

**CHAPTER 26**

**WELL CONSTRUCTION STANDARDS**

**Table of Contents**

Section 1. General Information.....	1
Section 2. Definitions Specific to Chapter 26.....	1
Section 3. Application.....	2
Section 4. Well Construction Not Specifically Covered By This Part; Deviations.....	3
Section 5. Well Location/Siting.....	3
Section 6. Sealing the Annular Space.....	3
Section 7. Surface Construction Features.....	5
Section 8. Casing.....	5
Section 9. Sealing/Cementing Off Strata.....	8
Section 10. Well Construction, Completion, Development and Evaluation.....	9
Section 11. Plugging and Abandonment.....	9

1  
2  
3  
4  
5  
6  
7  
8  
9  
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**CHAPTER 26**

**WELL CONSTRUCTION STANDARDS**

**Section 1. General Information.** This part contains minimum standards for design and construction and for the abandonment of wells covered by this part. The applicant or permittee shall provide for design and construction to protect ~~g~~Groundwaters of the ~~s~~State in accordance with the water quality standards contained in Chapter ~~VIII~~ ~~8~~, Water Quality Rules and Regulations.

All American Society for Testing of Materials (ASTM), American Water Works Association (AWWA) and American Petroleum Institute (API) specifications listed are intended to mean the latest revision.

14  
15

**Section 2. Definitions Specific to Chapter 26.**

16 (a) “Abandoned well” means a well regulated under this part for which use has been  
17 discontinued for more than one year and the owner does not desire to maintain this well for  
18 future use; or its use has been permanently discontinued or is in such a state of disrepair that it  
19 cannot be used for its intended purpose.

20  
21 (b) “Annular space” means the space between the well casing and the wall of the  
22 drilled hole or between two well casings.

23  
24 (c) “Artificial recharge well” means well constructed to introduce water into the  
25 ground as a means of replenishing groundwater basins.

26  
27 (d) “Commercial, municipal and industrial waste well” means well constructed to  
28 dispose of unusable waste or contaminated water resulting from a commercial activity, municipal  
29 collection, storage or treatment facility or an industrial activity.

30  
31 (e) “Conductor casing” means a tubular retaining structure installed in the upper  
32 portion of a well between the wall of the drilled hole and the inner well casing.

33  
34 (f) “Confining formation” means an impermeable bed or a bed of distinctly lower  
35 permeability than the adjacent material in which groundwater may be moving.

36  
37 (g) “Destroyed well” means a well that has been properly filled so that it cannot  
38 produce water nor act as a vertical conduit for the movement of groundwater.

39  
40 (h) “Geothermal well” means a well constructed to extract or return water to the  
41 ground after it has been used for heating or cooling purposes.  
42

43 (i) “Key seating” means a stuck drill pipe or casing caused by an abrupt change in  
44 direction or dogleg in the drilled hole.

45  
46 (j) “Miscellaneous discharge well” means a well constructed for a special process  
47 discharge of limited time and scope.

48  
49 (k) “Observation and monitor well” means a well constructed for the purpose of  
50 observing or monitoring groundwater conditions.

51  
52 (l) “Production casing” means a tubular retaining structure installed in the upper  
53 portion of a well between the wall of the drilled hole and the inner well casing.

54  
55 (m) “Sounding tube” means the access to the well casing that allows the water level in  
56 the well to be periodically determined. All sounding tubes should have a screw cap.

57  
58 (n) “Special process discharge well” means a well constructed for the use of a  
59 subsurface discharge for recovering a product or fluid at the surface. Special process discharges  
60 are defined in detail in Chapter ~~IX~~ 9, Wyoming Water Quality Rules and Regulations.

61  
62 (o) “Test well” means a well constructed for obtaining information needed to design a  
63 well prior to its construction. Test wells are cased and could be converted to observation or  
64 monitoring wells.

65  
66 (p) “Watertight” means impermeable to water except when under such pressure that  
67 structural discontinuity is produced.

68  
69 **Section 3. Application.** These standards shall apply to the types of wells listed below.  
70 Before a change of use for an existing well can occur, construction standards contained in this  
71 part shall be met for the new use.

72  
73 (a) Well type list requiring permits under Water Quality Rules and Regulations.

74  
75 (i) Commercial, municipal and industrial waste wells.

76  
77 (ii) Special process discharge wells.

78  
79 (iii) Artificial recharge and miscellaneous discharge wells.

80  
81 (iv) Geothermal wells.

82  
83 (v) Observation and monitoring wells.

84  
85 (vi) Test wells.

86 (b) Standards concerning construction, maintenance and operation of oil or gas  
87 producing, storage, injection or disposal wells are administered by the Oil and Gas Conservation  
88 Commission and therefore are not contained herein.

89 **Section 4. Well Construction Not Specifically Covered By This Part; Deviations.**

90

91 (a) The ~~a~~Administrator may grant a deviation from the standards provided the  
92 applicant or permittee can supply documentation of reliability, mechanical integrity, design and  
93 construction to protect ~~g~~Groundwaters of the ~~s~~State in accordance with the water quality  
94 standards contained in Chapter ~~VIII~~ 8, Wyoming Water Quality Rules and Regulations. Such  
95 documentation shall include:

96

97 (i) Theoretical technology; or

98

99 (ii) Full scale operation at another site with similar conditions; or

100

101 (iii) A pilot project of scope and length to justify a deviation.

102

103 **Section 5. Well Location/Siting.**

104

105 (a) The top of the casing shall terminate above grade or above any known conditions  
106 of flooding from runoff or standing water. The area around the well shall slope away from the  
107 well. Surface drainage shall be directed away from the well.

108

109 (b) Where a well is to be near a building, the well shall be located at a distance from  
110 the building to provide access for repairs, maintenance, etc.

111

112 **Section 6. Sealing the Annular Space.** The annular space shall be sealed to protect it  
113 against contamination or pollution by entrance of surface and/or shallow subsurface waters.  
114 Annular seals shall be installed to provide protection for the casing against corrosion, to ~~assure~~  
115 ensure structural integrity of the casing, and to stabilize the upper formation.

116

117 (a) Minimum depths of seal below ground surface for various uses of wells will be:

118

<u>Type Well</u>	<u>Minimum Depth of Seal</u>
Commercial, municipal and industrial waste	30 feet
Special process discharge	30 feet
Artificial recharge and miscellaneous discharge	30 feet
Geothermal wells	30 feet
Observation and monitoring	20 feet
Test wells	30 feet

126

127 (b) Sealing conditions. Following are requirements to be observed in sealing the  
128 annular space.

129  
130 (i) Wells situated in unconsolidated, caving material shall have an oversized  
131 hole, at least four inches greater in diameter than the production casing, drilled. A conductor  
132 casing shall be installed. The space between the conductor casing and the production casing shall  
133 be filled with sealing material. The conductor casing may be withdrawn as the sealing material is  
134 placed.

135  
136 (ii) Wells situated in unconsolidated material stratified with significant clay  
137 layers shall have an oversized hole of at least four inches greater in diameter than the production  
138 casing drilled, with the annular space filled with sealing material. If a clay formation is  
139 encountered within five (5) feet of the bottom of the seal, the seal should be extended five (5)  
140 feet into the clay formation.

141  
142 (iii) Wells situated in soft consolidated formations shall have an oversized hole  
143 of at least four inches greater in diameter than the production casing. The annular space between  
144 the production casing and the drilled hole shall be filled with sealing material.

145  
146 (iv) Wells situated in “hard” consolidated formations (~~erystaline~~ crystalline or  
147 metamorphic rock) shall have an oversized hole drilled with the annular space filled with sealing  
148 material.

149  
150 (c) Sealing material. The sealing material shall consist of neat cement grout, sand  
151 cement grout, bentonite clay or concrete.

152  
153 (i) Cement used for sealing mixtures shall meet the requirements of ASTM  
154 C150 “Standard Specifications for Portland Cement” or API 10B “Recommended Practices for  
155 Testing Oil-Well Cements and Cement Additives”. Materials used as additives for Portland  
156 Cement mixtures in the field shall meet the requirements of ASTM C494 “Standard  
157 Specifications for Chemical Admixtures for Concrete” or API RP 10B.

158  
159 (ii) Neat cement shall be composed of one sack of Portland Cement (94  
160 pounds) to 4½ to 6½ gallons of clean water.

161  
162 (iii) Sand-cement grout shall be composed of not more than two parts by  
163 weight of sand and one part of Portland cement to 4½ to 6½ gallons of clean water per sack of  
164 cement.

165  
166 (iv) Concrete used shall be “Class A” or “Class B”. Aggregates shall meet the  
167 requirements of ASTM C33 “Standard Specifications for Concrete Aggregates”.

168

169 (v) Special quick-setting cement, retardants to setting, and other additives,  
170 including hydrated lime to make the mix more fluid or bentonite to make the mix more fluid and  
171 reduce shrinkage, may be used.

172  
173 (vi) Bentonite clay mixtures shall be composed of bentonite clay and clean  
174 water thoroughly mixed before placement so that there are no balls, clods, etc.

175  
176 (vii) Used drillers mud or cuttings or chips from drilling the borehole shall not  
177 be used as sealing material.

178  
179 (viii) The minimum time that must be allowed for materials containing cement  
180 to “set” shall be in accordance with ASTM C150 or API RP10B. When necessary these times  
181 may be reduced by use of accelerators as determined by the well contractor.

182  
183 (d) Thickness of seal. The thickness of the seal shall be at least two (2) inches and not  
184 less than three (3) times the size of the largest coarse aggregate used in the sealing material

185  
186 (e) Placement of seal. Before placing the seal, all loose cuttings, chips, or other  
187 obstructions shall be removed from the annular space by flushing with water or fluid drilling  
188 mud. The sealing material shall be placed when possible, in one continuous operation from the  
189 bottom up. The fluid used to force the final sealing material through the casing shall remain  
190 under pressure, to prevent back flow, until the sealing material is set.

191 **Section 7. Surface Construction Features.**

192  
193 (a) Openings. Openings into the top of the well ~~which~~ that are designed to provide  
194 access to the well, (~~i.e.~~ e.g.), for measuring, chlorinating, adding gravel, etc., shall be protected  
195 against entrance of surface waters or foreign matter by installation of water tight caps or plugs.  
196 Access openings designed to permit the entrance or egress of air or gas shall terminate above the  
197 ground and above known flood levels and shall be protected against the entrance of foreign  
198 materials by installation of down turned and screened “U” bends. All other openings (holes,  
199 crevices, cracks, etc.) shall be sealed.

200  
201 A sounding tube, ~~taphole~~ tap hole with plug, or similar access for the introduction  
202 of water level measuring devices may be affixed to the casing of the well as long as the proper  
203 seal is maintained. Access ports for water level or pressure measuring devices are required by the  
204 State Engineer on all wells greater than four inches diameter.

205 **Section 8. Casing.**

206  
207 (a) The casing shall provide structural stability to prevent casing collapse during  
208 installation as well as ~~drillhole~~ drill hole wall integrity when installed, be of required size to

209 convey liquid at a specified injection/recovery rate and pressure, and be of required size to allow  
210 for sampling.

211

212 (i) Steel casing shall meet the following conditions:

213

214 (A) Standard and line pipe. This material shall meet one of the  
215 following specifications:

216

217 (I) API Std. 5L, "Specifications for Line Pipe."

218

219 (II) API Std. 5LX, "Specifications for High-Test Line Pipe."

220

221 (III) ASTM A53 "Standard Specification for Pipe Steel, Black  
222 and Hot Dipped, ~~ZincCoated~~ Zinc Coated Welded and Seamless."

223

224 (IV) ASTM A120 "Standard Specifications for Pipe, Steel,  
225 Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses."

226

227 (V) ASTM A134 "Standards Specifications for Electric-Fusion  
228 (arc) - Welded Steel Plate Pipe (Sizes 16 ~~in~~ inches and over)."

229

230 (VI) ASTM A135 "Standard Specifications for Electric -  
231 Resistance - Welded Steel Pipe."

232

233 (VII) ASTM A139 "Standard Specification for Electric-Fusion  
234 (arc) - Welded Steel Pipe (Sizes 4" inches and over)."

235

236 (VIII) ASTM A211 "Standard Specifications for Spiral - Welded  
237 Steel or Iron Pipe."

238

239 (IX) AWWA C200 "AWWA Standard for Steel Water Pipe 6  
240 inches and Larger."

241

242 (B) Structural steel. This material shall meet one of the following  
243 specifications:

244

245 (I) ASTM A36 "Standard Specification for Structural Steel."

246

247 (II) ASTM A242 "Standard Specifications for High Strength  
248 Low Alloy Structural Steel."

249

250 (III) ASTM A283 "Standard Specification for Low and  
251 Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars of Structural Quality."

252  
253 (IV) ASTM A441 “Tentative Specifications for High-Strength  
254 Low Alloy Structural Manganese Vanadium Steel.”  
255  
256 (V) ASTM A570 “Standard Specification for Hot-Rolled  
257 Carbon Steel Sheet and Strip, Structural Quality.”  
258  
259 (C) High Strength Carbon steel sheets or “well casing steel.” Each  
260 sheet of material shall contain mill markings ~~which that will~~ identify the manufacturer and  
261 specify that the material is well casing steel ~~which that~~ complies with the chemical and physical  
262 properties published by the manufacturer.  
263  
264 (D) Stainless Steel casing shall meet the provisions of ASTM A409  
265 “Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High  
266 Temperature Service.”  
267  
268 (ii) Plastic can also be used for casing in many locations and under a variety  
269 of circumstances. The two groups of plastic materials available are thermoplastics and  
270 thermosets.  
271  
272 (A) Thermoplastics. This material shall meet the requirements of  
273 ASTM F 480 “Standard Specification for Thermoplastic Water Well Casing Pipe and Couplings  
274 made in Standard Dimension Ratios (SDR).”  
275  
276 (B) Thermosets. This material shall meet the requirements of the  
277 following specifications: ~~;~~  
278  
279 (I) ASTM D2996 “Standard Specification for Filament Wound  
280 Reinforced Thermosetting Resin Pipe.”  
281  
282 (II) ASTM D2997 “Standard Specification for Centrifugally  
283 Cast Reinforced Thermosetting Resin Pipe.”  
284  
285 (III) ASTM D3517 “Standard Specification for Reinforced  
286 Plastic Mortar Pressure Pipe.”  
287  
288 (IV) AWWA C950 “AWWA Standards for Glass - Fiber -  
289 Reinforced Thermosetting - Resin Pressure Pipe.”  
290  
291 (iii) Concrete pipe used for casing should conform to the following  
292 specifications:  
293 (A) ASTM C14 “Standard Specifications for Concrete Sewer, Storm  
294 Drain, and Culvert Pipe.”



295  
296 (B) ASTM C76 “Standard Specification for Reinforced Concrete  
297 Culvert, Storm Drain, and Sewer Pipe.”

298  
299 (C) AWWA C300 “AWWA Standards for Reinforced Concrete  
300 Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.”

301  
302 (D) AWWA C301 “AWWA Standards for Prestressed Concrete  
303 Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.”

304  
305 (iv) Galvanized sheet metal pipe or natural wood shall not be used as casing.

306  
307 (b) All casing shall be placed with sufficient care to avoid damage to casing sections  
308 and joints. All joints in the casing above the perforations or screens shall be watertight. The  
309 uppermost perforations shall be at least below the minimum depth of seal. Casing shall be  
310 equipped with centering guides to ensure even thickness of annular seal and/or gravel pack.

311  
312 (i) Metallic casing. Steel casing may be joined by either welding or by  
313 threading and coupling.

314  
315 (ii) Plastic (non-metallic) casing. Depending on the type of material and its  
316 fabrication, plastic casing may be joined by solvent welding or may be mechanically joined.  
317 ~~Compatibility~~ Compatibility between potential contaminants and the sealing agent used shall be  
318 demonstrated.

319  
320 **Section 9. Sealing/Cementing Off Strata.** Where a well penetrates more than one  
321 aquifer or water bearing strata, every aquifer and/or strata shall be sealed off to prevent migration  
322 of water from one aquifer or strata to another.

323  
324 (a) Strata shall be sealed off by placing impervious material opposite the strata and  
325 opposite the confining formation(s). The seal shall extend above and below the strata no less than  
326 ten (10) feet. The sealing material shall fill the annular space in the interval to be sealed, and the  
327 surrounding void spaces ~~which~~ that might absorb the sealing material. The sealing material shall  
328 be placed from the bottom to the top of the interval to be sealed.

329  
330 (b) Commercial, municipal and industrial waste and artificial recharge wells shall be  
331 sealed/ cemented in order that all aquifers are isolated over the entire length of casing(s) and  
332 shall be surrounded by a minimum of two (2) inches of sealant. The sealant/cement plug used to  
333 isolate the aquifer(s) shall extend fifty (50) feet above and below the interface between confining  
334 layer and the aquifer(s).

335  
336 (c) Sealing material shall consist of neat cement, cement grout, or bentonite clay as  
337 per Section ~~65~~ 6 (c).

338 **Section 10. Well Construction, Completion, Development and Evaluation.**  
339

340 (a) Developing, redeveloping, or conditioning a well shall be done by methods ~~which~~  
341 that will not cause damage to the well or cause adverse subsurface conditions that may destroy  
342 barriers to the vertical movement of water between aquifers.  
343

344 (b) The well opening shall be closed with a cover to prevent the introduction of  
345 undesirable material into the well and to ~~insure~~ ensure public safety whenever the well is not in  
346 use or when maintenance is being performed on the well.  
347

348 (c) During well development, every well shall be tested for plumbness and alignment  
349 in accordance with AWWA or API approved standards, (i.e., deviation checks). The plumbing  
350 and alignment tests shall be documented to ensure problems such as key seating, or fatigue  
351 failures will not occur.  
352

353 (d) All injection/recharge wells used for discharge of commercial, municipal or  
354 industrial wastes shall inject fluid through a tubing with a packer set immediately above the  
355 injection zone or tubing with an approval fluid seal as an alternative.  
356

357 (e) At a minimum, all commercial, municipal and industrial waste, special process  
358 discharge, artificial recharge and miscellaneous discharge wells deviation checks and cement  
359 bond logs shall be conducted and documented. The Water Quality Division should be contacted  
360 prior to well construction or operation to determine the need for ~~addition-at~~ additional logs and  
361 tests.

362 **Section 11. Plugging and Abandonment.**  
363

364 (a) All wells that are no longer useful (including test wells) must be plugged in order  
365 to ~~assure~~ ensure that groundwater supply is protected and preserved for further use and to  
366 eliminate the potential physical hazard. A well is considered “abandoned” when it has not been  
367 used for a period of one year, unless the owner demonstrates ~~his~~ their intention to use the well  
368 again by properly maintaining the well in such a way that:  
369

370 (i) The well has no defects ~~which~~ that will allow the impairment of quality of  
371 water in the well or in the water bearing formations penetrated.  
372

373 (ii) The well is covered and the cover is watertight.  
374

375 (iii) The well is marked so that it can be clearly seen.  
376

377 (iv) The area surrounding the well is kept clear of brush or debris.  
378

379 Observation or test wells used in the investigation or management of usable sources of  
380 groundwater by state agencies or by engineering or research organizations are not considered  
381 “abandoned” so long as they are maintained for this purpose. These wells shall be covered with  
382 an appropriate cap, and labeled for their particular use.  
383

384 (b) Preliminary work. Before a well is plugged and abandoned, it shall be  
385 investigated by the permittee (owner/ operator) to determine its condition, details of construction  
386 and whether there are obstructions that will interfere with the process of filling and sealing.  
387

388 (c) Filling and sealing. Following are requirements to be observed when plugging  
389 wells-:

391 (i) Wells wholly situated in unconsolidated material in an unconfined  
392 groundwater zone shall have the uppermost thirty (30) feet sealed with impervious material. The  
393 remainder of the well shall be filled with clay, sand, or other suitable inorganic matters as  
394 described in paragraph e.  
395

396 (ii) Wells penetrating several aquifers or formations containing usable water  
397 sources shall have the uppermost thirty (30) feet sealed with an impervious material. All  
398 screened or perforated intervals shall be sealed to prevent vertical movement of waters from the  
399 producing or injected formation. Impervious material shall be placed opposite the confining  
400 formation above and below (and including) the screened or perforated interval for a minimum of  
401 fifty (50) feet or more.  
402

403 (iii) Any uncased hole below the well shoe shall be filled with an impervious  
404 material as described in paragraph e. to a depth of at least fifty (50) feet above the shoe.  
405

406 (iv) Whenever production casing has been severed or inadvertently removed  
407 the well bore shall be filled with impervious material from a point fifty (50) feet below to a point  
408 50 feet above the point of severance or to the surface limit.  
409

410 (v) Wells penetrating creviced or fractured rock shall have the portions of the  
411 well opposite this formation sealed with neat cement, sand cement grout or concrete. If these  
412 formations extend to considerable depth, alternate layers of coarse stone and cement grout or  
413 concrete may be used to fill the well.  
414

415 (vi) Wells in nonfractured, consolidated formations shall have the uppermost  
416 thirty (30) feet filled with impervious material and the non-creviced, consolidated formation  
417 portion of the well may be filled with clay or other suitable material.  
418

419 (d) Placement of material. The following requirements shall be observed in placing  
420 fill or sealing a plugged or abandoned well.  
421

422 (i) No material shall be placed in the well unless the ~~a~~Administrator has been  
423 notified that plugging and abandonment operations are to commence. A minimum of thirty (30)  
424 days notice must be given.

425  
426 (ii) The well shall be filled with the appropriate material as described in  
427 paragraph e. from the bottom of the well up.

428  
429 (iii) Sealing materials shall be placed in the interval or intervals to be sealed  
430 by methods that prevent free fall, dilution and/or separation of aggregates from cementing  
431 materials.

432  
433 (iv) When the underground pressure head producing flow is such that a  
434 counterpressure must be applied to force a sealing material into the annular space, this  
435 counterpressure shall be maintained for the length of time required for the cementing mixture to  
436 set as specified in Section ~~65-6~~, paragraph (c) (viii) of this part.

437  
438 (v) To ~~assure~~ ensure that the well is filled and there has been no bridging of  
439 the material, verification shall be provided that the volume of material placed in the well  
440 installation at least equals the volume of the empty hole.

441  
442 (e) Material. Requirements for sealing and fill materials are as follows.

443  
444 (i) Impervious sealing materials. Sealing materials shall have a permeability  
445 of 10 - 7 cm/sec or less. Impervious materials include neat cement, sand-cement grout, concrete,  
446 and bentonite clay as described in Section ~~66-6~~, paragraph (c). Used drilling muds are not  
447 acceptable.

448  
449 (ii) Filler material. Materials such as clay, silt, sand, gravel, crushed stone,  
450 native soil, and mixtures of these materials, as well as those described in ~~the preceeding~~  
451 paragraph (i) above may be used as filler material. Material containing organic matter or used  
452 drilling muds shall not be used.

453  
454 (f) Markings. The top of the plug of any plugged and abandoned well shall show  
455 clearly, by permanent markings, whether inscribed in the cement or on a steel plate embedded in  
456 the cement, the permit number, well identification number and date of plugging.

457  
458 (g) Reports. Within fifteen (15) days after a well has been plugged and abandoned,  
459 the owner shall file a plugging record with the Water Quality Division.