



Rules of
Department of Natural Resources
Division 23—Well Installation
Chapter 5—Heat Pump Construction Code

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**Title 10—DEPARTMENT OF
NATURAL RESOURCES
Division 23—Well Installation
Chapter 5—Heat Pump Construction
Code**

10 CSR 23-5.010 Definitions
(Rescinded February 28, 2019)

AUTHORITY: sections 256.603, 256.606, and 256.626, RSMo 2000. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.

10 CSR 23-5.020 Certification and Registration of Heat Pump Systems
(Rescinded February 28, 2019)

AUTHORITY: sections 256.606, 256.623, and 256.626, RSMo 2000. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.

10 CSR 23-5.030 General Protection of Groundwater Quality and Resources

PURPOSE: This rule prevents the use of heat pump wells for any other purpose.

(1) Heat pump wells shall not be converted to any other type of well unless advanced written approval is obtained from the department.

(2) On open-loop systems that utilize groundwater wells, it is the responsibility of the water well installation contractor to ensure that the integrity of the annular seal remains viable for three (3) years after the date of certification unless it can be shown that the well seal has been damaged by other persons.

*AUTHORITY: sections 256.606 and 256.626, RSMo 2016. * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

**Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

10 CSR 23-5.040 Location of Heat Pump Wells

PURPOSE: This rule sets standards for the placement of heat pump wells.

(1) A vertical heat pump well shall be located on a site which has good surface drainage and prevents the accumulation of water within ten feet (10') of the well and any buried pipes.

(2) Distances from pollution or contamination sources. A vertical heat pump well shall be at least—

(A) Three hundred feet (300') from a storage area for commercial fertilizers or chemicals, landfill, lagoon, or above-ground or underground storage tank for petroleum, petroleum products or chemicals.

(B) One hundred feet (100') from a below-grade manure storage area, cesspool, lagoon, unplugged abandoned well, subsurface disposal field (lateral field), grave, building or yard used for livestock or poultry, privy, or other contaminants that may drain into the ground.

(C) Fifty feet (50') from an existing operating well, septic tank, buried sanitary sewer, rim of a sinkhole, a pit or unfilled space below ground surface, a sump, except that a closed-loop heat pump well may be drilled closer than fifty feet (50') to a basement or another heat pump well.

(3) Any heat pump well that encounters oil and/or gas must have a grout plug from fifty feet (50') below the oil and/or gas bearing zone to fifty feet (50') above the oil and/or gas bearing zone. The grout plug must be composed of neat cement grout with a two percent–six percent (2%–6%) bentonite additive and be placed via tremie. The well must be grouted pursuant to 10 CSR 23-5.050(7)(A), from the bottom of the neat cement grout plug to total depth and from the top of the neat cement grout plug to the surface. If the well terminates in the oil and/or gas bearing zone, a grout plug composed of neat cement with a two percent–six percent (2%–6%) bentonite additive and placed via tremie must be placed from total depth to fifty feet (50') above the oil and/or gas bearing zone. The well must be grouted pursuant to 10 CSR 23-5.050(7)(A), from the top of the neat cement grout plug to the surface.

*AUTHORITY: sections 256.606 and 256.626, RSMo 2016. * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amend-*

ed: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

**Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

10 CSR 23-5.050 Construction Standards for Closed-Loop Heat Pump Wells

PURPOSE: This rule describes the minimum standards for a properly constructed closed-loop heat pump well.

(1) Casing, when used, shall follow the minimum standards pursuant to 10 CSR 23-3.030(1)(A) and be grouted full-length.

(2) Heat Pump Loop Material. In a closed-loop heat pump well, the material used to make up the heat-exchange loop that is placed in the borehole or trench must be composed of high density polyethylene or polybutylene pipe and must be installed and grouted without delay upon completion of drilling each well.

(A) High Density Polyethylene Pipe. This pipe must be manufactured in accordance with dimensional specifications of ASTM D-2513 or ASTM F-714 and must have a minimum cell classification of PE345434C or PE355434C when tested under ASTM D-3350 to be acceptable for use in closed-loop heat pump systems.

(B) Polybutylene Pipe. This pipe must be manufactured in accordance with ASTM D-2581. The pipe material must be—

1. Either Class B (general purpose and dielectric, in colors) or Class C (weather resistant, black in color containing not less than two percent (2%) carbon black);

2. Type II (density, ninety-one thousandths to ninety-two thousandths (0.091–0.092) grams per centimeter (g/cm));

3. Grade 1 (flow rate twenty-five thousandths to seventy-five thousandths (0.025–0.075) gallons per ten (10) minutes (g/10 min)).

(C) Other pipe may be used upon advanced written approval by the department.

(3) Connecting Closed-Loop Pipe. Polyethylene and polybutylene pipe must be thermally fused according to the pipe manufacturer's specifications and must not leak after assembly.

(A) Other connection methods may be used upon advanced written approval by the department.

(4) Heat Transfer Fluid. The fluid used inside the closed-loop assembly must meet



the following standards:

(A) Heat transfer fluids must be composed of—

1. Inhibited glycol;
2. Methanol;
3. Water;
4. Ethanol; or

5. Other fluids may be used upon advanced written approval by the department.

(B) The fluid as it is used in a diluted state in the closed-loop must have the following properties:

1. Be ninety percent (90%) biodegradable;
2. Demonstrate low corrosion to all materials common to ground source heat pump systems;
3. Be homogeneous, uniform in color, free from lumps, skins, and foreign material that would be detrimental to fluid usage;
4. Not have a flash point lower than ninety degrees Celsius (90°C);
5. Not have a five- (5-) day biological oxygen demand (BOD) at ten degrees Celsius (10°C) that exceeds two-tenths (0.2) gram oxygen per gram nor be less than one-tenth (0.1) gram oxygen per gram;
6. Have a toxicity that is less than the lethal dose (LD) of fifty (50) oral-rats of five (5) grams per kilogram; and
7. Show neither separation, or increase in turbidity, from exposure to heat or cold; and

(C) While this rule attempts to define antifreeze fluids that will protect the environment, it is the responsibility of the permittee to take necessary precautions to ensure groundwater protection.

(5) Borehole Size. The hole size for heat pump wells that are grouted full-length with high solids bentonite slurry (see 10 CSR 23-5.050(9)(A)) must be of sufficient size to allow placement of the pipe and placement of a tremie to emplace the high solids bentonite slurry grout. The slurry must be pumped via tremie to fill the hole and surround all pipes. There must be at least one-half inch (1/2") between the hole and all pipes. If full-length high solids bentonite slurry is not used, then the following hole sizes are required:

(A) At least a six-inch (6") borehole when the loop pipe is one and one-quarter inch (1 1/4") or greater in diameter;

(B) At least a five-inch (5") borehole when the loop pipe is less than one and one-quarter inch (1 1/4") in diameter.

(6) Borehole Depth. Closed-loop heat pump wells must not be deeper than five hundred feet (500'). Total depth of a new heat pump well in Drilling Area 12 (formerly Special

Area 3) and Drilling Area 13 (formerly Special Area 4) shall be determined in advance of drilling by the department.

(7) Grouting Depth of Vertical Heat Pump Wells. Grouting the annulus of a heat pump well must be completed immediately after the well is drilled due to cave-in potential in the uncased hole.

(A) Vertical heat pump wells require the annular space between the loop material, borehole, and/or casing to be grouted full length using materials in 10 CSR 23-5.050(8).

(B) Vertical heat pump wells drilled two hundred feet (200') or less that are not grouted full-length must follow the hole size requirements stated in section (5) and non-slurry bentonite plugs must be placed in the borehole. A plug (first plug) must be placed forty feet (40') above the total depth of the borehole. This plug must be composed of bentonite chips or pellets utilizing at least one (1) bag of bentonite resulting in at least a five foot (5') plug. Every forty feet (40') of borehole that exists above the first plug must have a plug set as described in this section. A near surface plug, consisting of bentonite granules or powder, must be set from a point ten feet (10') below the bottom of the trench that connects the closed-loop to the heat pump machine to the base of the trench. All bentonite plugs must be hydrated immediately with six to eight (6–8) gallons of potable water for each bag of bentonite after emplacement if they are in the unsaturated zone. All clean fill material placed between the bentonite plugs must be chlorinated. Clean fill is defined as sand, local drill cuttings, pea gravel, varied sized agricultural lime, or clean aggregate free from contamination. Contractors utilizing this type of grouting method must notify the department at least forty-eight (48) hours prior to beginning any construction on the system. The department will maintain a list of current notification methods (includes, but is not limited to, telephone, fax, email, voice mail, and the department's online notification system) and contact information available online or upon request. Notification information must include: owner name, owner address, GPS location, date work is to begin, primary contractor name, primary contractor permit number, drilling contractor name, and drilling contractor permit number.

(8) Approved Grout Materials. The following four (4) grout types are permitted for use in heat pump wells:

(A) Bentonite Slurry. High solids sodium bentonite slurry must be at least twenty percent to thirty percent (20%–30%) by weight solids to be used as grout. Thickened drilling mud or thinner bentonite slurry is strictly prohibited. When bentonite slurry is used, it must be applied in one (1) continual motion, through a tremie lowered to the grouting point;

(B) Nonslurry Bentonite. Only chipped or pelletized bentonite may be used when sealing the annulus of a well that is below the water level in the saturated zone. All nonslurry sodium bentonite varieties may be used in the unsaturated zone if the hole is dry and no bridging occurs. The dry bentonite must be hydrated after emplacement;

(C) Thermal Grout Slurry. Grout containing at least seven and one-half percent (7.5%) by weight bentonite solids and no more than sixty-five percent (65%) by weight silica solids may be used as grout. Specialized pumps are required to pump thermal grout slurry through a tremie lowered to within twenty feet (20') of the base of the borehole; and

(D) Other Grout. Other types of grout may be used if advanced written approval is obtained by the department.

(9) Wells that Encounter Karst Conditions. When a borehole encounters caves or larger fractures, chlorinated clean fill, such as gravel or sand, may be used to fill these intervals. Small fractures are effectively sealed by using chipped, hydrated bentonite. If the borehole cannot be grouted as specified, it must be plugged.

(10) Jetted Heat Pump Wells. Closed-loop heat pump wells that are jetted in Drilling Area 5 (see Figure 5) must have a minimum top grout plug of ten feet (10').

(11) Heat Pump Wells in Drilling Area 12 (formerly Special Area 3) may be constructed provided advanced written approval is obtained from the department pursuant to 10 CSR 23-3.090(12).

(12) Heat Pump Wells in Drilling Area 13 (formerly Special Area 4) may be constructed provided advanced written approval is obtained from the department pursuant to 10 CSR 23-3.090(13).

AUTHORITY: sections 256.606 and 256.626, RSMo 2016. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995.*



Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Dec. 16, 2002, effective June 30, 2003. Emergency amendment filed March 21, 2005, effective April 1, 2005, expired Sept. 27, 2005. Amended: Filed Sept. 27, 2005, effective April 30, 2006. Amended: Filed Jan. 4, 2007, effective Aug. 30, 2007. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.

**Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

10 CSR 23-5.060 Construction Standards for Open-Loop Heat Pump Systems

PURPOSE: This rule sets standards for open-loop heat pump systems that use wells to produce or return groundwater.

(1) Open-loop groundwater supply wells shall be constructed to domestic/multifamily well standards pursuant to 10 CSR 23-3.030(1) if it produces less than seventy (70) gallons per minute and to high yield well standards pursuant to 10 CSR 23-3.030(3) if it produces more than seventy (70) gallons of water per minute. Any well that was constructed before October 1987 that is utilized as the water supply or return for an open-loop heat pump system is exempt from these rules, except that the surface disposal of the water may be subject to other regulations.

(2) Heat pump systems and surface disposal of used water may require a permit pursuant to 10 CSR 20-6.

(3) Open loop water return wells shall be constructed to domestic/multifamily well standards pursuant to 10 CSR 23-3.030(1) if it produces less than seventy (70) gallons per minute and to high yield well standards pursuant to 10 CSR 23-3.030(3) if it produces more than seventy (70) gallons of water per minute. The depth of the return well shall be a similar depth as the supply well and the water must be returned to the same aquifer. The water return pipe must extend at least twenty feet (20') below the static water level.

AUTHORITY: sections 256.606 and 256.626, RSMo 2016. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

**Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

10 CSR 23-5.070 Closed-Loop Heat Pump Systems That Use Refrigerants as the Heat Transfer Fluid

(Rescinded December 30, 2018)

AUTHORITY: sections 256.606 and 256.626, RSMo 2000. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Rescinded: Filed April 25, 2018, effective Dec. 30, 2018.

10 CSR 23-5.080 Plugging of Heat Pump Wells

PURPOSE: This rule sets standards on the proper plugging of wells used in heat pump applications.

(1) Vertical Closed-Loop Heat Pump Wells. To plug a properly constructed vertical closed-loop heat pump well the following specifications must be met:

(A) Remove all heat transfer fluid from the closed-loop and take necessary precautions to ensure groundwater protection; and

(B) Dig down to the top of borehole and cut off the loop pipe at least three feet (3') below the surface. Pump the remaining loop full of bentonite or cement slurry. Allow the grout to fill the upper one foot (1') of borehole. Fill remaining hole with compacted earth or pavement.

(2) Open-Loop Heat Pump Wells. Wells used to supply water for heat pump and water return wells must be plugged pursuant to 10 CSR 23-3.110.

AUTHORITY: sections 256.606, 256.623, and 256.626, RSMo 2016. Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed May 17, 2013, effective Dec. 30, 2013. Amended: Filed June 27, 2018, effective Feb. 28, 2019.*

**Original authority: 256.606, RSMo 1991; 256.623, RSMo 1985, amended 1991; and 256.626, RSMo 1985, amended 1991.*