



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(Rescinded February 28, 2019)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 Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.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(Rescinded February 28, 2019)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 Rescinded: Filed June 27, 2018, effective Feb. 28, 2019.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. 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 23-5.050 Construction Standards for Closed-Loop Heat Pump Wells

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

PUBLISHER'S NOTE: The secretary of state has determined that publication of the entire text of the material that is incorporated by reference as a portion of this rule would be unduly cumbersome or expensive. This material as incorporated by reference in this rule shall be maintained by the agency at its headquarters and shall be made available to the public for inspection and copying at no more than the actual cost of reproduction. This note applies only to the reference material. The entire text of the rule is printed here.

(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 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 –

1. *ASTM D-2513 Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings*. This standard is incorporated by reference as published December 15, 2020, by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 and does not incorporate any subsequent amendments or additions; or

2. A minimum cell classification of PE345434C or PE355434C when tested pursuant to *ASTM D-3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials*. This standard is incorporated by reference as published July 21, 2021, by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 and does not incorporate any subsequent amendments or additions.

(B) Polybutylene Pipe. This pipe must be manufactured in accordance with *ASTM D-2581 Standard Specification for Polybutylene (PB) Plastics Molding and Extrusion Materials*. This standard is incorporated by reference as published August 16, 2017, by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 and does not incorporate any subsequent amendments or additions. 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)); and

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').

(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 and the borehole or casing to be grouted full-length using materials pursuant to 10 CSR 23-5.050(8), except as allowed in subsection (7)(B) of this rule.

(B) Vertical heat pump wells drilled two hundred feet (200') or less may not be grouted full-length only if they –

1. Follow borehole size requirements of 10 CSR 23-5.030(5);

2. Use grout plugs consisting of bentonite chips or pellets;

3. Place a five-foot (5') grout plug every forty feet (40'), beginning forty feet (40') above the bottom of the borehole;

4. Place the uppermost grout plug within ten feet (10') of the surface;

5. Hydrate all bentonite plugs immediately after emplacement, if they are in the unsaturated zone; and

6. Use clean fill for any material placed between the bentonite plugs.

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

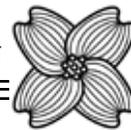
(A) Bentonite Slurry. High solids sodium bentonite slurry must be at least twenty percent to thirty percent (20%–30%) by weight solids to be used as grout. Thickened drilling mud or thinner bentonite slurry is strictly prohibited. When bentonite slurry is used, it must be applied in one (1) continual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

(B) Bentonite chips or pellets;

(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 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 Areas pursuant to 10 CSR 23-3.090(9) and Drilling Area 11 pursuant to 10 CSR 23-3.090(11) that penetrate the Ozark Confining Unit shall –

(A) Be grouted from ten feet (10') below the Ozark Confining Unit through the top of the Ozark Confining Unit; or

(B) If the Ozark Confining Unit is not fully penetrated, be grouted from the bottom of the borehole through the top of the Ozark Confining Unit.

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

(13) Conductive tracer wire that responds to aboveground electromagnetic locating equipment shall be laid in all horizontal trenches containing supply and return lines. Tracer wire shall –

(A) Be laid in a continuous loop;

(B) Be buried a minimum of twenty-four (24) inches deep; and

(C) Have the ends of the wire accessible at the surface in a test port or terminated above final grade at the building foundation with a permanent sign indicating the nature of the wires.

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. Amended: Filed March 20, 2024, effective Nov. 30, 2024.*

**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.*