Secretary of State
Certificate and Order for Filing

PERMANENT ADMINISTRATIVE RULES

I certify that the attached copies* are true, full and correct copies of the PERMANENT Rule(s) adopted on September 24, 2001 by the
Date prior to or same as filing date.

Water Resources Commission
Agency and Division

690
Administrative Rules Chapter Number

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to become effective November 15, 2001 Rulemaking Notice was published in the March, 2001 Oregon Bulletin.**
Date upon filing or later Month and Year

RULEMAKING ACTION

List each rule number separately, 000-000-0000.

ADOPT:
Secure approval of rule numbers with the Administrative Rules Unit prior to filing.

See attachment

AMEND:

See attachment

REPEAL: N/A

enumber: Secure approval of rule numbers with the Administrative Rules Unit prior to filing.

Amend and Renumber: Secure approval of rule numbers with the Administrative Rules Unit prior to filing.

ORS 536.027, 536.090 & 537.505-537.795
Stat. Auth.: ORS

Other Authority

ORS 536.090 & 537.505 - 537.795
Stats. Implemented: ORS

RULE SUMMARY

The rules in OAR Chapter 690, Division 200 through 240 pertain to well construction activities. The rule changes approved by the Water Resources Commission address new well drilling technology that has been developed. The rules will improve readability and increase the ease of use by the pubic. Minor modifications occur throughout the rules in order to correct grammatical mistakes, add clarity to the existing rules and delete outdated information.

In addition to the aforementioned items, the rules address the following: (1) Well identification labeling, to clarify the level of enforcement for non-compliance and acceptable label attachment methods; (2) Abandonment of old wells within setback distances, clarifying ORS 537.775(3); (3) Drilling while under suspension, clarifying that onsite supervision must be provided by a licensed well driller; (4) Clarifying that monitor well vaults must be designed to prevent surface water from entering the vault; and (5) Clarify how bentonite may be used during the sealing of wells..

Authorized Signer — Date 11/15/01

*Copies include a photocopy of this certificate with paper copy of each rule listed in the Rulemaking Action.
**The *Oregon Bulletin* is published on the 1st of each month and updates the rule text found in the Oregon Administrative Rules Compilation. Notice forms must be submitted to the Administrative Rules Unit, Oregon State Archives, 800 Summer Street NE, Salem, Oregon 97310 by 5:00 p.m. on the 15th day of the preceding month unless this deadline falls on a Saturday, Sunday or legal holiday when Notice forms are accepted until 5:00 p.m. on the preceding workday.

Oregon Administrative Rules Affected in Rule Revision
Chapter 690

Adopted
690-200-0048
690-215-0016
690-215-0045
690-215-0055
690-220-0035
690-240-0011
690-240-0014
690-240-0016
690-240-0024
690-240-0026
690-240-0082
690-240-0139

Amended
690-200-0005
690-200-0020
690-200-0025
690-200-0027
690-200-0030
690-200-0040
690-200-0050
690-205-0005
690-205-0010
690-205-0020
690-205-0025
690-205-0030
690-205-0040
690-205-0050
690-205-0060
690-205-0070
690-205-0080
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690-210-0390
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690-210-0420
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690-240-0155
690-240-0160
690-240-0165
690-240-0170
690-240-0180

Repeal
690-210-0020

Renumbered
690-210-0110 to 690-200-0047

Amend and Renumber
690-210-0015 to 690-200-0021
690-210-0040 to 690-200-0041
690-210-0050 to 690-200-0042
690-210-0080 to 690-200-0043
690-210-0090 to 690-200-0046
690-210-0120 to 690-210-0155
690-240-0140 to 690-240-0006

OREGON ADMINISTRATIVE RULES
WATER RESOURCES DEPARTMENT
CHAPTER 690
DIVISION 210

WELL CONSTRUCTION STANDARDS

Water Supply Well Construction

690-210-0005
Standards Apply to all Methods of Water Supply Well Construction

(1) The following well construction standards apply to all methods of water supply well construction. The methods include, but are not limited to, drilling, driving, jetting, boring, and digging.

(2) Horizontal and Remediation wells shall be constructed under special standard approval only as described in OAR **690-200-0021** [~~690-210-0015~~].

(3) Additional standards will apply to some methods as specified in the following regulations.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

~~**[690-210-0015**~~
~~**Special Standards**~~

~~(1) Site conditions may require specific design, construction, and abandonment procedures that differ from the water supply well construction rules. Site conditions may not permit adherence to minimum well setback distances. Alternative technologies not addressed in these rules may also exist which could be effectively utilized in the construction of a water supply well. The bonded constructor must request in writing, and receive written approval from the Director to use methods or materials that do not meet water supply well construction standards prior to completion or abandonment of the well. A bonded water supply well constructor may obtain an oral approval from the Department. If a oral approval is granted, the written request must be submitted to the Department either within three working days of the date of oral approval or prior to the completion of the associated work. Failure to submit a written request as described above may void the prior oral approval. The proposed methods or materials shall provide at least the same level of resource protection as that which is provided by these rules.~~

~~(2) The written request for special standards shall include:~~

~~(a) Name and license number of the bonded water supply well constructor;~~

~~(b) Location of the well by township, range, section, tax lot number, and 1/4, 1/4 section;~~

~~(c) Name and address of the project site;~~

~~(d) The distance to the nearest well and septic tank or drainfield;~~

~~(e) The reasons that conformance to the rules and regulations for water supply wells cannot be met;~~

~~(f) A diagram and written description showing the proposed water supply well design, construction, or abandonment; and~~

~~(g) The start card/well identification number, if [applicable] assigned.]~~

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

~~[690-210-0020~~
~~**Regulations of Other Agencies May Also Apply**~~
~~Certain wells constructed under these rules may not produce water of suitable quality for use as public, community, municipal, or public utility supplies. Regulations administered by other agencies may apply in addition to those in this Chapter (see Appendix 1).]~~

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0030
Placement of Water Supply Wells

(1) No person shall construct a **water supply** well within 50 feet of any septic tank; 100 feet of a septic drainline or sewage disposal **structure or facility** [~~area~~]; 50 feet of a closed sewage or storm drainage system **(except those in or underneath a building)**; 50 feet of a confined animal feeding or holding **area;** [~~operation or~~] **50 feet of any** animal waste holding **area such as a** pond[~~,~~]**or** lagoon; [~~other animal waste storage site~~;] 100 feet of any sewage sludge disposal area; or 500 feet of a hazardous waste storage, disposal or treatment unit without written permission of the Director. Rain water gutter downspouts and drains are exempt from the above setback requirements. The constructor should consider whether greater distances are required for the protection of the ground water depending on the topography and local geology.

(2) A new **water supply** well may be constructed at the site of an abandoned septic tank or drain field one year after the septic tank or drain field is taken out of use. The abandoned septic tank shall be pumped by a DEQ licensed sewage disposal business to remove all contents. Following pumping, the tank shall be filled with reject sand, bar run gravel or other material approved by the on site sub-surface sewage permitting agent. The delivery line between the building and the tank shall be permanently capped or filled with cement grout. ~~[In no event shall a]~~ **A water supply shall not be** [~~well be~~] constructed through an abandoned septic tank or **septic** drain line. The new **water supply** well shall be located to meet other setbacks as directed in section (1) of this rule.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

~~[690-210-0040~~
~~**Water Used Must be Potable**~~
~~All water used in the construction, alteration, repair or abandonment of well shall be potable.]~~

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

~~[690-210-0050~~
~~**Organic Materials**~~
~~Organic materials which foster or promote undesired organic growth or have the potential to degrade water quality shall not be employed in the construction of a well. This includes but is not limited to brans, hulls, grains, starches and proteins.~~]

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0060
Explosives

(1) If explosives are used in the construction of a **water supply** well, their use must be reported on the well report [~~form (well log)~~]. [~~Information which shall be included is~~] The type and amount of explosive**(s)** used **shall be reported.**

(2) In no case shall explosives other than commercially developed gun perforators be detonated inside the well casing or liner pipe without written permission from the Director. The request shall include the type of explosive to be used, how **it** [~~they~~] will be placed, and where **it is** [~~they are~~] to be placed. In no case shall an explosive charge be dropped down a well or used to sever installed well casing or liner pipe.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0065
Hydrofracturing

(1) If the **water supply** well is hydrofractured, the constructor shall so note on the well report. Information reported shall include methods and materials used, maximum pressure exerted on the formation, location of packers, **initial and final static water level figures,** as well as initial and final yield figures.

(2) In no case shall hydrofracturing allow commingling of waters within the well bore.

(3) The well shall not be hydrofractured within 20 feet of the bottom of the existing well casing.

(4) Clean sand or other materials **(propping agents)** [~~propants~~] approved by the Department may be injected into the well to hold the fractures open when the pressure is removed.

(5) All tools and **propping agents** [~~propants~~] shall be disinfected prior to placement into the well.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0070
Injection Wells

No **water supply** well subject to these rules shall be used for the injection of surface or ground waters, or chemically or thermally altered waters, unless the injection installation, well design, and receiving formations are approved by the Water Resources Department. For additional regulations on the use of wells for injection purposes, contact the Oregon Department of Environmental Quality.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

~~[690-210-0080~~
~~**Commingling of Waters**~~
~~In no case shall a well be constructed to allow commingling or leakage of groundwater within an individual well by gravity flow or artesian pressure from one aquifer to another. See definition of aquifer.]~~

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

~~[690-210-0090~~
~~**Perched Groundwater**~~
~~Wells drawing water from perched zones must be constructed to prevent the waste of this type of groundwater.~~]

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0100
Mineralized or Contaminated Ground Water
All formations which yield contaminated or mineralized water shall be adequately cased and sealed off [~~so as~~] to prevent contamination of the overlying or underlying water-bearing zones.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

~~[690-210-0110~~
~~**Unattended Wells**~~
~~All wells when unattended during construction shall be covered to protect public health and safety.~~]

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

~~[690-210-0120~~
~~**Additional Standards for Artesian Wells**~~
~~(1) Wells penetrating into an artesian aquifer shall have an upper drillhole four inches greater in diameter than the nominal diameter of the permanent well casing. Watertight unperforated casing shall extend and be sealed at least five feet into the confining formation immediately overlying the artesian water-bearing zone. In all cases, a minimum of 18 feet of casing and casing seal will be required. If cement grout is placed by a suitable [pump] from the bottom of the casing (Methods A, B, and D, in Appendix 3 and Figure 1), the diameter of the upper drillhole shall be at least two inches larger than the nominal diameter of the casing.~~
~~(2) When artesian pressures are encountered in the absence of a confining formation, casing and casing seal requirements shall be determined by the Director upon written application.~~
~~(3) If a well flows at land surface, the well shall be equipped with a watertight mechanical cap, threaded or welded, and a control valve, so that all flow of water from the well can be completely stopped.~~
~~(4) All flowing artesian wells shall be equipped with a pressure gauge placed on a dead-end line. A petcock valve shall be placed between the gauge and well casing. (See Figure 10, 1986)~~
~~(5) All flowing artesian wells shall be tested for artesian shut-in pressure in pounds per square inch and rate of flow in cubic feet per second, or gallons per minute, under free discharge conditions. This~~

~~data shall be reported on the well report.~~

~~Stat. Auth.: ORS Ch. 183, 536, 537 & 540~~

690-210-0130

Sealing of Water Supply Wells in Unconsolidated Formations Without Significant Clay Beds

[~~(1)~~] **Water supply** wells drilled into unconsolidated water-bearing strata overlain by unconsolidated materials, such as sand, silt, or gravel, without significant clay beds, shall have a watertight, unperforated well casing extending **to a minimum of eighteen (18) feet below land surface.** [~~at least five feet below the top of the water table. If the water table is 13 feet or less below land surface, a watertight, nonperforated, permanent well casing shall extend to a minimum depth of 18 feet.~~] An upper oversize drillhole, four inches greater in diameter than the nominal diameter of the casing, shall be constructed to a minimum depth of 18 feet. To prevent caving, a temporary surface casing, at least 18 feet in length, shall be used throughout the construction of the annular seal space. **The annular space between the permanent well casing and the upper, oversize drillhole shall be completely full of grout in accordance with OAR 690-210-0310 through OAR 690-210-0360 after the permanent well casing is set into final position. The temporary surface casing shall be removed from the well as the annular space is filled. (See Figure 210-1)**

[~~(2) The annular space between the permanent well casing and the temporary surface casing or drillhole wall shall be completely filled and sealed from a depth of at least 18 feet to land surface with grout in accordance with OAR 690-210-0300 through 690-210-0360 after the permanent well casing is set into its final position. The temporary surface casing shall be removed as the annular space is filled with grout. (See Figure 3.)~~]

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0140

Sealing of Water Supply Wells in Unconsolidated Formations with Significant Clay Beds

Water supply wells drilled into water-bearing strata overlain by unconsolidated deposits of clay, or sand and gravel in which significant interbeds of clay are present, shall have a watertight, nonperforated, permanent well casing extending at least five feet into a clay or other impermeable stratum overlying the water-bearing zone. In all cases, an upper oversize drillhole, at least four inches greater in diameter than the nominal diameter of the permanent well casing shall be constructed to this same depth. In the event that the subsurface materials penetrated by the upper drillhole cave, or tend to cave, an outer, temporary surface casing shall be used to case out caving materials throughout the construction of the oversize drillhole. If the clay or other impermeable stratum is 13 feet or less below land surface, the watertight, nonperforated well casing and the upper, oversize drillhole shall extend to a minimum depth of 18 feet below land surface. If necessary to complete the well, the single, permanent well casing may be extended below the required sealing depth prior to sealing the well with grout. If preferred, a smaller diameter casing, liner, or well screen may be installed. The annular space between the permanent well casing and the upper, oversize drillhole shall be completely **full of** ~~[filled with]~~ grout in accordance with OAR 690-210-0310 through 690-210-0360

after the permanent well casing is set into final position. The temporary surface casing shall be removed from the well as the annular space is filled. (See Figure **210-2** [4].)

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0150
Sealing of Water Supply Wells in Consolidated Formations

(1) **Water supply** wells drilled into a water-bearing rock formation overlain by clay, silt, sand, gravel, or similar materials, shall be constructed in accordance with one of the following methods:

(a) Method 1 **(Continuous Seal):** An upper drillhole, four inches greater in diameter than the nominal diameter of the permanent well casing to be installed, shall extend from land surface to at least five feet into solid, uncreviced, consolidated rock overlying the water-bearing rock formation below a depth of 13 feet. Unperforated permanent well casing shall extend to this same depth. The annular space between the casing and the drillhole wall within the rock formation shall be filled with grout. The upper annular space between the casing and the drillhole wall shall be filled from land surface to at least five feet into an impermeable clay stratum below a depth of 13 feet. The annular space between the upper and lower [~~required cement grout~~] sealing intervals shall be filled with an impermeable sealing material. If necessary to complete the well, a smaller diameter well casing, liner pipe, or well screen may be installed. If cement grout is placed by a suitable **method** [~~pump~~] from the bottom of the casing to land surface (Methods A, B, D, Appendix **3** [~~2~~]), the upper drillhole shall be at least two inches larger than the nominal diameter of the casing. (See Figure **210-3** [~~5~~].);

(b) Method 2 **(Step-Down Casing):** An upper drillhole, four inches greater in diameter than the permanent well casing to be installed, shall extend from land surface to at least five feet into an impermeable clay stratum below a depth of 13 feet. Unperforated, permanent well casing shall extend to, and [~~shall~~] be driven into, solid, uncreviced, consolidated rock overlying the water-bearing rock formation. A lower drillhole, equal in diameter to the inside diameter of the upper permanent well casing, shall be constructed at least five feet into solid uncreviced rock overlying the water-bearing formation. A smaller diameter casing, at least two inches smaller in diameter than the diameter of the upper permanent well casing, shall extend at least five feet into the lower drillhole and at least eight feet into the upper permanent well casing. The annular space between the upper oversize drillhole and the permanent well casing, and the annular space between the smaller diameter lower casing and the lower drillhole, shall be completely filled with grout in accordance with OAR 690-210-0310 through 690-210-0360 after the permanent well casing and the lower casing are set into final position. (See **Figure 210-4** [6].);

(c) Method 3 **(Under-Reaming):** An upper drillhole, four inches greater in diameter than the permanent well casing to be installed, shall extend from land surface to at least five feet into an impermeable clay stratum below a depth of 13 feet. A lower drillhole, at least two inches greater in diameter than the diameter of the permanent well casing, shall be constructed at least -five feet into solid, uncreviced, consolidated rock by under-reaming methods. Unperforated, permanent well casing shall extend to and be driven into solid, uncreviced, consolidated rock at the bottom of the under-reamed section following placement of the sealing material. The annular space between the upper oversize drillhole and the upper permanent well casing shall be filled with cement grout using Method C or bentonite [~~grout~~]. The annular space between the lower under-reamed drillhole wall and the permanent well casing, shall be completely filled with grout applied under pressure in accordance

with the appropriate Method A, B, or D, in **Appendix 3** [~~2~~]. (See Figures **210-5** [~~2~~] and **210-6** [~~7~~].)

(2) In all cases, (Methods 1, 2, or 3, above), if materials penetrated by the upper oversize drillhole cave, or tend to cave, an outer temporary surface casing shall be used to case out all caving material throughout construction of the oversize drillhole. The temporary surface casing shall be withdrawn as the annular space is filled with grout.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0155

Additional Standards for Artesian Water Supply Wells

(1) Water supply wells penetrating into an artesian aquifer shall have an upper oversize drillhole four inches greater in diameter than the nominal diameter of the permanent well casing. Watertight unperforated casing shall extend and be sealed at least five feet into the confining formation immediately overlying the artesian water-bearing zone. In all cases, a minimum of 18 feet of casing and casing seal will be required. If cement grout is placed by a suitable method from the bottom of the casing (Methods A, B, and D, in Appendix 3 and Figure 210-5), the diameter of the upper drillhole shall be at least two inches larger than the nominal diameter of the casing. To complete the well, smaller diameter casing, perforated liner, or a well screen may be installed.

(2) When artesian pressures are encountered in the absence of a confining formation, casing and casing seal requirements shall be determined by the Director upon written application. In the alternative, the person constructing the well may construct the well in conformance with the minimum standards for artesian wells with a confining formation, set forth in section (1) of this rule.

(3) If an artesian water supply well flows at land surface, the well shall be equipped with a control valve and a watertight mechanical cap, threaded or welded, so that all flow of water from the well can be completely stopped.

(4) All flowing artesian wells shall be equipped with a pressure gauge placed on a dead-end line. A petcock valve shall be placed between the gauge and well casing. (See Figure 210-7)

(5) All flowing artesian water supply wells shall be tested for artesian shut-in pressure in pounds per square inch and rate of flow in cubic feet per second, or gallons per minute, under free discharge conditions. This data shall be reported on the well report.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0160

Additional Standards for Filter Pack Wells With Surface Casing

If a permanent surface casing is installed in the construction of a filter pack well, a watertight, welded, steel plate at least 3/16 of an inch in thickness shall be installed between the inner production casing and the outer surface casing at the well head. A watertight fill port with threaded cap may be installed for the purpose of placing additional filter pack material in the well. (See Figure **210-8** [~~8~~].)

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0170

Additional Standards for Filter Pack Wells Without Surface Casing

If a permanent surface casing is not installed in the construction of a filter pack well, and filler tubes are to be used, an oversize well bore having a nominal diameter of at least eight inches greater than the nominal diameter of the permanent well casing shall be constructed. If filler tubes are not to be used, an oversize well bore having a nominal diameter of at least four inches greater than the nominal diameter of the permanent well casing shall be constructed. A suitable plug shall be installed in the annular space between the filter pack material and the grout seal. A watertight fill pipe with threaded cap may be installed for the purpose of placing additional filter pack material in the well. The outside diameter of the fill pipe shall not exceed one-half the thickness of the grout seal surrounding the permanent well casing and shall be centered in the annular space. (See Figure **210-9** [9].)

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0180

Additional Standards for Driven or Jetted Wells

All drive point wells or jetted wells shall have nonperforated, watertight **casing** [~~pipe~~] meeting the minimum specifications shown in Table **210-1** [~~V~~] and extending a minimum distance of 18 feet below land surface. Drive **casing** [~~pipe~~] greater than 3-1/2 inches shall comply with the minimum specifications in OAR 690-210-0190. An upper drillhole at least four inches greater in nominal diameter than the permanent **casing** [~~production pipe~~] shall extend at least 18 feet below land surface. The annular space shall be filled with grout. If temporary casing is used during construction, it must be removed during placement of the grout. (See Figure **210-10** [~~11~~].)

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0190

Steel Casing

(1) All steel casing installed shall be in new or like new condition, being free of pits or breaks, and shall meet or exceed the minimum American Society for Testing Materials (ASTM A-53A or B) specifications for steel pipe, for the sizes as set out in Table **210-2** [~~III~~].

(2) All steel casing having a diameter larger than 20 inches shall have a wall thickness of at least 0.375 inch.

(3) Steel casing installed in a well greater than a nominal diameter of ten inches, having a wall thickness of 0.250 inch and meeting or exceeding ASTM A-53 A or B specifications must not exceed the following depth limitations (Diameter - Maximum Depth, respectively):

(a) 12 inches - 500 feet;

(b) 14 - 16 inches - 250 feet;

(c) 18 - 20 inches - 100 feet.

(4) Steel casings of other ASTM specifications shall not be used without written permission of the Director. A written request to use casing of other specifications shall be submitted to the Director. This request shall include a description of the casing specifications and the reason for its use.

Publications: The publication(s) referred to or incorporated by reference in this rule are available from the Water Resources Department.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0200
Steel Casing Joints

All steel casing joints shall be welded or **thread** [~~screw~~] coupled and shall be water tight. If welded casing joints are used, the weld shall be a full penetrating weld at least equal in thickness to the wall thickness of the casing. Welded casing joints shall have a tensile strength equal to or greater than that of the casing.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0210
Plastic Casing

(1) Plastic casing shall not be driven and may only be installed in an oversized drillhole.

(2) Plastic casing may only be installed after drilling has been completed. No drilling is allowed inside plastic casing.

(3) Such casing shall be of polymerized vinyl chloride (PVC), type 1120 or 1220, SDR 21 (Class 200) or SDR 26 (Class 160) **or greater wall thickness**, meeting the standards of the "National Sanitation Foundation" and the specifications of ASTM F-480 or ASTMD-2241-73 and D-1784-69. The well casing must be clearly marked by the manufacturer showing: nominal size, type plastic material, Standard Dimension Ratio (SDR), ASTM designation, and National Sanitation Foundation seal of certified approval. The maximum depth to which this plastic casing may safely resist collapsing forces is a function of the "Standard Dimension Ratio" (SDR), i.e., the ratio of the outside diameter to the casing wall thickness. The maximum depths have been computed for readily available SDR and are cited as:

(a) SDR = 21 - Maximum Depth = 150 feet;

(b) SDR = 26 - Maximum Depth = 100 feet.

(4) If PVC casing is to be used, it shall be protected from physical and ultraviolet light damage using one of the following methods:

(a) By use of an upper protective steel casing meeting the requirements of OAR 690-210-0190. The protective steel casing shall be a minimum of 2" larger in diameter than the PVC casing and shall overlap the PVC casing. The protective steel casing shall extend at least six inches above the top of the plastic well casing and shall be sealed at least four feet into the ground within the annular seal and shall be fitted with a lid; **or**

(b) By use of a **wellhead** [~~concrete~~] bunker. The bunker shall **be made of concrete, hard plastic, fiberglass, wood or other structurally sound material that will protect the casing from both physical damage and ultraviolet light damage**. The bunker shall completely surround the well and be fitted with a lid. **The bunker shall be constructed so that access to the wellhead is maintained**; **or**

(c) By other appropriate methods as approved in advance by the Water Resources Department.

(5) Pitless adaptors or units are not recommended in conjunction with PVC casing. If a pitless adaptor or unit is to be used, the constructor should take care that the weight of the pump and pump column do not exceed the strength of the casing.

Publications: The publication(s) referred to or incorporated by reference in this rule are available from the Water Resources Department.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0220
Plastic Casing Joints

All plastic casing joints shall be watertight. Either "bell" type, threaded, or coupling hubs are approved. Hub couplings shall be of material meeting the specifications for plastic casings as set forth in OAR 690-210-0210. Joints shall be made by solvent cement in accordance with manufacturer's directions. Newly assembled joints require careful handling until the initial set has taken place, which varies with the temperature and the pipe size. The recommended initial set times are from manufacturer's recommendations (See Table **210-3** [~~IV~~]).

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0230
Inner Casing

Inner casing installed into a well must meet the minimum requirements of well casing (OAR 690-210-0190). The space between the two well casings shall be sealed so as to prevent the movement of water between the two casings. Inner casing installed in a well shall extend or telescope at least eight feet into the lower end of the well casing. The inner casing must be centered and must be a minimum of one inch smaller in diameter than the outer casing if an under reaming method system is used. If other methods are used, the inner casing must be a minimum of two inches smaller in diameter than the outer casing. The grout must be placed in a positive manner in accordance with method A, B, D, or E (see Appendix 3).

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0240
Casing Shall be Centered

In all instances, casings shall be centered in sealed intervals. Casing centralizers may be used to ensure centering. When sealing a well by Method E, casing centralizers shall be used. (See Figure **210-11** [~~I~~], 1986)

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0250
Top Terminal Height

(1) The casing head or pitless unit of any well shall extend **a minimum of** [~~not less than~~] 12 inches above the finished ground surface or pumphouse floor, and **a minimum of** [~~not less than~~] 12 inches above the local surface runoff level. The ground surface immediately surrounding the top of the well casing or pitless unit should be graded so as to drain surface water away from the well. **Without permission of the Director**, no casing shall be cut off below land surface except to install a pitless unit or during permanent abandonment of a well [~~without permission of the Director~~].

(2) Application to the Director to reduce the top terminal height of casing shall include:

(a) A description of physical characteristics of the well site which make the requested change necessary; and

(b) A description of additional steps to be taken over and above the minimum standards in these rules which will assure adequate protection **of** [~~to~~] the ground water resource.

(3) The Director may approve a reduction of the top terminal height of the casing only upon a determination that the additional precautions to be taken and specific physical characteristics of the site would prevent contamination of the ground water resource.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0260
Openings in the Casing

There shall be no opening in the casing wall between the top of the casing and the bottom of the required casing seal except for pitless adapters, measurement access ports, and grout nipples installed in conformance with these standards. In no case shall holes be cut in the casing wall for the purpose of lifting or lowering casing into the well bore unless such holes are properly welded closed and watertight prior to placement into the well bore.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0270
Pitless Well Adapters and Units

Surface seal requirements for well casing set forth herein shall also apply when a pitless adapter or unit is installed in a well. The seal shall cover that interval occupied by the pitless case from the point of casing connection to land surface. A cement grout seal shall not be allowed within the pitless unit or pitless adaptor sealing interval. The pitless adapter or unit sealing interval shall be sealed with unhydrated bentonite as described in OAR 690-210-0330 and 690-210-0340. The pitless adapter or unit, including the cap or cover, pitless case and other attachments, shall be designed and constructed to be watertight to prevent the entrance of contaminants into the well from surface or near-surface sources. Pitless units shall be vented to the atmosphere. Refer to OAR 690-210-0210 if the pitless adaptor or unit is to be used in conjunction with PVC casing.

NOTE: Prior to installing pitless well adapters or units on public, community, municipal, or public utility water supply wells, contact the **Oregon** Department of Human Resources. (See reference[s] to **Oregon** Health Division regulation in **Appendix 1.**)

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0280
Access Ports and Airlines

All **water supply** wells shall be equipped with a usable access port with a minimum diameter of ½ inch. In addition, an airline with a pressure gauge adequate to determine the water level in the well at any time may be installed. If an airline is installed, it must enter the well in a location other than the access port. **Unless it is located inside the well casing, the access port or airline shall be capped and be a minimum of twelve inches above finished ground surface or pumphouse floor.** If the well constructor does not install a pump in the well, the landowner will be required to provide the access port. (See Figure **210-12** [~~17~~].)

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0290
Liner Pipe

Liner pipe installed through caving formations and installed without driving, may be of lighter weight than specified by Table **210-2** [~~II~~] under OAR 690-210-0190. Such lightweight pipe shall have a wall thickness equal to or greater than 0.188 inch. All liner pipe shall be of steel, in new or like new condition, being free of pits or breaks; or shall be of polymerized vinyl chloride (PVC) type 1220 or 1120 **and** [~~SDR 21 (Class 200), or~~] SDR 26 (Class 160) **or greater wall thickness**. Liner pipe installed in a well shall extend or telescope at least eight feet into the lower end of the well casing. In the event that more than one string of liner pipe is installed, each string shall extend or telescope at least eight feet into the adjacent larger diameter liner pipe. Liner pipe shall be removable. Liner pipe may be welded or hooked onto the permanent well casing but shall not be permanently fixed to a well casing or borehole wall using packers or grout which would prohibit the liner's removal. (See Inner Casing, OAR 690-210-0230.)

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0300
Drill Cuttings or Chips

In no case shall drill cuttings or drill chips be used or allowed to fill, partially fill, or fall into the required sealing interval of a well during the construction or the completion of a well.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0310
Cement Grout

When using cement grout as the sealing material in a well, it must meet the following requirements:

(1) Cement grout used to seal a well shall be composed of a uniformly mixed slurry of Portland cement or High Early Strength Type III Portland cement and potable water, or High-alumina cement

and potable water, mixed in the following proportions (Type of Cement - Gallons of Water Per Sack of Dry Cement, respectively):

(a) Portland Cement - 4-1/2 to 6;

(b) High Early Strength Type III Portland Cement - 5-1/2 to 6-1/2;

(c) High-alumina Cement - 4-1/2 to 6.

(2) Additives to increase fluidity, reduce shrinkage, or control time of set may be used in a cement grout mixture. Expanding agents such as aluminum powder may be used at a rate not exceeding 0.075 ounce (one level teaspoonful) per sack of dry cement. The powder shall not contain polishing agents. The addition of bentonite clay to a cement grout mixture is permissible but shall not in any case exceed five percent **(5%)** by weight of dry cement. Calcium chloride may be added to a Portland cement grout to accelerate the set but shall not exceed two pounds per sack of dry cement. High-alumina cement and Portland cement of any type shall not be mixed together for use in a well.

(3) Cement types other than those set forth herein shall not be used as a sealing material in a well except upon written approval of the Director of the Water Resources Department.

(4) In no case shall sand or aggregate be added to cement grout seal mixtures.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0315

Concrete

Concrete for use in the construction of a dug well, or for filling the annular space or well bore of a well, shall consist of clean, hard, and durable aggregate, and not less than five sacks of Portland cement per cubic yard of concrete. Concrete will be allowed only when the oversize drill hole is a minimum of eight inches larger in diameter than the well casing used in construction of the well. The maximum diameter of aggregate particles shall not exceed 1-1/2 inches, but, in any case, shall not exceed 1/5 or 20 percent of the minimum width of the space to be filled. The ratio of coarse aggregate to fine aggregate (Passing No. 4, U.S. Standard Sieve) shall be approximately 1-1/2 to one by volume, but, in any case, shall not exceed two to one nor be less than one to two.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0320

Methods of Placement of Cement Grout or Concrete

Cement grout or concrete used as a sealing material in a well shall be placed or forced upward from the bottom **to completely fill the annular space** ~~[of the space]~~ to be grouted and shall be placed in one continuous operation without significant interruption. If temporary outer surface casing is used in the construction of the well, it shall be withdrawn as the grout or concrete is placed. (For acceptable methods of **placement** [~~procedure~~], see Appendix 3 and Figure **210-5** [~~2~~], 1986.)

[ED. NOTE: The Appendix and Figure referenced in this rule are not printed in the OAR Compilation. Copies are available from the Water Resources Department.]

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0330
Unhydrated Bentonite

Unhydrated bentonite used in construction of [~~surface~~] casing seals for **water supply** wells **shall be specifically designed for sealing wells and be within industry tolerances for dry western sodium bentonite. Bentonite shall be free of polymers that promote bacterial growth. Placement of the bentonite shall conform to the manufacturers specifications and result in a seal that is free of voids or bridges**. Powdered **bentonite and** bentonite **grout or slurry** shall not be used **as an annular seal material**.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0340
Method of Placement of Unhydrated Bentonite

(1) An upper oversize drillhole, four inches greater than the nominal inside diameter of the permanent well casing, shall be constructed to a minimum depth of 18 feet. The use of unhydrated bentonite as a surface casing seal shall not be allowed below 50 feet from land surface. In the event that the subsurface materials penetrated by the oversize drillhole cave, or tend to cave, an outer temporary surface casing shall be used to case out the caving materials throughout construction of the oversize drillhole. The temporary surface casing shall be removed before completion of **the well** [~~drilling~~].

(2) **In the event water is present or encountered during the construction of the oversize drillhole, only bentonite chips manufactured to be greater than 1/4 inch or tablets shall be allowed in the sealing interval.** A maximum of 25 feet of water may be **present** within the sealing interval. Granular bentonite **may** [~~shall~~] be used if the annular space is dry.

(3) Placement of bentonite shall conform to the manufacturer's specifications and result in a seal that is free of voids or bridges.

(4) [~~(3)~~] After placement of the permanent casing, the annular space shall be filled to land surface with bentonite. The annular space **shall** [~~should~~] be kept full while drilling or driving casing. A sounding or tamping tool shall be **used** [~~run~~] in the sealing interval during pouring to measure fill[~~-up~~] rate and to break up possible bridges or cake formations. **Care shall be taken to minimize the introduction of bentonite dust into the sealing interval.**

(5) [~~(4)~~] Pour rate shall be three minutes or slower per 50 pound sack in the water-filled portion of the annulus.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0350
Resumption of Construction Following Placement of Cement Grout

The time **needed for** [~~of~~] the final set **of** [~~for~~] a cement grout mixture varies greatly in accordance with cement-water ratio and temperature. When cement grout is used to seal a well, construction should not resume [~~in any way~~] until after the final set of the cement grout mixture. Performance of all cement grout seals shall be the responsibility of the person responsible for the construction of the well. **Under no circumstances shall construction resume within six hours of the placement of the**

cement grout seal. Recommended periods of time **for the** [~~of~~] final set are:

(1) If Portland Cement is used - 72 hours;

(2) If High Early Strength Type III Portland Cement is used - 48 hours;

(3) If High-alumina Cement is used - 6 hours.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0360

Movement of Casing After Cement Grouting

In no case shall the permanent well casing be moved or driven following the placement and initial set of the cement grout.

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0370

Well Test

Upon completion, every well shall be tested for yield and drawdown **either by bailing, pumping, or air testing** for a period of not less than one hour [~~either by bailing, pumping, or air testing~~]. Any testing method that does not provide for drawdown measurements during testing is not an accurate or reliable test of yield.

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0380

Disinfection of a Well

[~~Every new, altered, or reconditioned water supply well including~~] **Prior to or after being placed in the well, pumping** [~~Pumping~~] equipment, sand, [~~or~~] gravel [~~used in filter pack wells~~] and [~~a~~] well casing [~~standing above the water table,~~] shall be thoroughly hosed or sluiced with water, and shall be disinfected with a solution containing at least 50 parts per million chlorine**.** [~~. before being placed in the well.~~] All water introduced into a well during construction shall be clean and potable. **Upon completion,** the well and its equipment, including the interior of the well casing, shall be thoroughly swabbed and cleaned to remove all of the oil, grease, and foreign substances. [~~upon completion of the well's construction. Following the completion of a water supply well, and again after the pumping equipment has been installed,~~] The well and its equipment shall be disinfected by thoroughly agitating and mixing in the well a solution containing enough chlorine to leave a residual of 25 parts per million throughout the well after a period of 24 hours. **Disinfection should also occur following the installation of pumping equipment.** (See Chart Recommendations for Disinfection of Wells, Appendix 2.)

NOTE: Other public agencies may have jurisdiction over the discharge of chlorine in certain areas. The constructor should contact the Oregon Department of Environmental Quality or the appropriate city public works department for further information.

[ED. NOTE: The Appendix referenced in this rule is not printed in the OAR Compilation. Copies

are available from the Water Resources Department.]

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0390
Completion of Wells

A well constructor or permitted landowner constructing **their** [~~his~~] own well shall not remove the drilling machine from a well site, unless it is immediately replaced by another drilling machine in operating condition prior to[~~:~~
~~(1)C~~] **c**ompletion **or abandonment** of the **water supply** well in compliance with OAR 690-210-0005 through **690-220-0140 .**[~~690-210-0420 and a watertight seal, threaded or welded cap [placed on the well] in accordance with OAR 690-220-0005; or~~
~~(2) Completion of the well in compliance with OAR 690-210-0005 through 690-210-0420 and a pump [installed]; or~~
~~(3) Abandonment of the well in compliance with OAR 690-220-0030 through 690-220-0140~~].

Stat. Auth.: ORS 536.090 & 537.505 - 537.795

690-210-0400
Construction of Dug Wells

[~~All dug~~] **Dug** wells **that are between** [~~greater than~~] 12 feet in depth **and 21 feet in depth** shall be constructed with a watertight surface curbing extending from a minimum of 12 inches above land surface to [~~a depth of 18 feet below land surface. In the case of wells ranging from 12 to 21 feet in depth, water tight surface casing shall extend to~~] within three feet of the bottom of the well. **Dug wells greater than 21 feet in depth shall be constructed with a watertight surface curbing that extends from a minimum of 12 inches above land surface to a depth of at least 18 feet below land surface**. Open wells, sometimes called sumps, which exceed ten feet in average diameter are exempt from these construction requirements, but are subject to all the requirements covering the use of ground water. (water right application).

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0410
Buried Slab Construction

In a buried slab type well, the slab shall be at least 18 feet below land surface and shall be at least three inches in thickness. The slab shall be reinforced to withstand all stresses. The slab shall be sealed with cement grout at least one foot thick, and the well bore backfilled with grout or concrete in accordance with OAR 690-210-0300 through 690-210-0360 and OAR 690-210-0430. (See Figure **210-13** [~~12~~].)

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0420

Surface Curbing

(1) The surface curbing required in OAR 690-210-0400 shall be of concrete, concrete tile, or steel. If concrete is used, the concrete wall thickness shall not be less than six inches. In **the** case of buried slab type well**s**, well casing meeting the minimum specifications given in OAR 690-210-0190 through OAR 690-210-0220 shall be used. (See Figure **210-13** [~~12~~][~~, 1986~~].)

(2) If precast concrete tile or steel casing **is** [~~are~~] used for the surface curbing, the well diameter to the bottom of the surface curbing shall be eight inches greater than the outside diameter of the tile or steel, and the annular space shall be completely filled with grout or concrete **in accordance with OAR 690-210-0310 and OAR 690-210-0315**. (See Figure **210-13** [~~12~~], 1986.)

Stat. Auth.: ORS Ch. 183, 536, 537 & 540

690-210-0510

Special Temporary Standards for Repair, Maintenance and Delays in Completion of New Well Construction

[WRD 13-1986, f. 10-7-86, ef. 11-1-86; WRD 7-1988, f. & cert. ef. 6-29-88; Repealed by WRD 8-1993, f. 12-14-93, cert. ef. 1-1-94]

APPENDIX 1

Additional Requirements by Other State Agencies of Oregon

In the administration of ORS 537.505 to 537.795, the Director of the Water Resources Department has statutory authority under the provisions of ORS 537.780 "to prescribe and enforce general standards for the construction and maintenance of wells and their casings, fittings, valves, and pumps ..." Other agencies of the state have statutory responsibilities that relate either directly or indirectly to the construction and operation of public water supply systems and their source of water supply. These agencies and their responsibilities are listed as follows:

OREGON HEALTH DIVISION 800 NE Oregon Street Portland, OR 97232 (serving more than three single residents) www.ohd.hr.state.or.us	ORS Chapter 448	Municipal Water Supply Systems Public Water Supply Systems Community Water Supply Systems **Source Water Protection**
BUILDING CODES AGENCY 1535 Edgewater NW Salem, OR 97304-4635 www.cbs.state.or.us/external/bcd	ORS Chapter 446	Electrical and Plumbing for all Commercial Enterprises Mobile Home Park Water Supply Systems
OREGON PUBLIC UTILITY COMMISSIONER 550 Capitol St NE Salem, OR 97301-2551 www.puc.state.or.us	ORS Chapter 757	Private Owners (water supply systems, 200 homes or more)
DEPARTMENT OF ENVIRONMENTAL QUALITY 811 SW 6th Portland, OR 97204-1390 www.deq.state,or.us	ORS Chapter 468	Water Quality Monitoring **Underground Injection Systems** **Source Water Protection**
SECRETARY OF STATE CORPORATION DIVISION Business Services Division Public Service Bldg., Suite 180 Salem, OR 97310 www.sos.state.or.us		Business Registry for Water Districts

APPENDIX 1- CONTINUED

All wells constructed in Oregon, including those to serve as a source of ground water to municipal, community, public, or public utility water supply systems, must be constructed in accordance with the rules and regulations prescribing general standards for the construction and maintenance of wells in Oregon (OAR 690 Divisions 205, 210, 215, 220 and 240). Additional construction standards for water supply systems **may be** [~~are~~] required by the above listed agencies. Such rules and regulations generally include the source of water supply to the systems and may affect well construction requirements. Copies of the various agency rules may be obtained by contacting the responsible agency. Well constructors planning to construct a well as a source of water supply for any of the above systems are **advised** [~~requested~~] to contact the responsible agency prior to the beginning of well construction.

APPENDIX 2

I. Recommendations For Disinfection of Wells (OAR 690-210-0380)

Every newly constructed, altered, or repaired well should be assumed to be contaminated by micro-organisms. Before the initiation of use, each well must be thoroughly and carefully cleaned and treated to ensure that all disease carrying organisms are eliminated. Care should be exercised to make certain that all areas of the well come into contact with a solution containing enough available chlorine to completely destroy all harmful bacteria. An initial chlorine concentration of 50 parts per million (ppm) with a residual chlorine requirement of 25 ppm after 24 hours is considered adequate for this purpose. Either domestic laundry bleaches containing sodium hypochlorite, such as Clorox or Purex, or calcium hypochlorite in powder or tablet form (Olin HTH) may be used.

Hypochlorite solutions should be thoroughly mixed throughout the well either by the use of drilling tools, a pump, or by placing a calculated number of HTH tablets at regular intervals on a nylon string and dissolving them in places throughout the well. In all cases, the well casing and pump column standing above the water table should be thoroughly cleaned of all grease and oil and should be carefully washed down with the hypochlorite solution.

The well should be allowed to remain undisturbed after the treatment for a period of 24 hours. Then it is recommended that the well be tested for residual chlorine (at least 25 ppm must remain). After successful treatment, all water remaining in the well and supply system should be run to waste and a sample of fresh water from the well tested by the local county sanitarian for bacteriological purity.

SOLUTIONS CONTAINING HYPOCHLORITES

Laundry Bleach

Common domestic laundry bleaches contain from 5.25 percent to 6.00 percent sodium hypochlorite. These amounts are equivalent to approximately 2.5 percent available chlorine or about 25,000 ppm as originally purchased. A one gallon container of liquid bleach mixed with 500 gallons of water will dilute the original solution to approximately 50 ppm available chlorine.

High-Test Hypochlorite Compounds

Calcium hypochlorite (Olin HTH) in powder or tablet form contains about 50 percent active chlorine. One ounce of dry HTH powder mixed with 75 gallons of water will result in a solution containing approximately 50 ppm available chlorine. Eight tablets V(1/8 oz. each) of HTH are equivalent to one ounce of dry powder or granules.

QUALITY OF HYPOCHLORITE NEEDED TO PROVIDE 50 PPM ACTIVE CHLORINE IN WELL WATER

(1) If using liquid bleaches, the following formula is applicable:

$$\frac{\text{Feet of water in well} \times \text{Gallons per foot}}{62} = \text{Pints of bleach needed}$$

Feet of water = Total depth of well minus static water level multiplied by gallons per foot (See Table II).

(2) If using HTH compounds, the following formula is applicable:

$$\frac{\text{Feet of water} \times \text{Gallons per foot}}{75} = \text{Ounces HTH needed}$$

(3) If HTH tablets are used:

$$\frac{\text{Feet of water} \times \text{Gallons per foot}}{9} = \text{Number of 1/8 oz. tablets needed}$$

APPENDIX 3

I. Recommended Methods of Placement of Cement Grout (OAR 690-210-0320)

Method A - The well bore shall be plugged with a drillable plug or bridge at the lowest point to be sealed. A well casing with a float shoe at its lower end shall be placed in the well and suspended slightly above the point of bearing. A grout pipe shall be run inside the casing to the check valve. The grout pipe shall be connected to a suitable pump and water or drilling fluid shall first be circulated to clear the annular space. Grout shall be pumped through the grout pipe until clean grout completely fills the interval to be sealed. The grout pipe shall then be removed and the cement allowed to set. (See Figure **210-5** [~~2~~])

Method B - Grout shall be placed by pumping or air pressure injection through a grout pipe installed inside the casing from the casing head to a point five (5) feet above the bottom of the casing. The grout pipe shall extend through an airtight sealed cap on the head of the well casing. The casing head shall be equipped with a relief valve and the grout pipe shall be equipped at the top with a valve permitting injection. The lower end of the grout pipe and the casing shall be open. Clean water shall be injected down the grout pipe until it returns through the casing head's relief valve. The relief valve is then closed and injection of water is continued to clean the hole until it flows from the bore hole outside the casing that is to be grouted in place. Without significant interruption, grout shall be substituted to water and, in a continuous manner, injected down the grout pipe until it returns to the surface outside of the casing. A small amount of water may be used to flush the grout pipe, but the pressure should remain constant on the inside of the grout pipe and the inside of the casing until the grout has set. Pressure shall be maintained for at least twenty-four (24) hours, or until such time as a sample of the grout indicates a satisfactory set. Cement grout shall be used for this procedure with a minimum annular space of one (1) inch completely surrounding the casing. (See Figure **210-5** [~~2~~])

Method C - The well bore shall be plugged with a drillable packer or bridge at the lowest point to be sealed. The well casing shall be firmly seated at the bottom of the drillhole. A grout pipe shall be run to the bottom of the hole through the annular space between the casing and the well bore. After water or any other drilling fluid has been circulated in the annular space sufficiently to clear obstructions, the grout pipe shall be connected to a suitable pump and grout shall be pumped through the grout pipe until clean grout is circulated to land surface, or until grout completely fills the interval to be sealed. The lower end of the grout pipe shall remain submerged in grout **while** [~~at all times during the period that~~] grout is being placed. The grout pipe shall be withdrawn before the initial set of the grout. (See Figure **210-5** [~~2~~])

Method D - The well bore shall be plugged with a drillable packer or bridge at the lowest point to be sealed. After the casing is run and landed, a casing plug, having a length greater that the diameter of the casing, shall be placed in the casing. If the drillhole is free of mud or water, this lower separation plug may be eliminated. A measured amount of cement grout necessary to completely fill the annular space of the interval to be grouted is pumped or placed by bailer in the casing. A second casing plug, having a length greater that the diameter of the casing, shall be placed in the casing above the grout[~~; and~~]. The casing shall **then** be capped with a pressure cap and shut-off valve, and shall be connected to a suitable pump. The casing shall then be raised far enough above the point of bearing to clear the

first separation plug. Water or drilling mud shall then be pumped under pressure into the casing forcing the grout and upper casing plug down the casing. The position of the plug must be known at all times. A small amount of [~~the~~] grout **may** [~~shall be allowed to~~] remain in the lower end of the casing. When the plug reaches the point desired above the bottom of the casing, the pump shall be stopped and the casing seated. (See Figure **210-5** [~~2~~])

Method E - The well bore shall be plugged with a drillable packer or bridge at the lowest point to be sealed. A sufficient amount of cement grout to completely fill the interval of the well to be sealed shall be placed at the bottom of the drillhole by pump bailer **or** grout pipe[~~, or tremie pipe~~]. The well casing shall have centering guides attached at appropriate intervals to keep the casing centered in the bore hole. The bottom of the well casing shall be fitted with a tight drillable plug and shall be lowered into the drillhole forcing the grout upward into the annular space. Gravity installation without the aid of a [~~tremie or~~] grout pipe shall not be used. In no instance shall this method be used **deeper than** [~~beyond a depth of~~] thirty (30) feet and in no case for a municipal, community, or public water supply well. (See Figure **210-5** [~~2~~])

TABLE 210-1 [V]
(690-210-0180)
(Specifications for Drive Pipe)

Nominal Size (inches)	Outside Diameter (inches)	Wall Thickness (inches)	Weight Per Foot (pounds)
1-1/2	1.900	0.145	2.72
2	2.375	0.154	3.65
2-1/2	2.875	0.203	5.79
3	3.500	0.216	7.58
3-1/2	4.000	0.226	9.11

TABLE 210-2 [HH]
(690-210-0190)
(Minimum specifications for steel well casing)

Nominal Size (inches)	Outside Diameter (inches)	Wall Thickness (inches)	Weight Per Foot (pounds)
2	2.375	.154	3.56
2-1/2	2.875	.203	5.79
3	3.500	.216	7.58
3-1/2	4.000	.226	9.11
4	4.500	.237	10.79
5	5.563	.244	13.70
6	6.625	.250	17.02
8	8.625	.250	22.36
10	10.750	.250	28.04
*12	12.750	.312	41.45
*14	14.000	.312	45.68
*16	16.000	.312	52.27
*18	18.000	.375	70.59
*20	20.000	.375	78.60

* Note: Steel casing installed in a well greater than a nominal diameter of ten (10) inches, having a wall thickness of .250 inch and meeting ASTM A-53 A or B specifications must not exceed the following depth limitations (Diameter - Maximum Depth, respectively):

(a) 12 inches - 500 feet
(b) 14 - 16 inches - 250 feet:
(c) 18 - 20 inches - 100 feet

Table 210-3
Capacity of Drillhole or Casing

Nominal Size (in inches)	Gallons per Linear Foot
2	0.163
4	0.653
5	1.020
6	1.469
7	1.999
8	2.611
9	3.305
10	4.080
11	4.937
12	5.875
14	7.997
16	10.445
18	13.219
20	16.320
24	23.501

Table 210-4
Set time for plastic casing joints

Temperature Range During Initial Set Time	Set Time for Various Pipe Sizes In Hours					
	3"	4"	6"	8"	10"	12"
60 F - 100 F	1/2	1/2	1/2	3/4	3/4	1
40 F - 60 F	2	2	4	4	4	4
0 F - 40 F	6	6	8	10	12	12

NOTE: After the initial set, the joints will withstand the stress of a normal installation. However, considerable care should be employed in handling the string.