



USDA NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION
ARIZONA

WATER WELL

(no.)
CODE NO. 642

1. SCOPE

The work shall consist of drilling and furnishing and installing materials as required constructing the well.

2. GENERAL REQUIREMENTS

The immediate area surrounding the well site shall be cleared, smoothed, and graded to allow for a safe and dry working area.

A. Alignment

Drilled vertical wells shall be round, plumb, and aligned to permit satisfactory installation and operation of a pump of the proposed size and type to the greatest anticipated depth of setting.

B. Casing Material

Casing can be made of steel, plastic, fiberglass, concrete, or other material of equivalent strength and durability. No casing materials containing asbestos shall be used.

Steel, plastic, or fiberglass pipe casings can be used in drilled wells. Only steel pipe casing shall be used in driven wells.

Thermoplastic or plastic casings shall be made of acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC), or styrene-rubber (SR) and shall conform to the requirements specified in ASTM-F-480. Plastic pipe manufactured for water or irrigation pipelines can be used if the quality of the pipe equals or exceeds that specified in ASTM-F-480. See Table 1 for maximum depth of installation for plastic pipes and Table 2 for maximum depth of installation for schedule 40 and 80 PVC plastic pipes.

All materials must be approved for human consumption by the National Sanitation Foundation.

A fiberglass pipe is a thermoset plastic pipe containing glass fiber reinforcements embedded in or surrounded by cured thermosetting resin. The following fiberglass casings can be used if tests indicate that:

1. The filament-wound fiberglass casing (glass-fiber-reinforced-thermosetting-resin pipe (RTRP)) material meets the requirements specified in ASTM-D-2996. RTRP is a fiberglass pipe without aggregate. Tests for long-term cyclic pressure strength, long-term static pressure, and short-term rupture strength as required in ASTM-2996 are not needed because the pipe is to be used for well casing.
 - a. The joints meet the requirements specified in Section 3.8 ASTM-F-480.
 - b. The modulus of elasticity is certified for use in determining maximum depth.
2. Fiberglass pressure pipe or glass fiber-reinforced plastic mortar casing (RPMP) shall equal or exceed the requirements specified in ASTM-D-3517. RPMP is a fiberglass pipe with aggregate.

See Table 3 for depth limitations for fiberglass reinforced plastic well casings.

Concrete casings shall be reinforced and shall meet or exceed the requirements specified in ASTM-C-76. The minimum 28-day compressive strength shall be 4,000 pounds per square inch.

Steel well casings shall equal or exceed the requirements specified in ASTM-A-589. Steel pipe manufactured for other purposes can be used if the quality of the pipe equals or exceeds that specified in ASTM-A-589. Used steel pipe can be used for well casings if it is of good quality and has a wall thickness equal to or greater than that of Table 4.

C. Joints

Joints for well casings shall have adequate strength to carry the load due to the casing length and still be watertight or shall be mechanically supported during installation to maintain joint integrity. Such mechanically supported casing shall terminate on firm material that can adequately support the casing.

D. Gravel Pack

If gravel packing is required, as dictated by the actual project aquifer and / or drilling conditions meeting conditions as given in the standard under section, Gravel Pack, then gradation of gravel pack and screen slot size shall meet requirements provided and as recommended by the well driller for approval by NRCS.

Gravel materials shall be carefully placed to prevent segregation and bridging. Gravel pack material shall extend a minimum of 10 feet above the top of the perforated or screened section and shall extend through the length of the water-bearing formation and 10 feet below.

Gravel pack materials shall be protected from direct contact with the ground and contamination until installed. Bulk materials shall be stored on a surface covered with a plastic sheet or tarp having a minimum thickness of 2 mils.

E. Installation

In consolidated formations, the casing shall extend from at least one foot above the ground surface through the overburden material to an elevation of at

least 2 feet into the consolidated material.

In unconsolidated formations, the casing shall extend from at least one foot above the ground to the screen.

Artesian aquifers have special requirements for casing. An artesian aquifer is an aquifer which is overlain by a confining formation and which contains groundwater under sufficient pressure for the water to raise above the top of the aquifer. Not all artesian wells flow at the surface. Requirements for installation of wells under artesian pressure are as follows:

1. The well casing shall extend into the confining formation overlying the artesian aquifer, and shall be sealed a minimum of 10 feet into the confining formation to prevent surface leakage into and subsurface leakage from the artesian aquifer.
2. If leaks occur adjacent to the well or around the well casing, the well shall be completed with seals, packers or casing and grouting necessary to eliminate such leakage.
3. If the well flows at land surface, the well shall be equipped with a control valve, or suitable alternative means of completely controlling the flow, which must be available for inspection at the well site at all times.

F. Development

The well shall be developed until it stops producing detrimental quantities of solid particles when the continuous discharge rate is approximately 20 percent greater than the anticipated normal production rate.

G. Surface Seal

All wells shall be constructed with a surface seal as herein provided. The seal shall consist of steel casing, one foot of which shall extend above ground level, a concrete slab and cement grout placed in one continuous application from the bottom of the zone to be

grouted to the land surface. If a pitless adaptor is utilized, the cement grout may terminate at the bottom of the pitless adaptor. The minimum length of the steel casing shall be 20 feet.

Wells shall have the casing surrounded on the ground surface by a 4-inch thick concrete slab extending at least 2 feet in all directions. A cover at the top of the well casing with a sanitary well seal, well cap or a pump mounting plate that seals the opening shall be installed to prevent the entrance of contaminated water or other objectionable material.

The annular space between the casing and well bore shall be filled with expansive hydraulic cement (ASTM C845) or bentonite based grout. The minimum annular space between the casing and the well bore for placement of grout shall be 3 inches. The aggregate size to be used in the grout mixture shall not exceed 1/4 inch. Curing additives, such as calcium chloride, shall not exceed 10 percent of the total volume. Bentonite as an additive shall not exceed 5 percent of the total volume. The minimum length of the surface seal shall be 20 feet. Any annular space between the surface casing and an inner casing shall be completely sealed to prevent contamination of the well from the land surface.

H. Workmanship

The well casing pipe, couplings, and screens, shall be homogeneous throughout and shall be free of visible cracks, holes, foreign materials, or other injurious defects. The well casing pipe, couplings, and screens shall be as uniform in color, density, and other physical properties as is commercially possible.

I. Markings

The well casing pipe shall be marked according to the ASTM Specification for the material used.

J. Certification

Markings on casing pipe material identifying the manufacturer and indicating compliance with appropriate specifications can be accepted as evidence that the material meets the requirements of this standard. If the material does not bear these markings, the manufacturer can certify that pipe complies with the requirements of this standard. The State Conservation Engineer, however, can request tests supporting this certification.

K. State Law

All wells installed under this specification shall meet the requirements of all applicable laws of the State of Arizona.

L. Cultural Resources

This practice involves soil disturbance. The area of potential effect for each undertaking must be investigated for cultural resources under Section 106 of the National Historical Preservation Act of 1966, as amended, before soil disturbance occurs. (See the NRCS Arizona Handbook of Cultural Resources Procedures in Section IV of the FOTG.)

M. Procedure for testing a well

- 1) Measure and record depth to static water level. (May be measured with steel tape that has 1 to 2 feet of its lower end chalked.)
- 2) Determine if the well is artesian or nonartesian by reference to the well log for presence of a confining layer. If the static water level is above the bottom of the confining layer, the well is artesian.
- 3) Determine height of the static water column or 100 percent drawdown. For nonartesian wells, 100 percent drawdown is the depth from static water level to the bottom of the aquifer is not completely penetrated. For artesian wells, 100 percent drawdown is the depth from static

- water level of piezometric surface to the bottom of the confining layer.
- 4) Pump the well at near maximum rate (50 percent drawdown or slightly more) until drawdown and yield are constant at the rate. Drawdown may be considered constant when three measurements taken one hour apart are the same. Measurement of water levels while pumping should be made with an electric sounder or air line. Several hours to several days of continuous pumping may be required. Record drawdown and yield.
 - 5) Convert measured drawdown to percent drawdown and refer to Exhibit 12-3 to estimate optimum drawdown and yield.
 - 6) After the well has been surged and bailed, it shall be tested with a pump furnished by the driller. Pump shall have a capacity in excess of expected yield and be capable of pumping at variable rates. The pump shall be operated continuously for a total of hours. An air line or other suitable method shall be used to measure the drawdown periodically during pumping.

Table 1
Maximum Depth of Installation for selected plastic pipe
(SDR-PR) pipe

SDR	Material			
	PVC	ABS	styrene-rubber (SR)	
	Modulus of elasticity (E)			
	400,000 psi	320,000 psi	250,000 psi	300,000 psi
	feet			
13.5	1,020	920	815	665
17	495	445	395	320
21	255	230	205	165
26	130	120	105	85
32.5	65	60	50	40

TABLE 2
Dimensions and Maximum Depth of Installation for selected PVC-12454 plastic pipe
Schedule 40 and 80 PVC Plastic Pipe

Nominal diameter (in.)	Outside diameter (in.)	Schedule 40			Schedule 80		
		Min. Wall Thickness (in.)	SDR	Maximum depth (ft.)	Min. Wall thickness (in.)	SDR	Maximum depth (ft.)
2	2.375	0.154	15.4	675	0.218	10.9	2,020
2 ½	2.875	0.203	14.2	870	0.276	10.4	2,350
3	3.500	0.216	16.2	575	0.300	11.7	1,610
3 ½	4.000	0.226	17.7	435	0.318	12.6	1,270
4	4.500	0.237	19.0	350	0.337	13.4	1,045
5	5.563	0.258	21.6	235	0.375	14.8	765
6	6.625	0.280	23.7	175	0.432	15.3	690
8	8.625	0.322	26.8	120	0.500	17.3	470
10	10.750	0.365	29.5	90	0.593	18.1	405
12	12.750	0.406	31.4	70	0.687	18.6	375

TABLE 3
Dimensions and Depth Limitations for Reinforced Plastic (RPMP) Well Casings

Diameter (in.)	Maximum depth (ft.)								
	20	60	100	200	300	400	500	750	1000
	Minimum wall thickness (in.)								
8	0.17	0.17	0.23	0.23	0.23	0.29	0.29	0.33	0.33
10	0.17	0.17	0.28	0.28	0.28	0.36	0.36	0.41	0.41
12	0.18	0.19	0.34	0.34	0.34	0.43	0.43	0.46	0.46
14	0.19	0.22	0.34	0.34	0.40	0.43	0.46	0.46	0.46
15	0.19	0.24	0.34	0.34	0.46	0.46	0.46	0.46	0.46
16	0.20	0.25	0.36	0.36	0.46	0.46	0.46	0.46	0.46
18	0.21	0.28	0.40	0.40	0.46	0.46	0.46	0.52	0.52
20	0.21	0.31	0.42	0.42	0.46	0.46	0.46	0.54	0.54
21	0.21	0.33	0.48	0.48	0.48	0.48	0.48	0.57	0.57
24	0.24	0.38	0.48	0.48	0.48	0.57	0.57	0.57	0.57
27	0.26	0.40	0.49	0.49	0.49	0.62	0.62	0.62	0.62
30	0.29	0.44	0.49	0.49	0.49	0.68	0.68	0.68	0.68
33	0.32	0.44	0.60	0.60	0.60	0.75	0.75	0.75	0.75
36	0.35	0.48	0.65	0.65	0.65	0.82	0.82	0.82	0.82

TABLE 4
Maximum Depth of Installation of Steel Casing

Wall thickness (uncoated)	Casing Size (in.)									
	4	5	6	8	10	12	14	16	18	24
	Outside Diameter (in.)									
	4.500	5.563	6.625	8.625	10.75	12.75	14.00	16.00	18.00	24.00
Maximum depth (ft.)										
20 Ga (0.036)	60	35	20	0	0	0	0	0	0	0
18 Ga (0.048)	140	75	45	20	0	0	0	0	0	0
16 Ga (0.060)	250	145	90	40	20	0	0	0	0	0
14 Ga (0.075)	460	260	160	80	40	25	20	0	0	0
12 Ga (0.105)	1,040	630	400	200	110	70	50	35	0	0
10 Ga (0.350)	1,810	1,140	750	390	220	135	105	70	50	0
8 Ga (0.164)	2,660	1,740	1,190	640	360	230	180	125	90	0
7 Ga (0.179)	3,130	2,090	1,450	790	460	290	230	160	110	0
3/16 (0.188)	3,415	2,300	1,610	890	520	330	260	180	130	60
7/32 (0.219)	4,430	3,070	2,200	1,260	750	500	390	270	200	90
Sch 40 (0.237)	5,035	---	---	---	---	---	---	---	---	---
¼ (0.250)		3,880	2,840	1,680	1,030	690	550	390	290	130
Sch 40 (0.258)		4,090	---	---	---	---	---	---	---	---
Sch 40 (0.280)			3,490	---	---	---	---	---	---	---
9/32 (0.280)				2,140	1,350	910	730	520	390	180
5/16 (0.312)				2,625	1,690	1,160	930	680	510	240
Sch 40 (0.322)				2,785	---	---	---	---	---	---
11/32 (0.344)					2,065	1,445	1,175	860	650	310
Sch 40 (0.365)					2,325	---	---	---	---	---
3/8 (0.375)						1,970	1,420	1,055	800	390
Sch 40 (0.406)						2,045	---	---	---	---
Sch 40 (0.438)							1,975	---	---	---
7/16 (0.438)								1,490	1,145	580
Sch 40 (0.500)								1,970	---	---
Sch 40 (0.562)									1,965	---
Sch 40 (0.668)										1,645

3. SPECIAL REQUIREMENTS

Installation shall be in accordance with the drawings, specifications and special requirements. NO CHANGES ARE TO BE MADE IN THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR NRCS APPROVAL AND AUTHORIZATION.

Other Requirements

4. REQUIRED ATTACHMENTS

Construction Drawings to include at a minimum the following requirements: project location and standard drawing for water well; and other information as appropriate. AZ standard drawing no. 06016_Well.dwg, Well with pitless adapter.

Practice Specifications

O&M Plan

5. OTHER ATTACHMENTS

Associated Practice Specifications

Water Quality Considerations

Other _____
