

CONSTRUCTION SPECIFICATION

VA-730. WELL

1. SCOPE

This specification applies to drilled, driven and dug wells developed to supply water from an underground source. It does not include pumps installed in the well, or above-ground installations such as pumping plants, pipelines or tanks.

All wells shall comply with state water laws and regulations. Wells at recreation sites shall comply with applicable regulations of the Virginia Department of Health, or other state and county agencies having jurisdiction.

2. CASING AND MATERIALS

Wells shall be cased, except that the lower sections of a well passing through consolidated strata do not require casing. Materials shall be in accordance with the requirements of Section 9 of this specification.

3. SCREENS

All wells finished in unconsolidated aquifers shall be equipped with manufactured screen sections, well points or field perforated sections meeting the criteria stated below.

The screen openings for aquifer material of near uniform size shall be slightly smaller than the average diameter of the aquifer material. For graded aquifer materials (of non-uniform gradation), the screen openings shall be such that 25 to 40 percent of the aquifer material is larger than the screen opening. In wells using a gravel pack envelope, the screen shall have openings of a size that will exclude at least 85 percent of the gravel pack material.

The length and open area of the screen shall be sufficient to maintain the entrance velocity of water into the well at an acceptable level, preferably less than 0.1 foot per second (30 mm/sec).

The position of the screen in the well will be governed by the depth of the aquifer below the ground surface and the thickness of aquifer to be penetrated by the well. Where practical, the top elevation of the screen should be below the lowest water level expected during pumping and be located opposite the most permeable areas in the water-bearing strata.

4. GRAVEL PACK

Filter packs will be used in wells developed in stratas composed of fine material of relatively uniform grain size to prevent aquifer materials from passing through the well screen or perforated casing. The pack shall be 3 to 12 inches (76 to 305 millimeters) thick and shall be composed of sand or gravel material having a D30 grain size 4 to 12 times the D30 grain size of the aquifer material.

5. SANITARY PROTECTION

Wells should be located a safe distance from known sources of contamination. The well shall be located on ground that is higher than any source of contamination. Drainage that might reach the source from areas used by livestock should be diverted.

Each well shall be provided with a watertight cover or seal to prevent contaminated water or other objectionable material from entering the well. The annulus around the casing shall be filled with expansive hydraulic cement (ASTM C 845), shrinkage compensating concrete,

bentonite based grout, clay , or other material with similar sealing properties. The length of the grout seal shall be no less than 10 feet and not less than the minimum specified in state or locally applicable codes. A positive seal shall be provided between the casing and the less pervious material overlying the aquifer of artesian wells, and in all aquifers where co-mingling of waters in undesirable.

If the water is intended for human consumption, the casing shall be surrounded at the ground surface by at least a 4-inch (100 mm) thick concrete slab extending at least 2 feet (0.6 m) in all directions or as specified in state or locally mandated codes. A sanitary well seal shall be installed at the top of the well casing to prevent the entrance of contaminated water or other objectionable material.

6. ALIGNMENT

Drilled, jetted, bored, and driven wells shall be sufficiently round, straight, and of adequate diameter to permit satisfactory installation of inlet, well casing, filter pack, and annular seal, and passage of tremie pipe (including couplings), if used.

7. CASING INSTALLATION

Casing shall extend from above the ground surface down through unstable earth materials to an elevation of at least 2 feet into stable material or to the top of the screen. All wells shall be cased to a sufficient height (minimum of 18 inches) above the ground surface to prevent entry of surface water. Casing for artesian aquifers shall be sealed into overlying, impermeable formations in such a manner as to retain confining pressure. If a zone is penetrated that is determined or suspected to contain water of quality unsuitable for intended use, the zone shall be sealed to prevent infiltration of the poor-quality water into the well and the developed portion of the aquifer.

8. DEVELOPING

For massive, unfractured rock formations unresponsive to well development procedures, the use of aquifer stimulation techniques may be considered to improve well efficiency and specific capacity. Techniques may include dry ice or hydrofracturing, depending on the composition and structure of the formation.

9. MATERIALS

Casings may be of steel, iron, stainless steel, copper alloys, plastic, fiberglass, concrete, or other material of equivalent strength and durability consistent with the intended use of the water and the maximum anticipated differential head between the inside and outside of the casing. Steel well casing shall meet or exceed requirements specified in ASTM A 589. Steel pipe manufactured for other purposes may be used if the quality of the pipe meets or exceeds requirements specified in ASTM A 589.

Only steel pipe casings shall be used in driven wells. New metal pipe or new plastic pipe shall be used for well casing in drilled wells. Only new metal pipe shall be used for driven wells.

To prevent galvanic corrosion, dissimilar metals shall not be joined.

Table 1: Minimum thickness of metal casings for livestock or recreation wells, in inches.

Diameter In.	Steel Casing In.
4	0.188
6	0.188
8	0.277
10	0.279

Plastic casings made of acrylonitrilebutadiene-styrene (ABS), polyvinyl chloride (PVS), or styrene-rubber (SR) shall conform to material, dimensional and quality requirements specified in ASTM F 480.

Table 2: Maximum depth of installation for plastic (SDR-PR) pipe, in feet.

SDR	PVC Modulus 400K	PVC Of 320K	ABS Elasticity 250K	SR (E) 300K
13.5	985 ft	785	615 ft	735
17	475	380	295	355
21	245	200	150	185
26	130	100	80	95
32.5	65	50	40	50

Table 3: Dimensions and maximum depth of installation for schedule 40 PVC plastic pipe with a modulus of elasticity of 400,000 lb/in².

Schedule 40				
Nominal Diameter In.	Outside Diameter In.	Min. Wall Thickness In.	SDR	Max. Depth Ft.
2	2.375	0.154	15.4	650
2 ½	2.875	0.203	14.2	840
3	3.5	0.216	16.2	550
3 ½	4.00	0.226	17.7	420
4	4.50	0.237	19.0	340
5	5.563	0.258	21.6	230
6	6.625	.280	23.7	170
8	8.625	0.322	26.8	120
10	10.75	0.365	29.5	90
12	12.75	0.406	31.4	60

If the water is to be used for human consumption, plastic pipe shall be approved by the National Sanitation Foundation. Plastic pipe manufactured for water or irrigation pipelines may be used if the quality equals or exceeds requirements specified in ASTM F 480. Filament-wound fiberglass casings (glass-fiberreinforced-thermosetting-resin pipe, RTRP) may be used if

material meets requirements specified in ASTM D 2996. Tests for long-term cyclic pressure strength, long-term static pressure strength, and short-term rupture strength as required in ASTM D 2996 are not needed because the pipe is to be used for well casing. Joints shall meet requirements specified in Section 3.8, ASTM D 3517.

Fiberglass pressure pipe, (also called reinforced plastic mortar pipe, RPMP, or fiberglass pipe with aggregate) shall meet or exceed requirements specified in ASTM D 3517. The maximum depth for well casings shall be based on critical collapse pressure calculated by the Cleindeinst Equation in ASTM F 480, Appendix X2. Depth applies to the difference in static head between the inside and outside of the casing. This can be determined by measuring the static head or by using the total depth of the well.

10. JOINTS STRENGTH

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 casings shall terminate on firm material that can adequately support the casing weight.