur when a valve is closed rapidly, causing the moving column of water in the well to suddenly slow or stop. The faster the water column is slowed and stopped, the greater the stress or pressure on the casing, joints, and packers and the greater the disturbance of unstable formation materials near the drill hole;

(61) "Water hammer arresters," engineered mechanical devices having a cushion of air or gas permanently sealed in the unit, designed to provide continuous protection, without maintenance, against water hammer or excessive water surge pressure;

(62) "Water table," the water surface in an aquifer where the pore water pressure is equal to atmospheric pressure;

(63) "Water table aquifer," an unconfined aquifer;

(64) "Well," as defined in SDCL46-1-6(18), with a depth greater than the largest surface dimension;

(65) "Well rehabilitation," restoration of a well to beneficial use by recasing, rebuilding, repairing, and resealing the well to provide for continued use of the well as a water supply, but not cleaning, acidizing, pump removal, or pump repair by itself; and

(66) "Well screen," the intake structure of a well which allows water to enter the well and which helps prevent formation material from entering with the water.

**Source:** SL 1975, ch 16, § 1; transferred from §§ 52:01:02:01 and 52:01:04:01, effective July 1, 1979; transferred from §§ 74:02:02:01 and 74:02:04:01, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-2-9, 46-6-6.1, 46-6-10, 46-6-14, 46-6-18, 46-6-20, 46-6-21, 46-6-27.

**References:** ANSI/AWWA Standards C600-87, "Installation of Ductile-Iron Water Mains and Their Appurtenances," approved June 14, 1987; C603-90, "Installation of Asbestos-Cement Pressure Pipe," approved June 17, 1990, and effective February 1, 1991; and C900-89, "Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution," approved January 29, 1989, and effective July 1, 1989. Published by American Water Works Association, 1987, 1991, and 1989, respectively. Copies may be obtained from American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235. Cost: C600-87, \$12; C603-90, \$8; C900-89, \$12.

ASTM Standard C150-89, "Standard Specification for Portland Cement," approved May 26, 1989. Published by the American Society for Testing and Materials, July 1989. Copies may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. Cost: \$12.

**74:02:04:21. Permits required before construction of certain wells.** Before drilling a well for which a water permit is required, the well owner shall obtain a permit pursuant to SDCL 46-1-15, 46-2A-9, and 46-5-10. Following a request, the chief engineer may authorize construction of a test well prior to approval of a permit. The construction and testing does not constitute construction of works for appropriation of water pursuant to SDCL 46-5-9.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5.

**Law Implemented:** SDCL 46-1-15, 46-2A-9, 46-5-10.

**74:02:04:22. Requirements for all wells.** Sections 74:02:04:20 to 74:02:04:76, inclusive, apply to all wells constructed, rehabilitated, or rebuilt after July 16, 1992.

**Source:** SL 1975, ch 16, § 1; transferred from §§ 52:01:02:02 and 52:01:04:02, effective July 1, 1979; transferred from §§ 74:02:02:02 and 74:02:04:02, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6, 46-6-6.1, 46-6-9, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-2-9, 46-6-6, 46-6-6.1, 46-6-9, 46-6-9.1, 46-6-10, 46-6-11, 46-6-13, 46-6-14, 46-6-15, 46-6-18, 46-6-20, 46-6-21, 46-6-27, 46-6-28.

**74:02:04:23. Intent of South Dakota well construction standards.** The intent of the South Dakota well construction standards is as follows:

- (1) To protect the health of the public;
- (2) To provide water which is both bacteriologically safe and of reasonable quality and quantity for domestic use;
- (3) When water is supplied to the public, to provide water which complies with Drinking Water Standards, Chapter 74:04:05;
- (4) To protect the groundwater resources of the state from bacteriological and chemical contamination and from leakage between aquifers;
- (5) To prevent waste of groundwater;
- (6) To provide minimum well construction standards; and
- (7) To provide for a reasonable life of all wells.

When conflicts develop in interpretation of the South Dakota well construction standards this section will be the basis for settlement of the conflicts.

**Source:** SL 1975, ch 16, § 1; transferred from §§ 52:01:02:02 and 52:01:04:02, effective July 1, 1979; transferred from §§ 74:02:02:02 and 74:02:04:02, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6, 46-6-6.1, 46-6-9, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-2-9, 46-6-6, 46-6-6.1, 46-6-9, 46-6-9.1, 46-6-10, 46-6-11, 46-6-13, 46-6-14, 46-6-15, 46-6-18, 46-6-20, 46-6-21, 46-6-27, 46-6-28.

**74:02:04:23.01. Construction of adequate well required.** Except for monitoring wells, all wells shall be constructed to comply with the definition of an adequate well in subdivision 74:02:04:20(6).

**Source:** 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-1-2, 46-2-5, 46-6-6.1, 46-6-20.

**Law Implemented:** SDCL 46-1-2, 46-2-5, 46-2-9, 46-6-6.1, 46-6-20.

**74:02:04:24. Well locations.** Except for monitoring wells installed to assess the extent of contamination, all wells shall be located as follows:

(1) Wells supplied by aquifers whose top is less than 100 feet deep may be located no closer than 150 feet horizontally from a pollution source, 75 feet horizontally from wastewater system components, or 30 feet horizontally from sewer lines as defined by subdivision 74:02:04:20(46);

(2) Wells supplied by aquifers whose top is more than 100 feet deep may be located no closer than 100 feet horizontally from a pollution source, 50 feet horizontally from wastewater system components, or 30 feet horizontally from sewer lines as defined by subdivision 74:02:04:20(46);

(3) No well constructed to supply water to water distribution systems as defined by SDCL 46-1-6(17) may be located any closer than:

(a) Five hundred feet horizontally from a wastewater treatment plant, wastewater pumping station, hazardous chemical warehouse, bulk petroleum storage facility, bulk fertilizer storage facility, or bulk pesticide storage facility; and

(b) One thousand feet horizontally from a sanitary landfill or dump, wastewater drainage ditch, or wastewater stabilization pond; and

(4) All wells shall be located a minimum of 10 feet horizontally from permanent structures and overhead projections of the structure and 10 feet horizontally from overhead power lines.

Spacing for wells for which water permits are required may be determined individually by the water management board.

Small removable structures or pump houses with roof access may be built over a well.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 34A-2-12, 34A-2-93, 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 34A-2-12, 34A-2-21, 46-6-6.1, 46-6-20, 46-6-27.

**74:02:04:25. Wells to be accessible.** Wells shall be easily accessible for cleaning, repair, disinfection, acidizing, and inspection.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-2-20.

**Law Implemented:** SDCL 46-6-20.

**74:02:04:26. Well construction prohibited along sections of Whitewood Creek and sections of Belle Fourche River -- Variance.** No well that supplies water to the public or supplies water for household domestic use or for agricultural purposes may be constructed in the 100-year flood plain of Whitewood Creek from the Crook City Bridge, above the town of Whitewood, Lawrence County, in the northeast quarter of the northeast quarter of section 33, township 6 north, range 4 east of the Black Hills meridian, downstream to the confluence of Whitewood Creek and the Belle Fourche River, Butte County, in the northeast quarter of the northeast quarter of section 24, township 8 north, range 5 east, and the 100-year flood plain of the Belle Fourche River to two and one-half miles downstream from the confluence of Whitewood Creek, Butte County, in the southwest quarter of the southwest quarter of section 20, township 8 north, range 6 east. A variance may be granted from this section if it is shown that a well in this location will not be contaminated from tailings deposits and will not cause groundwater pollution. The chief engineer or the board shall grant a variance by written order.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 34A-2-93, 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 34A-2-21, 46-6-6.1, 46-6-20, 46-6-27.

**74:02:04:27. Upper well terminal -- Wells in pits prohibited.** The top of the well casing may not terminate in a pit, room, or space that is located below the established ground surface. The top of the well casing or pitless adapter barrel, excluding the well cap or the pitless unit or pitless adapter cap, shall terminate at least 12 inches above the ground surface or pumphouse floor and at least 24 inches above the high-water level where flooding occurs. A pitless unit or pitless adapter with an underground discharge may be used. Positive surface drainage in all directions away from the well shall be provided with a slope of at least one-fourth inch per foot for a distance of at least 10 feet. The well shall be located at least 10 feet from a pit, room, and other below-ground surface space used to locate a pressure tank, pump, and well control equipment. When existing wells located in pits are rehabilitated, the pit shall be eliminated.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-20, 46-6-27.

**74:02:04:28. Minimum grouting requirements for wells -- Exceptions.** The annular space between the wellbore and casing of all public water supply wells and all other wells except those wells described in §§ 74:02:04:31, 74:02:04:35, 74:02:04:36, and 74:02:04:46, shall be pressure-grouted as follows:

(1) All wells completed into confined aquifers shall be pressure-grouted with bentonite grout or cement grout from the top of the producing aquifer to the ground surface or to the base of the pitless unit;

(2) All wells completed into unconfined aquifers shall be pressure-grouted with bentonite grout or cement grout from a depth no more than 4 feet above the top of the aquifer or to a depth of 20 feet below grade, whichever is nearest to ground surface, up to the ground surface or to the base of the pitless unit. Monitoring wells in which the well screen extends above the top of the unconfined aquifer shall be grouted from a depth beginning no more than 4 feet above the top of the well screen or to a depth of 20 feet below grade, whichever is nearest to the ground surface, up to the ground surface or to the base of the pitless unit;

(3) Any permanent casing installed for the purpose of stabilizing the upper wellbore so the drilling of the well can proceed to the intended total depth or any surface casing as required by §§ 74:02:04:35 and 74:02:04:36 must be pressure grouted with cement grout from the bottom to the top.

See Appendix D at the end of this chapter.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992; 31 SDR 62, effective November 8, 2004.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**Notes:** Bentonite manufactured for use as a drilling fluid does not meet the requirements for bentonite grout. The driller should be aware of the limitations inherent in bentonite grout. The low density of bentonite grout may make it inappropriate for use as a grout when higher hydrostatic pressure is required.

Section 74:53:05:02 requires submission of plans and specifications for review and approval prior to construction of wells to supply community water systems defined by subdivision 74:04:05:01(3).

**74:02:04:29. Dakota or Newcastle aquifer and shallower artesian aquifer well grouting requirements.** Repealed.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; repealed, 18 SDR 224, effective July 16, 1992.

**74:02:04:30. Public water supply well grouting requirements.** Repealed.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; repealed, 18 SDR 224, effective July 16, 1992.

**74:02:04:31. Driven well casing to be sealed with bentonite.** The casing for a driven well shall be sealed with bentonite as the casing is driven by pouring dry granular bentonite around the casing at the ground surface. The granular bentonite must be an 8 x 20 mesh or 16 x 60 mesh material. A driven well may not be used as a public water supply well.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**74:02:04:32. Hard rock well construction.** Hard rock wells are defined as wells that do not require casing throughout their entire depth. Hard rock is defined as Precambrian aged rock and igneous or metamorphic rock. The well casing of hard rock wells shall be pressure grouted with cement grout from the bottom of the casing to the ground surface or to the bottom of a pitless adapter or pitless unit, if used. The minimum allowable casing length is 20 feet. If a pitless adapter or pitless unit is used, at least 20 feet of casing must be installed below the pitless adapter or pitless unit.

See Appendix E at the end of this chapter.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**74:02:04:33. Minimum cement grouting requirements for wells finished in bedrock aquifers below Dakota -- Exceptions.** Repealed.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; repealed, 18 SDR 224, effective July 16, 1992.

**74:02:04:34. Locations of aquifers and formations.** The general stratigraphic locations of aquifers and formations are shown on the general stratigraphic correlation chart, Appendix B at the end of this chapter. The general locations of the stratigraphic regions on the chart are found on the map of South Dakota showing major structural features, Appendix C at the end of this chapter.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**Note:** See Appendix A at the end of this chapter for aquifer and formation descriptions and drilling characteristics.

**74:02:04:34.01. Wells producing water from more than one aquifer prohibited.** No well may be constructed to allow production from more than one aquifer unless approved by the chief engineer or the water management board.

**Source:** 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-1-2, 46-2-5, 46-6-6.1, 46-6-10, 46-6-20.

**Law Implemented:** SDCL 46-1-2, 46-2-9, 46-6-6.1, 46-6-10, 46-6-20.

**74:02:04:35. Alternative well construction requirements for certain Dakota aquifer wells.**

The well construction described in this section may be used for private and reasonable domestic use wells and for noncommercial livestock watering wells as an alternative to the construction required by § 74:02:04:28. All other wells, including public water supply wells, shall be constructed as required by § 74:02:04:28. If any of the following requirements cannot be met, the well construction must comply with requirements of § 74:02:04:28. The following alternative well construction may be used to construct wells which are completed into the Dakota aquifer in the Kennedy Basin, Sioux Ridge, the Canadian Shield, and the eastern portion of the Williston Basin if the following requirements are met:

- (1) The drill bit used to drill into the Dakota aquifer is no larger than four and one-half inches in diameter;
- (2) The vertical distance between the ground surface and the top of the Greenhorn formation is more than 300 feet;
- (3) The size of the production casing installed to the top of the production aquifer, below any larger upper casing which is installed to allow installation of a pump is no larger than two inches in diameter and is type K hard copper, schedule 80 thermoplastic, brass, or stainless steel. The casing must be installed in accordance with the manufacturer's recommendations;
- (4) Packers are located above the Dakota as necessary to help form a seal to stop movement of mud, silt, or other aquifer water into the Dakota aquifer well. Packers made from burlap bags, gunny sacks, or similar materials are prohibited. Local conditions may require use of other construction techniques in lieu of packers; however, the well driller shall construct the well to prevent movement of mud, silt, or other aquifer water into the Dakota aquifer well;
- (5) The production casing and packers are not installed unless the weight of the drilling fluid is heavy enough to overcome aquifer pressures;
- (6) If any flow of water at the surface outside the casing does not stop within a reasonable length of time, the well driller shall pressure-grout the upper portion of the casing with cement grout using a tremie pipe to a depth of 300 feet or into unweathered clay or shale, whichever depth is greater;
- (7) Only one casing is placed into the production aquifer of a new well. New wells double-cased into the production aquifer are prohibited. However, if the original casing becomes defective, the well may be rehabilitated by placing new casing inside the old defective casing; and
- (8) In those locations where pressures greater than 50 pounds per square inch at the surface may be encountered in the Dakota aquifer, to assure compliance with § 74:02:04:73, surface casing is installed and pressure-grouted with cement grout to a depth of at least 300 feet or into an unweathered clay or shale formation, whichever depth is greater.

See Appendix F at the end of this chapter.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**Note:** Although this type of well construction may be less expensive, it is more likely to fail than a well constructed and grouted pursuant to § 74:02:04:28. The success of this type of well construction is dependent upon the use of packers or other sealing techniques outside the casing above the Dakota aquifer and the sloughing off of the shale above the Dakota to fill and seal the drill hole annulus outside the casing, preventing movement of water, mud, or silt into the Dakota aquifer well or movement of water on the outside of the casing between aquifers or to the surface. When aquifer pressures above the Dakota are great enough to overcome the Dakota pressure, the success of the well is also dependent upon establishing a packer and shale seal just above the Dakota before the remainder of the annulus toward the surface is sealed. Water may flow outside the casing to the surface for a short period of time until an annulus seal is established even though the well does not produce a flow from the Dakota. If any flow toward the surface is sealed off first, the packer and shale seal may not be established and the well may produce silt or muddy water or water of a different chemical quality.

**74:02:04:36. Alternative well construction requirements for certain Inyan Kara wells.**

Well construction as described in this section may be used for private and reasonable domestic use wells and for noncommercial livestock watering wells as an alternative to the construction required by § 74:02:04:28. All other wells, including public water supply wells, shall be constructed as required by § 74:02:04:28. If any of the following requirements cannot be met, the well construction must comply with the requirements of § 74:02:04:28. The following alternative well construction may be used to construct and complete wells into the Inyan Kara group if the top of the Inyan Kara is more than 1,000 feet below the land surface. The Inyan Kara group includes the Fall River and the Lakota. The alternative well construction may be used if the following requirements are met:

- (1) Surface casing is installed and pressure-grouted with cement grout to a depth of at least 300 feet or into an unweathered clay or shale formation, whichever depth is greater;
- (2) The drill bit used to drill into the production aquifer is no larger than four and one-half inches in diameter;
- (3) The size of the production casing installed below the grouted surface casing down to and the screen installed in the production aquifer is no larger than two inches in diameter;
- (4) The production casing material installed below the surface casing and down to the production formation is type K hard copper, schedule 80 thermoplastic, brass, or stainless steel. The casing may not be installed under conditions that exceed the manufacturer's recommendations;
- (5) Depending upon local conditions, packers and other construction techniques may be used that result in sealing the annulus between the drill hole and the casing above the production aquifer. The well driller shall construct the well to prevent movement of mud, silt, or other aquifer

water into the production aquifer well. Packers made from burlap bags, gunny sacks, or similar materials are prohibited;

(6) The production casing and packers are not installed unless the weight of the drilling fluid is heavy enough to overcome aquifer pressures; and

(7) Only one casing is placed into the production aquifer of a new well. New wells double-cased into the production aquifer are prohibited. However, if the original casing becomes defective, the well may be rehabilitated by placing new casing inside the old defective casing.

See Appendix G at the end of this chapter.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**Note:** Although this type of well construction may be less expensive below the cement-grouted surface casing, it is more likely to fail than a well constructed and grouted pursuant to § 74:02:04:28. The success of this type of well construction is dependent upon the shale above the production aquifer sloughing off and filling and sealing the drill hole annulus outside the casing to prevent movement of high-pressure production aquifer water outside the casing, movement of other aquifer water, mud, or silt into the production aquifer, or movement of other aquifer water between aquifers.

**74:02:04:37. Well driller to correct well defective within one year.** If a well constructed using alternative construction techniques pursuant to §§ 74:02:04:35 and 74:02:04:36 and operated pursuant to written instructions provided by the well driller produces an increase in mud or silt turbidity of 25 or more milligrams per liter in less than one year following completion and satisfactory development pursuant to § 74:02:04:58, the well driller shall correct the problem.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**74:02:04:38. Driller's license required to install closed loop.** A person drilling the holes necessary for installation of a vertical closed-loop system must be a licensed well driller.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**74:02:04:39. Vertical closed-loop installation.** Following installation of piping for the vertical closed loop, the hole shall be filled with bentonite grout from the bottom to the ground surface.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**74:02:04:40. Horizontal closed-loop installation.** All plastic piping used for closed-loop installation must meet or exceed ASTM D2666-89 or ASTM Standard D3035-91 and must be joined by thermal fusion.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**References:** ASTM D2666-89, "Standard Specification for Polybutylene (PB) Plastic Tubing," February 24, 1989, and ASTM Standard D3035-91, "Standard Specification for Polybutylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter," February 24, 1989, published by the American Society for Testing and Materials, D2666-89, May 1989, and D3035-91, August 1991. Copies may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. Cost: \$12 each.

**74:02:04:41. Drill hole construction requirements.** Drill holes must be straight and plumb and must be of sufficient size to allow installation of the casing, centralizers, grout, gravel pack, screen, and pump. The drilling methods must fit the geologic characteristics and conditions at the well site.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:03, effective July 1, 1979; transferred from § 74:02:04:03, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20.

**74:02:04:41.01. Construction water requirements.** Water used for drilling, development, or rehabilitation purposes, other than from the well itself, must be chlorinated clear water containing a free chlorine residual at the time of use.

**Source:** 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-1-2, 46-2-5, 46-6-6.1, 46-6-10.

**Law Implemented:** SDCL 46-1-2, 46-2-9, 46-6-6.1, 46-6-10.

**Note:** Best management practices as defined in subdivision 74:52:01:01(6) should be taken to reduce the potential of chlorinated waters reaching surface waters.

**74:02:04:42. General requirements for well casing.** All casing and casing connections shall be of new materials or of a condition equal to new materials. Casing materials may be thermoplastic, steel, nonferrous metal, fiberglass, precast curbing, or concrete. All casing and screen lengths shall be joined by fittings or methods recommended by the casing manufacturer. Except for well casing described in § 74:02:04:46, the joints must be straight and watertight.

Casing may only be used under conditions that meet manufacturers' recommendations and specifications for its type.

**Source:** SL 1975, ch 16, § 1; transferred from §§ 52:01:02:03 and 52:01:04:04, effective July 1, 1979; transferred from §§ 74:02:02:03 and 74:02:04:04, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-10, 46-6-20, 46-6-27.

**74:02:04:43. Thermoplastic casing requirements.** All thermoplastic casing used for water well casing must meet or exceed ASTM Standard F480-90e and NSF Standard 14 (1990). Thermoplastic well casing five inches in diameter or larger must have a minimum wall thickness of 0.250 inches.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-10, 46-6-20, 46-6-27.

**References:** ASTM Standard F480-90e, "Thermoplastic Water Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR)," July 27, 1990. Published by American Society for Testing and Materials, September 1990. Copies may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. Cost: \$12.

NSF Standard 14 (1990), "Plastics, Piping Components and Related Materials." Published by the National Sanitation Foundation, November 1990. Copies may be obtained from the National Sanitation Foundation, P. O. Box 1468, Ann Arbor, Michigan 48106; Cost: \$20.

**74:02:04:44. Thermoplastic casing installation requirements.** The driller shall be knowledgeable of heat of hydration and thermoplastic hydraulic collapse pressure limits listed in ASTM Standard F480-90e and the "Manual on the Selection and Installation of Thermoplastic Water Well Casing," 1980. When using thermoplastic casing to construct a well, the driller shall install the thermoplastic casing in a manner that does not exceed the casing hydraulic collapse resistance.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-10, 46-6-20, 46-6-27.

**References:** ASTM Standard F480-90e, "Thermoplastic Water Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR)," July 27, 1990. Published by American Society for Testing and Materials, September 1990. Copies may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103; Cost: \$12.

"Manual on the Selection and Installation of Thermoplastic Water Well Casing," 1980. Published by the National Water Well Association and the Plastic Pipe Institute, October 1, 1980.

Copies may be obtained from the National Ground Water Association Bookstore, P.O. Box 182039, Dept. 017, Columbus, OH 43218-2039. Cost: \$15.

**74:02:04:45. Solvent cementing procedures for thermoplastic connections.** Solvent cementing procedures for thermoplastic casing connections shall be as recommended by the casing manufacturer or as stated in the "Manual on the Selection and Installation of Thermoplastic Water Well Casing," 1980. Set times for solvent joints may be shortened by using stainless steel screws in the joints provided the screws do not penetrate to the inside of the casing.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-10, 46-6-20, 46-6-27.

**Reference:** "Manual on the Selection and Installation of Thermoplastic Water Well Casing," 1980. Published by the National Water Well Association and the Plastic Pipe Institute, October 1, 1980. Copies may be obtained from the National Ground Water Association Bookstore, P.O. Box 182039, Dept. 017, Columbus, OH 43218-2039. Cost: \$15.

**74:02:04:46. Precast curbing and concrete casing use limitations.** Precast curbing or concrete casing may be used to construct wells for private and reasonable domestic use, irrigation wells, and noncommercial livestock watering wells. Precast curbing or concrete curbing may not be used for public water supply wells or any other wells which require water permits. When used, construction must meet the following requirements:

(1) The top of the precast curbing or concrete casing shall be covered with a cover with a downward flange which will overlap the edge of the curbing or casing;

(2) The casing must be located deep enough into the saturated aquifer material to allow placement of the pump to meet the definition for adequate wells in subdivision 74:02:04:20(6);

(3) Pressure grouting as required by § 74:02:04:28 must be completed or, as an alternative, the precast curbing or concrete casing may be terminated 10 feet below the ground surface and the terminated casing covered with a concrete or steel cover. A concrete cover must have a hole in the center formed by a short section of pipe 10 inches in diameter or less. The pipe section must be an integral part of the cover and in place when the concrete cover is poured. A steel cover must have a hole in the center with a pipe 10 inches in diameter or less welded over the opening. The cover shall be placed on the terminated casing and the annular space outside the casing below the cover and the cover joint shall be sealed to a depth of no more than 2 feet above the top of the aquifer or to a depth of 20 feet below grade, whichever is nearest to ground surface, by pouring dry granular bentonite into the annular space through a tremie pipe. The space around the pipe extension to the surface shall be filled with bentonite to at least one foot above the cover and with clay or native soil to the ground surface. The pipe extension to the surface and any joints in the pipe must be watertight.

See Appendix G at the end of this chapter.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**74:02:04:47. Pitless unit or pitless adapter requirements.** Pitless units or pitless adapters installed pursuant to this chapter shall be manufactured or shop-fabricated and constructed of materials which provide strength and durability equal to or greater than the well casing. The pitless unit shall be threaded, compression flange gasketed, or welded to form a watertight seal to the well casing. The top of the pitless unit or casing shall be capped with a cover having a downward flange which will overlap the edge of the pitless unit or casing. The cover shall be securely fastened to the pitless unit or casing and shall fit sufficiently snug to the unit or casing to be vermin proof. The cover shall be designed to prevent surface contamination. The design of the adapter or unit shall allow access to disinfect the well and access to measure the static and pumping water level in the well.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-10, 46-6-20, 46-6-27.

**74:02:04:48. Steel casing specifications.** Steel well casing must be at least schedule 40 in accordance with ASTM Standard A53-90b, "Standard Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated, Welded, and Seamless," December 28, 1990, including threads and couplings and plain-end pipe. Examples are in Tables 1 and 2, as follows:

Table 1

Nominal Diameter in inches	Weight in pounds per foot*
1	1.68
1 1/4	2.28
1 1/2	2.73
2	3.68
2 1/2	5.82
3	7.62
3 1/2	9.20
4	10.89
5	14.81

6	19.18
8	29.35
10	41.85
12	51.15

\* Weight includes threads and couplings

Table 2

Nominal Diameter in inches	Weight in pounds per foot**
1	1.68
1 1/4	2.27
1 1/2	2.72
2	3.65
2 1/2	5.79
3	7.58
3 1/3	9.11
4	10.79
5	14.62
6	18.97
8	28.55
10	40.48
12	49.56

\*\* Weight is for plain-end pipe

The well casing must be certified by the manufacturer to meet ASTM Standard A53-90b and may not be mill reject. Casing corrected to meet standards is acceptable.

If steel well casing five inches in diameter or larger will be pressure-grouted with cement grout from the top of the producing formation up to the bottom of the pitless adapter or unit or to the ground surface, casing with a minimum wall thickness of 0.250 inches must be used.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:02:04, effective July 1, 1979; transferred from § 74:02:02:04, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-10, 46-6-20, 46-6-27.

**Reference:** ASTM Standard A53-90b, "Standard Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated, Welded, and Seamless," December 28, 1990. Published by American Society for Testing Materials, February 1991. Copies may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. Cost: \$12.

**74:02:04:49. Copper casing specifications.** Copper casing must be type K hard. Examples are in Table 3, as follows:

Table 3

Nominal Diameter in inches	Weight in pounds per foot
1	0.84
1 ¼	1.04
1 ½	1.36
2	2.06
2 ½	2.93
3	4.00
3 ½	5.12
4	6.51

Types L and M hard copper casing may be used for recasing wells.

Copper casing shall meet or exceed ASTM B88-89, "Standard Specification for Seamless Copper Water Tube," November 10, 1989.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:02:04, effective July 1, 1979; transferred from § 74:02:02:04, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-10, 46-6-20, 46-6-27.

**Reference:** ASTM B88-89, "Standard Specification for Seamless Copper Water Tube," November 10, 1989. Published by American Society for Testing and Materials, December 1989. Copies may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. Cost: \$12.

**74:02:04:50. Requirements for well screens and gravel packs.** Well screens or casing may have openings which are sawed, drilled, punched, rolled, welded, stamped, or made by any means which will control the size of perforations or openings. Installed well casing may be shot-perforated. If gravel pack is used, the screen must be sized and designed to retain 90 percent of the gravel pack material. In naturally developed wells, the screen must be sized and designed to retain 50 percent of the aquifer material. The screen shall be centered in the drill hole. If used, the gravel pack material must be clean material without shale or iron pellets. The driller shall ensure that all well construction materials, including gravel pack, are clean and sanitary prior to placement. The gravel pack material shall be disinfected before being placed in the well or equivalent quantities of chlorine tablets shall be mixed with the gravel pack material and placed in the well. Screen diameters and openings shall be selected so as to accomplish the same purpose as required for wells developed in the natural aquifer materials. If additional filter pack materials are to be added after the well has been completed, those materials shall be installed through a permanent tremie pipe.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:05, effective July 1, 1979; transferred from § 74:02:04:05, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-2-20, 46-6-27.

**Law Implemented:** SDCL 46-6-20, 46-6-27.

**74:02:04:51. Requirements for length and diameter of screens.** The length and diameter of screens or perforated casings shall be sufficient to permit the passage of the water permit or right capacity, with a water velocity through the screen or casing not to exceed one-tenth foot per second.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:06, effective July 1, 1979; transferred from § 74:02:04:06, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5.

**Law Implemented:** SDCL 46-6-6.1, 46-6-9, 46-6-20.

**74:02:04:52. Requirements for centralizers.** Casing centralizers, designed to create minimum obstruction in the annulus, are required at sufficient intervals to center the casing in the drill hole when casing will be grouted. One centralizer is required near the bottom of each size of grouted casing. Centralizer and casing materials must be compatible. Centralizers shall be designed to provide a uniform annulus and to minimize grout channeling and to allow the grout to completely surround the casing.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:02:08, effective July 1, 1979; transferred from § 74:02:02:08, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20.

**Law Implemented:** SDCL 46-6-20.

**74:02:04:52.01. Requirements for packers.** Packers must be of a material that will not deteriorate or impart taste, odors, toxic substances, or bacterial contamination to the water in the well.

**Source:** 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-10, 46-6-20.

**Law Implemented:** SDCL 46-2-9, 46-6-6.1, 46-6-10, 46-6-20.

**74:02:04:53. Cement grout requirements.** Water used in making cement grout must be clean and may not contain oil or other organic material. The cement grouting of the well casing must be completed in one continuous operation. Bentonite may be added to cement grout in quantities not exceeding 2 pounds of bentonite for each 94-pound sack of cement. Up to 7 gallons of water may be mixed for each 94-pound sack of cement when 2 pounds of bentonite are added. Calcium chloride may be added to the cement grout except when the mixture will be used to grout thermoplastic casing.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:02:07, effective July 1, 1979; transferred from § 74:02:02:07, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**74:02:04:53.01. Bentonite grout requirements.** Bentonite material manufactured for use as a drilling fluid does not meet the requirements for bentonite grout. For approval by the chief engineer, bentonite grout must contain a minimum of 20 percent solids by weight and have a minimum slurry density of 9.4 pounds per gallon and must be mixed according to the manufacturer's recommendations.

**Source:** 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**74:02:04:54. Cement grout additives.** Repealed.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; repealed, 18 SDR 224, effective July 16, 1992.

**74:02:04:55. Minimum grout volumes.** The minimum volumes of grout necessary for grouting various casing and drill hole sizes are found in the **Halliburton Cementing Tables**. Voids or cavities require additional grout.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**Reference:** **Halliburton Cementing Tables** issued January 1985. Published by the Halliburton Services. Copies may be obtained from Halliburton Services, Suite 440, 410 17th Street, Denver, CO 80202. Cost: no charge.

**74:02:04:56. Bentonite slurry additive.** Repealed.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; repealed, 18 SDR 224, effective July 16, 1992.

**74:02:04:57. Minimum hole size for grouting.** When grouting is required, the drill hole size must be large enough to allow the casing with centralizers to be pressure grouted from the top of the producing formation up to the bottom of a pitless unit or adapter or to the ground surface.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

**74:02:04:58. Requirements for development of wells.** Wells shall be thoroughly developed by surging, jetting, or any other method which will remove drilling mud or any other aquifer material which will pass through the screen openings or casing perforations. The well shall be developed by the driller until the water is clear and reasonably free of silt, mud, and sand. Completion of public water supply wells and wells for household domestic use shall include disinfection pursuant to AWWA Standard A100-90, "AWWA Standard for Water Wells," January 29, 1990, after installation of the pump.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:07, effective July 1, 1979; transferred from § 74:02:04:07, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-20.

**Law Implemented:** SDCL 46-6-6.1, 46-6-20.

**Reference:** AWWA Standard A100-90, "AWWA Standard for Water Wells," January 29, 1990. Published by American Water Works Association, 1991. Copies may be obtained from the American Water Works Association, 6666 West Quincy Avenue, Denver, Co 80235. Cost: \$17.

**74:02:04:58.01. Disinfection requirements.** Any water supply well constructed, rehabilitated, or rebuilt shall be disinfected with chlorine in a manner outlined in the "Recommended Procedure for Chlorine Disinfection of Water Wells." (See Appendix H at the end of this chapter.) The pump installer is responsible for chlorinating any water supply well upon which the installer works.

**Source:** 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-20.

**Law Implemented:** SDCL 46-1-2, 46-2-9, 46-6-6.1, 46-6-20.

**Note:** Best management practices as defined in subdivision 74:52:01:01(6) should be taken to reduce the potential of chlorinated water reaching surface waters.

**74:02:04:59. Wells in road ditches to be protected.** Observation wells located in road ditches shall be protected by installing a minimum of two steel posts around the well.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-6-20.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20.

**74:02:04:60. Requirements for pump installations.** Requirements for installation of pumps are as follows:

(1) The specific capacity of a well shall be determined by the well driller;

(2) The depth of the pump setting shall be determined by dividing the specific capacity into the required yield and adding at least 10 additional feet to maintain pump inlet submergence below the maximum anticipated drawdown, where possible; and

(3) Wells with a pump capacity of more than 18 gallons per minute and a casing size 8 inches or larger must have at least a one-inch threaded hole and a plug at the top of the well that allows measurement of the water level.

If the driller does not install the pump, the pump installer is responsible for installation of the pump and final disinfection of the well after installation of the pump.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:08, effective July 1, 1979; transferred from § 74:02:04:08, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-20.

**Law Implemented:** SDCL 46-6-6.1, 46-6-20.

**74:02:04:61. Requirements for well and pump capacities.** Domestic use wells shall be sized and the pump capacity or flow limited to the amount of water needed. The pump capacity of a well for which a water permit is required may not be larger than the authorized diversion rate.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:10, effective July 1, 1979; transferred from § 74:02:04:10, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-6-20.

**Law Implemented:** SDCL 46-6-20.

**74:02:04:62. Backflow prevention required for large capacity wells.** All large capacity pumped wells shall be provided with check valves or other approved backflow preventer devices to protect the well from backflow or backsiphonage. When the driller does not install the pump, the pump installer shall install backflow preventer.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-20, 46-6-27.

**74:02:04:63. Water analysis required.** Following completion of any public water supply well or any well for domestic use, a water quality sample shall be collected and submitted to the department of health laboratory or another laboratory approved by the division of environmental regulation, department of environment and natural resources. If the well flows or if the well driller installs the pump, the well driller shall collect and submit the water sample. If the pump is not installed by the well driller, the owner shall collect and submit the water sample. The completed analysis shall be submitted to the division of environmental regulation, office of drinking water, department of environment and natural resources, by the well driller or the owner within 30 days after the submittal of the well completion report. At a minimum, the water sample must be analyzed for nitrate, coliform bacteria, sodium, conductivity, and sulfate. Other parameters may be analyzed for at the option of the well owner or driller.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 34A-3A-3, 46-2-5, 46-6-20.

**Law Implemented:** SDCL 34A-3A-18, 46-6-6.1, 46-6-20.

**Note:** Bacteriological sample bottles may be obtained by contacting the Office of Drinking Water, Division of Environmental Regulation, Department of Environment and Natural Resources, Joe Foss Building, Pierre, SD 57501.

**74:02:04:64. Chief engineer to furnish forms for required records.** Records required by §§ 74:02:04:65, 74:02:04:66, and 74:02:04:71 shall be made on forms furnished by the chief engineer.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:11, effective July 1, 1979; transferred from § 74:02:04:11, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-6-9.

**Law Implemented:** SDCL 46-2-9, 46-6-6, 46-6-6.1, 46-6-11, 46-6-20.

**74:02:04:65. Well drillers to prepare and file well construction records.** A record of water well construction shall be furnished by the driller to the chief engineer and to the well owner. State agencies that construct wells or drill test holes with state-owned equipment may retain their records. The record shall contain the following:

- (1) The name and complete mailing address of the owner;
- (2) The legal description of the well location;
- (3) The completion date;
- (4) The driller's log of geologic formations penetrated plus any geophysical logs;

- (5) The depth of the well;
- (6) The depth of the static water level in the well;
- (7) The size of the drill hole and the method of drilling;
- (8) The length, depth, and size of the casing, changes in size of casing, and type of casing;
- (9) The grout used; the amount, type, slurry weight, and location in the hole of the grout used; and a description of the grouting procedure;
- (10) The packers, their location in the hole, and the type used;
- (11) The length of the screen or casing perforations;
- (12) The location of the top and bottom of the screen, the top and bottom of the aquifer, and the location of multiple screens;
- (13) The screen slot or perforation size;
- (14) The gravel pack and its volume, type, or size;
- (15) The well test that includes specific capacity, static water level, flow, shut-in, pressure or estimate, or actual pump test data if available;
- (16) The type and method of disinfection;
- (17) The date and signature of the license representative; and
- (18) The signature of the well owner.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:04:12, effective July 1, 1979; transferred from § 74:02:04:12, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-9.

**Law Implemented:** SDCL 46-2-9, 46-6-6, 46-6-6.1, 46-6-11, 46-6-20.

**74:02:04:66. Well drillers to prepare and file well rehabilitation record.** A record of water well rehabilitation shall be furnished by the driller to the chief engineer and to the well owner. The record shall contain the following:

- (1) The name and complete mailing address of the owner;
- (2) The legal description of the well location;
- (3) The rehabilitation completion date;
- (4) A description of the condition of the well before rehabilitation and original construction information;

- (5) A description of rehabilitation work completed;
- (6) Recasing information, including type, size, depth, screened or perforated sections, and any grouting completed;
- (7) Well test data, including specific capacity, static water level or flow, shut-in pressure, amount of flow, and pump test data, if available;
- (8) The completion date and signature of the license representative; and
- (9) The signature of owner.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-9, 46-6-20.

**Law Implemented:** SDCL 46-2-9, 46-6-6, 46-6-6.1, 46-6-11, 46-6-20.

**74:02:04:67. Requirements for plugging wells or test holes completed into confined aquifers or encountering more than one aquifer.** All abandoned or forfeited wells or test holes that are completed into confined aquifers or that encounter more than one aquifer must be plugged with bentonite grout if the weight of the bentonite grout column is sufficient to overcome the bottom hole pressure or must be plugged with cement grout placed from the bottom of the well or hole to within eight feet of the ground surface. Cement grout must be placed from eight feet below ground surface to within three feet of the ground surface. The top three feet may be filled with native material. If a pipe cannot be lowered inside the well casing to place grout from the bottom to the top, the well may be plugged by making a tight connection to the top of the casing and pumping a volume of cement grout, sufficient to fill the well, under pressure into the well. Bentonite grout may not be used if the well must be plugged by making a tight connection to the top of the casing and pumping the grout in under pressure. If it cannot be verified that a well's casing was grouted in accordance with this chapter, an effort must be made to plug the annulus from the bottom of the annulus up to the ground surface with the same type of material or materials required for plugging inside the casing.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-9, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-2-9, 46-6-6.1, 46-6-10, 46-6-14, 46-6-18, 46-6-20, 46-6-27, 46-6-28.

**Note:** Bentonite manufactured for use as a drilling fluid does not meet the requirements for bentonite grout. Bentonite grout may be used to plug wells at depths greater than eight feet. The driller should be aware of the limitations inherent in bentonite grout. The low density of bentonite grout may make it inappropriate for use as a plug when higher hydrostatic pressure is required.

**74:02:04:68. Requirements for plugging nonflowing artesian wells or test holes.** Repealed.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; repealed, 18 SDR 224, effective July 16, 1992.

**74:02:04:69. Requirements for plugging wells or test holes completed into unconfined aquifers with only one aquifer encountered.** Wells completed into unconfined aquifers, provided only one aquifer is encountered, may be backfilled with clean sand or gravel to the top of the aquifer. Test holes encountering a single, unconfined aquifer may be backfilled with drill cuttings or clean sand or gravel to the top of the aquifer. Above the aquifer, clay, bentonite grout, or cement grout shall be used for plugging to within at least three feet of the ground surface. If clay is to be used as a backfill material, a minimum of two feet of dry bentonite, bentonite grout, or cement grout must be placed at the top of the aquifer. The top three feet of casing or hole, if not filled with clay, bentonite grout, or cement grout, shall be backfilled with native material. Plugging materials must be added to the well or hole via tremie pipe to any well or test hole less than 16 inches in diameter and to any well or test hole more than 50 feet deep. If it cannot be verified that a well's casing was grouted in accordance with this chapter, an effort must be made to plug the annulus from the bottom of the annulus up to the ground surface with the same type of material or materials required for plugging inside the casing.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-9, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-2-9, 46-6-6.1, 46-6-10, 46-6-14, 46-6-18, 46-6-20, 46-6-27, 46-6-28.

**74:02:04:70. Requirements for plugging other test holes.** Test holes that encounter no water or only low-permeability formations such as clays, shales, and till must be backfilled to restore natural conditions as nearly as possible. Backfill material must be free of contamination and have a permeability equal to or less than the permeability of the formations encountered in the borehole.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-9, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-2-9, 46-6-6.1, 46-6-10, 46-6-14, 46-6-18, 46-6-20, 46-6-27, 46-6-28.

**74:02:04:70.01. Requirements for temporary abandonment of wells.** If verification can be provided that a well was constructed in accordance with this chapter, a well removed from service and not permanently abandoned may be temporarily abandoned by sealing the top with a watertight cap.

**Source:** 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-1-2, 46-2-9, 46-6-6.1, 46-6-18, 46-6-20, 46-6-27.

**74:02:04:71. Well driller to prepare and file well and test hole plugging records.** The record of water well and test hole plugging shall be furnished by the driller to the chief engineer and to the well owner. State agencies that construct wells, drill test holes, and plug their own wells and test holes may retain their records. The record shall contain the following:

- (1) The name and complete mailing address of the owner;

- (2) The legal description of the well or hole location;
- (3) The completion date;
- (4) The casing or hole size, type of well, and well or hole depth;
- (5) A general description of the condition of the well;
- (6) A description of the plugging procedure;
- (7) The grout or material used to plug the well or test hole; and
- (8) The date and the signature of the license representative.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-9, 46-6-20.

**Law Implemented:** SDCL 46-6-6, 46-6-6.1, 46-6-9, 46-6-27.

**74:02:04:72. Pressure regulator valve required on flowing wells.** If the surface pressure, also known as artesian pressure, of any flowing well exceeds 60 psi, the well driller shall install a pressure regulator valve after installing the main control valve, but before installing any flow reducers. Irrigation wells are exempt from this section.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987.

**General Authority:** SDCL 46-2-5, 46-6-6.1.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-14, 46-6-20.

**74:02:04:73. Well driller's responsibilities.** The well driller is responsible for the following:

- (1) Certifying on the well driller's record that the well as constructed is an adequate well according to subdivision 74:02:04:20(6) and the well construction meets well construction standards;
- (2) Informing well owners of well drilling and well construction requirements for a proposed well;
- (3) Initial construction, including construction necessary to control a well that flows, and completion of the well;
- (4) Installing shutoff valves, water hammer arresters, or other equipment to control flowing wells;
- (5) Completion and submission of records; and
- (6) Informing the well owner of plugging requirements.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:02:11, effective July 1, 1979; transferred from § 74:02:02:11, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141,

effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-9, 46-6-20.

**Law Implemented:** SDCL 46-2-9, 46-6-6.1, 46-6-9, 46-6-9.1, 46-6-11, 46-6-20, 46-6-27.

**74:02:04:74. Well owner's responsibilities.** The owner or equitable property holder is responsible for the well from the time the licensed well driller successfully completes the well in compliance with this chapter. The owner or equitable property holder shall keep the well capped or covered, in good repair, and in a sanitary condition. If the well is flowing, the owner or equitable property holder shall control the flow to the amount necessary for reasonable domestic use or to the amount authorized by the water permit or right. The owner or equitable property holder shall shut in the well or reduce the flow to no more than five gallons a minute to prevent freezing when the flowing well is not in use. The owner or equitable property holder may not change the construction to deviate from the requirements of this chapter. If property is leased, the obligations of the owner or equitable property holder which are set in this section may be transferred to the lessee by mutual consent.

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-2-9, 46-6-6.1, 46-6-10, 46-6-14, 46-6-18, 46-6-20, 46-6-21, 46-6-27, 46-6-28.

**74:02:04:75. Variance.** A well driller may request a variance from requirements of this chapter from the chief engineer. The chief engineer may grant a variance for a request that is reasonable in the chief engineer's judgment. The variance may be authorized by telephone with written authorization following by mail.

**Source:** SL 1975, ch 16, § 1; transferred from § 52:01:02:12, effective July 1, 1979; transferred from § 74:02:02:12, 12 SDR 50, effective September 29, 1985; 13 SDR 129, 13 SDR 141, effective July 1, 1987; 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-6.1, 46-6-9, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-2-9, 46-6-6.1, 46-6-9, 46-6-10, 46-6-20, 46-6-27, 46-6-28.

**74:02:04:76. Flowing well construction.** Any well that flows or may flow shall be constructed to allow the completed well to be completely shut off or the flow reduced to no more than 5 gallons per minute to prevent freezing when not in use.

**Source:** 18 SDR 224, effective July 16, 1992.

**General Authority:** SDCL 46-2-5, 46-6-20, 46-6-27.

**Law Implemented:** SDCL 46-6-6.1, 46-6-10, 46-6-20, 46-6-27.

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES  
AQUIFER AND FORMATION DESCRIPTIONS AND  
DRILLING CHARACTERISTICS

Chapter 74:02:04

APPENDIX A

SEE: §74:02:04:34

**Source:** 12 SDR 50, effective September 29, 1985; 13 SDR 129,  
13 SDR 141, effective July 1, 1987.

**APPENDIX A**  
(See § 74:02:04:34)

<b>FORMATION</b>	<b>LITHOLOGY</b>	<b>DRILLING CHARACTERISTICS</b>
Glacial Till	Gray, yellow, brown, or red mixture of sand, gravel, silt, and clay. Can contain boulders of any composition or size.	Variable, often sticky, forming bit balls and mud collars, thin easy drilling sand lenses or very hard boulders.
Glacial sands and gravels	Usually mixture of many rock types and grain sizes. Pebbles with one or more flat or polished sides, broken pieces, and sharp edges are common. May be angular to well rounded.	Fast erratic penetration, low pump pressures, moderate to sharp irregular table chatter.
Loess	Yellow, brown and light-gray, silt and sandy silt. Effervesces in HCL, (can be identical to lake clays or silts).	Sticky, moderate to high pump pressure, even drilling characteristics, no rocks.
Pierre Shale	Black, blocky shale marked at base by black petroliferous oil shale and white bentonite.	Variable penetration, high pump pressure, thickens, drilling mud, forms bit balls and mud collars. Shale will heave if hold kept open for extended period of time.
Niobrara Formation	Light to dark gray-speckled chalk, fizzes violently in HCL.	Rapid penetration, bit may chatter, often lose circulation.
Codell Sandstone	Yellow, white, green, dark-gray fine-grained sandstone; often very hard ironstone concretions at top.	Usually fast easy drilling but occasionally hard due to cementation; low pump pressure.
Carlile Shale	Soft, medium gray shale.	Drills fairly easily except for hard concretion layers,

		often forms mud collars or doughnuts, very sticky, muds up quickly, high pump pressures.
Greenhorn Limestone	White to medium-gray shaley limestone, many Inoceramus Prisms, fizzes violently in HCL.	Usually hard drilling, slow penetration, bit may chatter and snap; can sometimes be cut with drag bit; usually low pump pressure.
Graneros Shale	Light gray splintery shale and dark gray shale with dense concretions.	Medium hard drilling, concretions cause hard table chatter and snapping; medium to high pump pressures.
Dakota Formation Upper Sand Unit	White to light gray sand-stone. Often shaley in southeastern South Dakota; some poorly cemented or uncemented zones.	Usually very fast penetration, low pressure, however, in some cases may be pyrite or silica cemented and be very hard drilling with hard table chatter or snaps, cuttings are fine sand and often remains suspended in mud.
Middle Shaley Unit	Light gray clayey silt with dark-brown pellets.	Drills easily, may ball bit, hole erodes quickly.
Lower Sand Unit	Usually white, fine to medium grained sandstone may be loosely cemented.	Usually fast penetration, low pump pressure, firm even table chatter, cuttings are fine sand and often remains suspended in mud.
Skull Creek Shale	Dark gray to black shale with occasional green glauconite grains.	Medium hard drilling, hard siliceous siltstone near middle of formation.
INYAN KARA GROUP Fall River Formation	White to light-gray sand- stone.	Usually fast drilling.
Fuson Shale	Light-gray to varicolored clayey silt.	Soft drilling, sticky, may ball rock bit
Lakota Formation	White to light-gray sand- stone.	Fast drilling except south of Black Hills where the Minnewasta Limestone may be present.

Morrison Shale	Dark-gray to greenish-gray shale.	Medium drilling, not present east of the Missouri River.
Sundance Sandstone	Light-gray, fine-grained glauconitic sandstone.	Medium hard drilling, not present east of the Missouri River.
Spearfish Formation	Brick-red, clayey silt with beds of white gypsum.	Fast, usually trouble free drilling.
Minnekahta	Light-colored, fine lime- stone.	Moderately-hard drilling, not present east of the Missouri River.
Opeche	Brick-red shale.	Easy drilling, not present east of the Missouri River.
Minnelusa Group	Varied lithology, anhydrite, sand, shales and dolomite.	Moderately-hard drilling, not usually a target for water wells except in periphery of Black Hills.
Madison Group	White- to light-colored limestone with some anhydrite.	Moderately-hard drilling, may be hazardous drilling (lost circulation, cavernous).
Red River Formation	Light-colored limestone and dolomite.	Moderately-hard drilling, may be hazardous drilling due to caverns.
Deadwood Formation	Calcereous cement sand- stone and dolomite, some green shale.	Very hard, slow penetration, seldom drilled.
Sioux Quartzite	Extremely hard, well- rounded quartz sand, silica cemented, occasional pipe-stone beds.	Very slow penetration, usually breaks into small chips or powder.
Miscellaneous Igneous and Metamorphic Rocks	Too variable to discuss in detail.	Variable, usually very hard and brittle.

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

GENERALIZED STRATIGRAPHIC CORRELATION CHART

Chapter 74:02:04

APPENDIX B

SEE: § 74:02:04:34

**Source:** 12 SDR 50, effective September 29, 1985.



DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

MAP OF SOUTH DAKOTA SHOWING MAJOR  
STRUCTURAL FEATURES

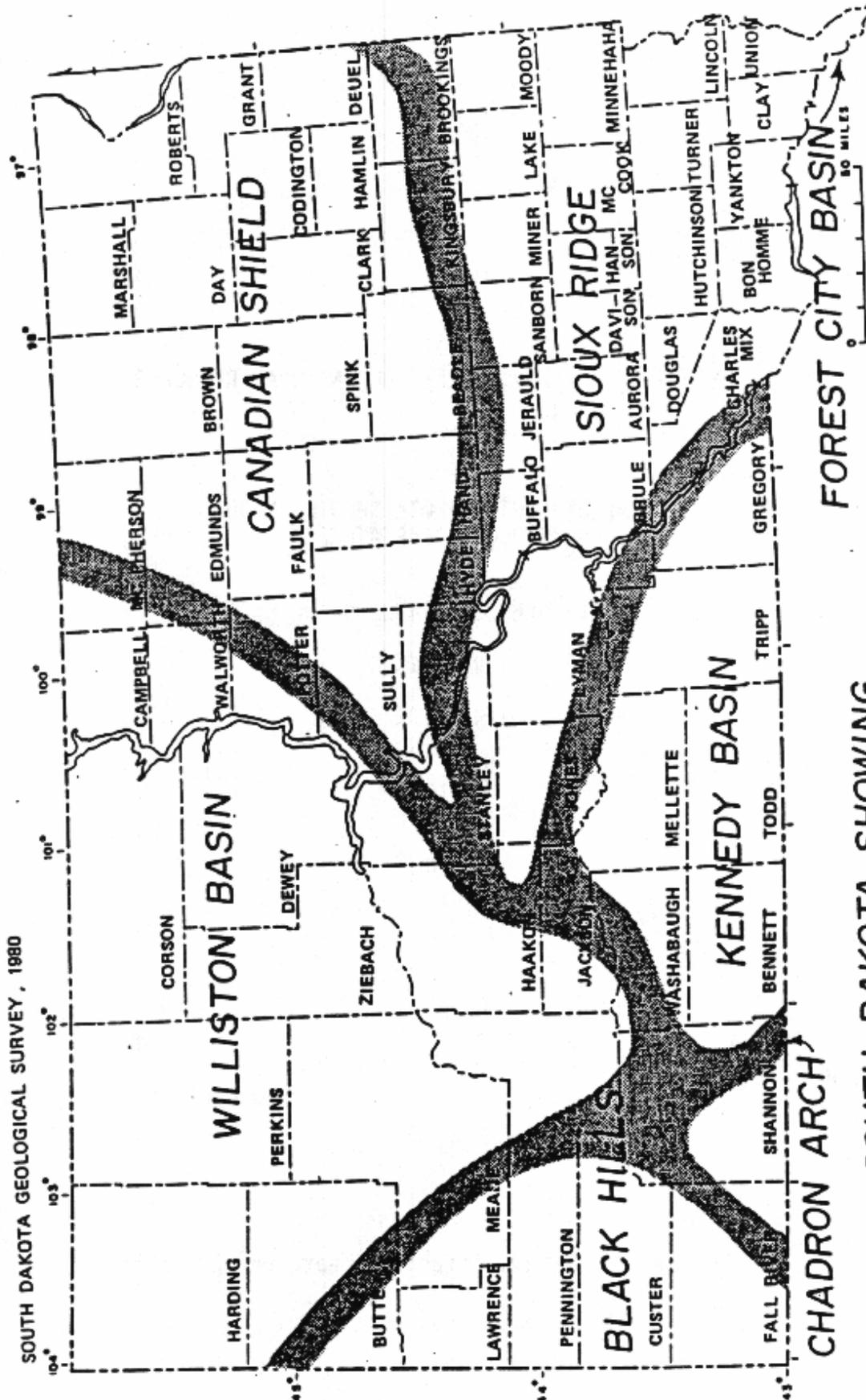
Chapter 74:02:04

APPENDIX C

SEE: § 74:02:04:34

**Source:** 12 SDR 50, effective September 29, 1985.

APPENDIX C



§ 74:02:04: 34

MAP OF SOUTH DAKOTA SHOWING MAJOR STRUCTURAL FEATURES

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

MINIMUM GROUTING REQUIREMENTS FOR WELLS

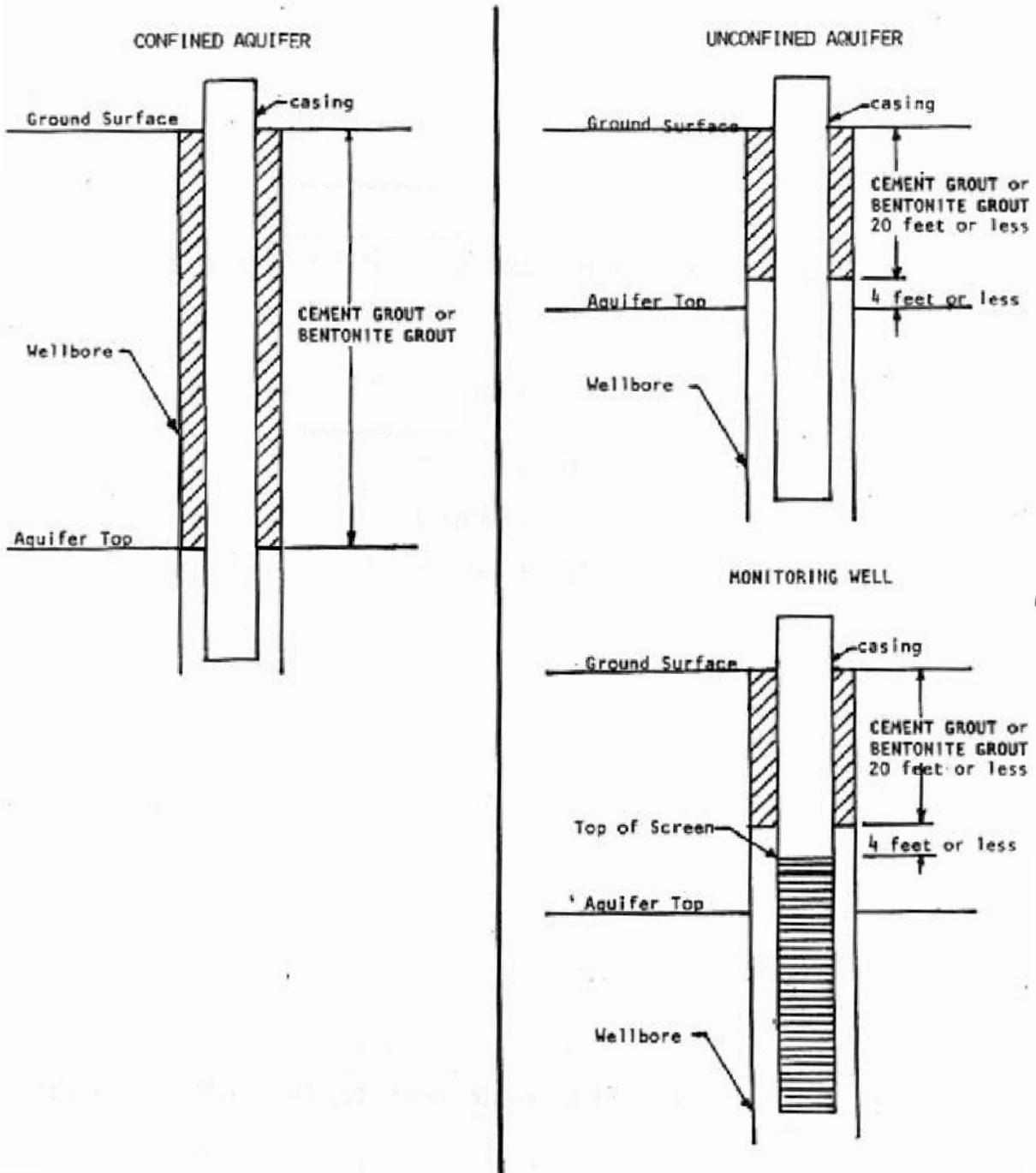
Chapter 74:02:04

APPENDIX D

SEE: § 74:02:04:28

**Source:** 12 SDR 50, effective September 29, 1992; 18 SDR 224, effective July 16, 1992.

APPENDIX D  
SECTION 74:02:04:23 MINIMUM GROUTING REQUIREMENTS FOR WELLS.



DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

HARD ROCK WELL CONSTRUCTION

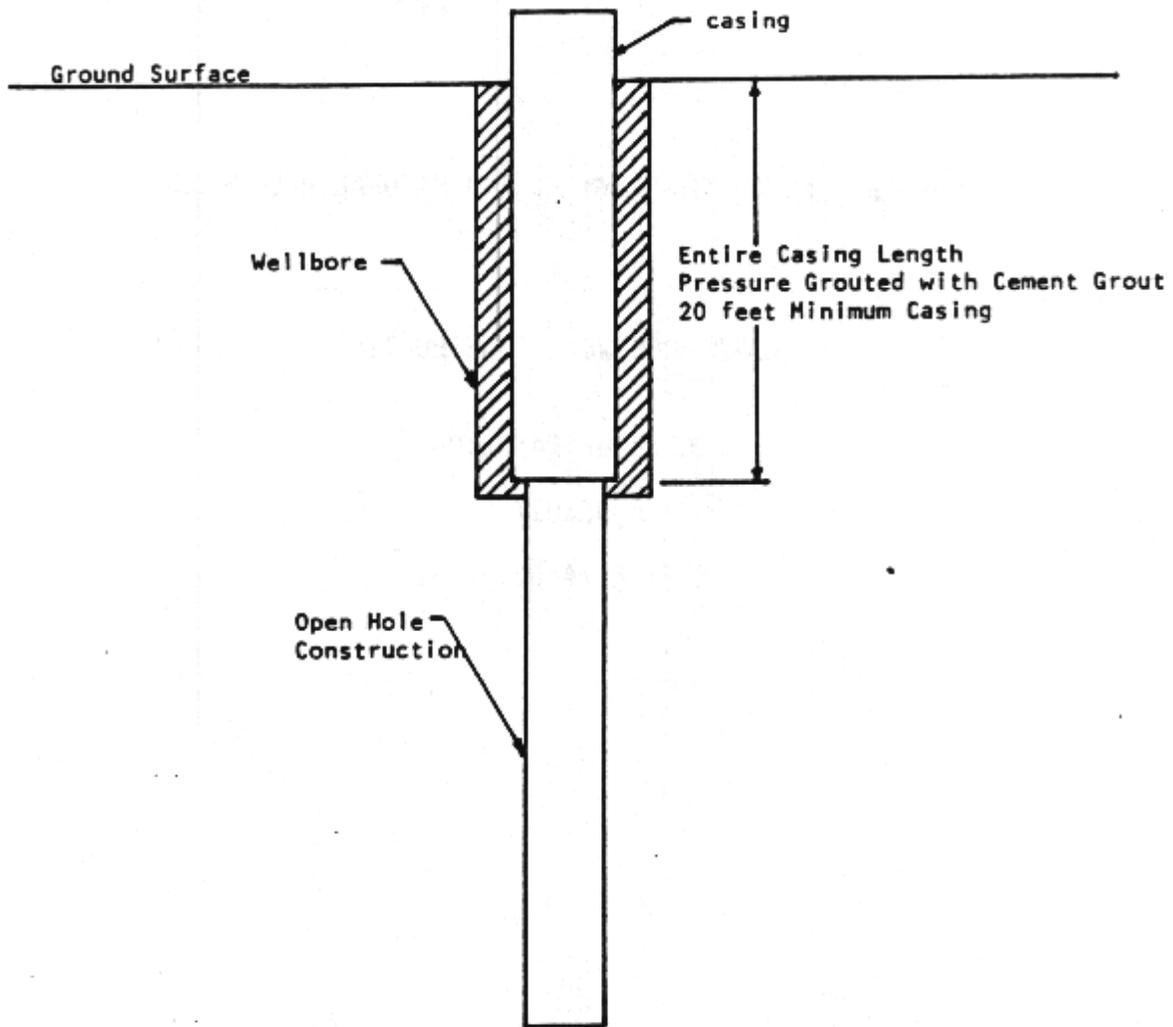
Chapter 74:02:04

APPENDIX E

SEE: § 74:02:04:32

**Source:** 12 SDR 50, effective September 29, 1985; 18 SDR 224, effective July 16, 1992.

APPENDIX E  
SECTION 74:02:04:32 HARD ROCK WELL CONSTRUCTION.



DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

ALTERNATIVE WELL CONSTRUCTION FOR  
CERTAIN DAKOTA AQUIFER WELLS

Chapter 74:02:04

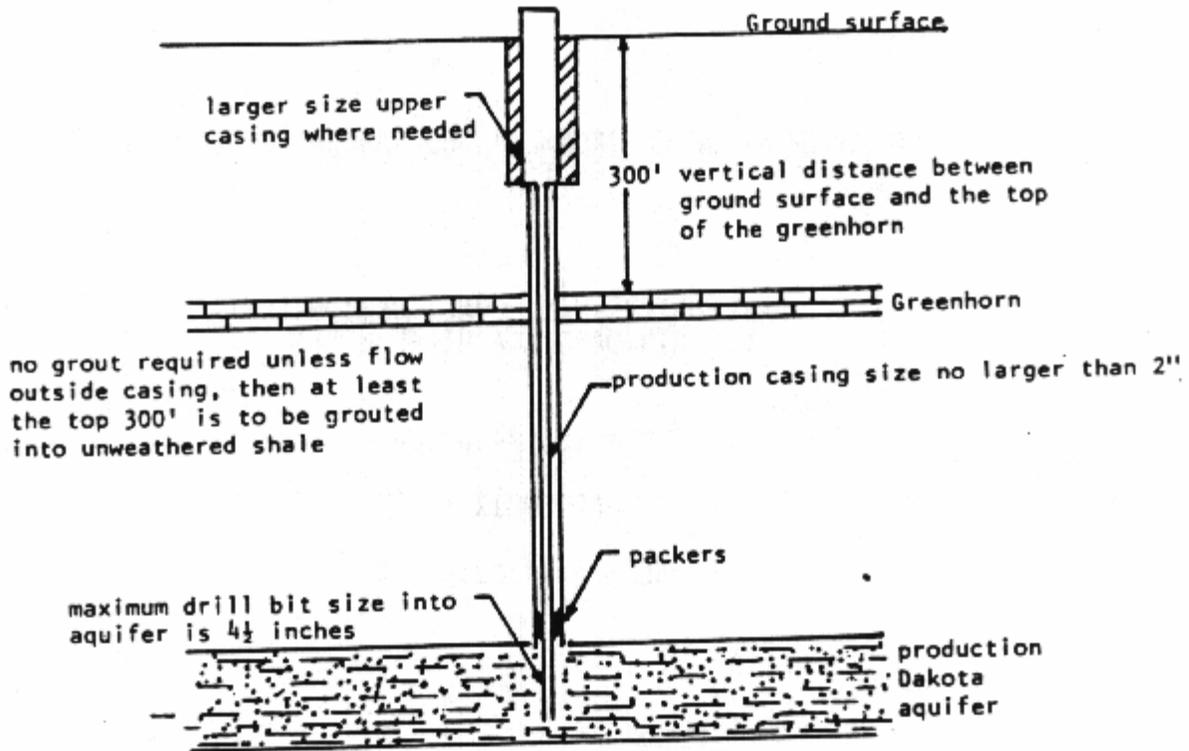
APPENDIX F

SEE: § 74:02:04:35

**Source:** 12 SDR 50, effective September 29, 1985; 18 SDR 224, effective July 16, 1992.

APPENDIX F

SECTION 74:02:04:35 ALTERNATIVE WELL CONSTRUCTION FOR CERTAIN DAKOTA AQUIFER WELLS



Where pressures greater than 50 psi at the surface may be encountered at least 300' of surface casing must be cement grouted into unweathered shale as required

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

ALTERNATIVE WELL CONSTRUCTION FOR  
CERTAIN INYAN KARA WELLS  
AND  
PRECAST CURBING AND CASING USE LIMITATIONS

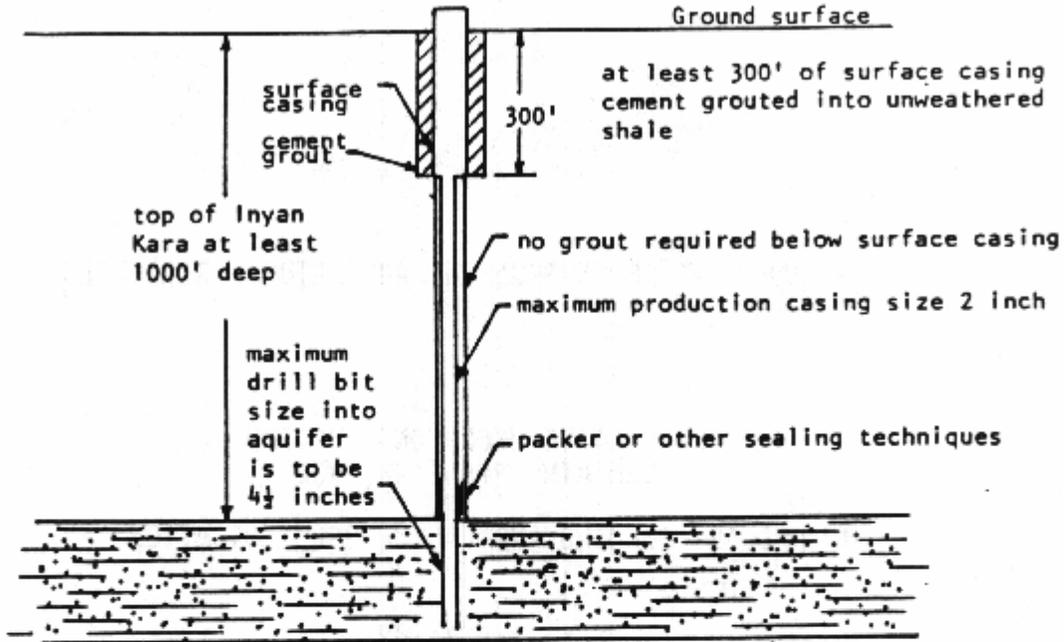
Chapter 74:02:04

APPENDIX G

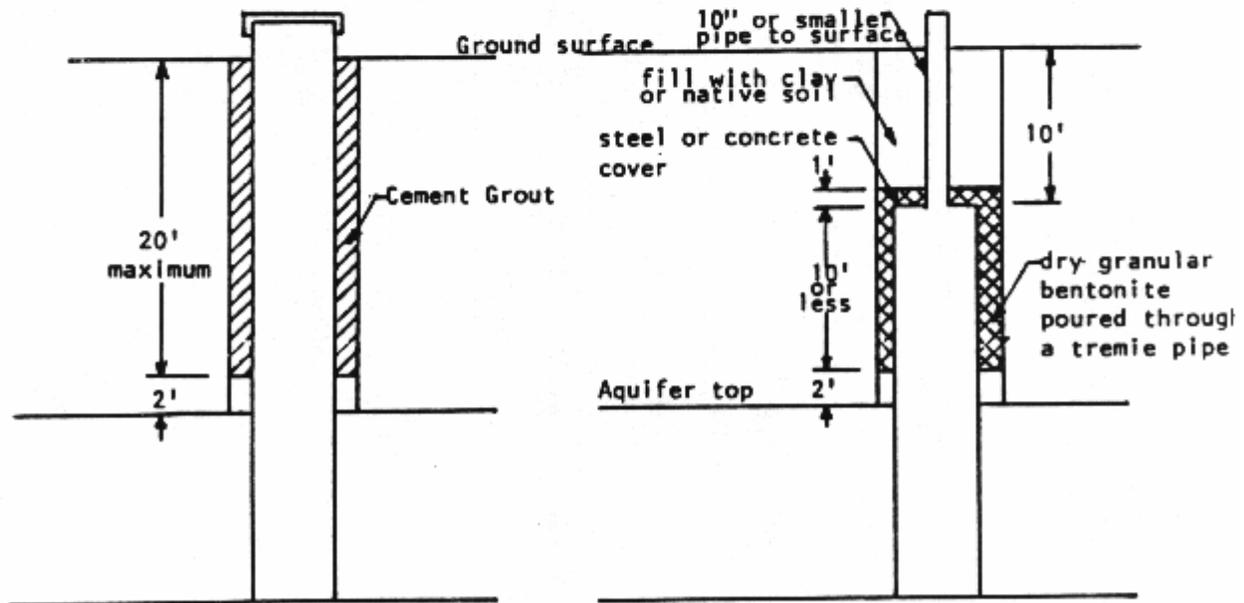
SEE: §§ 74:02:04:36 and 74:02:04:46

**Source:** 12 SDR 50, effective September 29, 1985; 18 SDR 224, effective July 16, 1992.

APPENDIX G  
SECTION 74:02:04:36 ALTERNATIVE WELL CONSTRUCTION  
FOR CERTAIN INYAN KARA WELLS,



SECTION 74:02:04:46 PRECAST CURBING AND CASING USE LIMITATIONS.



DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

RECOMMENDED PROCEDURE FOR CHLORINE  
DISINFECTION OF WATER WELLS

Chapter 74:02:04

APPENDIX H

SEE: § 74:02:04:58.01

**Source:** 18 SDR 224, effective July 16, 1992.

APPENDIX H  
(See § 74:02:04:58.01)

RECOMMENDED PROCEDURE FOR CHLORINE DISINFECTION OF WATER WELLS \*

**Introduction**

A water well should be thoroughly cleaned and disinfected with a strong chlorine solution after:

- |                              |  |
|------------------------------|--|
| 1. ORIGINAL CONSTRUCTION     | 4. A PERIOD OF NONUSE  |
| 2. ANY REPAIR OR MAINTENANCE | 5. TWO OR MORE "UNSAFE" WATER BACTERIOLOGICAL SAMPLES ARE TRACED TO THE WELL |
| 3. FLOODING                  |  |

Adequate chlorine requires a certain chlorine dosage for a minimum contact time - 100 parts per million for 2 hours, 50 parts per million for 8 hours, or 25 parts per million for 24 hours.

Chlorine for disinfection of water wells can be either 5.25% sodium hypochlorite solution or 65% calcium hypochlorite powder. A 5.25% hypochlorite solution is common household chlorine bleach such as "Hilex," "Chlorox," or "Purex" available at grocery stores and supermarkets. The 65% calcium hypochlorite powder is available from chemical supply houses and is known commercially as "HTH," "Perchloron," or "Pittchlor."

**Recommended Procedure**

- 1 Determine the chlorine dosage for the desired contact time from the following tables:

**AMOUNT OF CHLORINE NECESSARY PER 10 FEET OF WATER IN WELL**

**5.25% Sodium Hypochlorite (Bleach)**

Inside Diameter of Well Casing	100 ppm* for 2 hrs	50 ppm* for 8 hrs	25 ppm* for 24 hrs
1 1/4 inches	1/8 fl.oz.	-----	-----
2 inches	1/2 fl.oz.	1/4 fl.oz.	1/8 fl.oz.
3 inches	1 fl.oz.	1/2 fl.oz.	1/4 fl.oz.
4 inches	1 1/2 fl.oz.	3/4 fl.oz.	3/8 fl.oz.
6 inches	4 fl.oz.	2 fl.oz.	1 fl.oz.
8 inches	7 fl.oz.	3 1/2 fl.oz.	1 3/4 fl.oz.
10 inches	10 fl.oz.	5 fl.oz.	2 fl.oz.
12 inches	2 cups	1 cup	1/2 cup
18 inches	4 1/2 cups	2 1/4 cups	1 1/8 cups

24 inches	7 1/2 cups	3 3/4 cups	1 7/8 cups
36 inches	17 1/2 cups	8 3/4 cups	4 3/8 cups

**65% Calcium Hypochlorite**

100 ppm* for 2 hrs	50 ppm* for 8 hrs	25 ppm* for 24 hrs
-----	-----	-----
-----	-----	-----
-----	-----	-----
-----	-----	-----
1/4 oz.	1/8 oz.	1/16 oz.
1/2 oz.	1/4 oz.	1/8 oz.
3/4 oz.	3/8 oz.	1/16 oz.
1 oz.	1/2 oz.	1/4 oz.
1 1/2 oz.	1 1/4 oz.	5/7 oz.
4 1/2 oz.	2 1/4 oz.	1 1/8 oz.
10 oz.	5 oz.	1 1/2 oz.

\* ppm = parts per million  
8 fluid ounces = 1 cup

1 heaping tablespoon of 65%  
chlorine powder = 1/2 oz

2. Prepare a chlorine solution, lift well pump, and pour the chlorine solution into the well.
  3. Lower the pump and operate until a chlorine odor is noticed at all discharge points.
  4. Leave the chlorine and water solution in the well for the recommended contact time. **Do not** use the water.
  5. At the end of the contact time, pump the well to waste until the chlorine odor cannot be detected. **DO NOT ALLOW CHLORINATED WATER TO ENTER A RIVER, LAKE, OR STREAM.**
  6. Pump the well for a considerable period of time, collect a bacteriological water sample, and submit it for testing.
- Reference - AWWA A 100-90, "AWWA Standard for Water Wells," January 29, 1990. Published by American Water Works Association, 666 West Quincy, Denver, CO 80235