



Bored Geothermal Heat Exchangers

SUMMARY OF RULES EFFECTIVE MARCH 22, 2021

Rulemaking Process and Timeline

In 2013, the Minnesota Legislature amended Minnesota Statutes, chapter 103I (www.revisor.mn.gov/statutes/cite/103I), to include regulating all bored geothermal heat exchangers (BGHEs), not just vertical heat exchangers. The Minnesota Department of Health (MDH) revised Minnesota Rules, chapter 4725 (www.revisor.mn.gov/rules/4725) (Wells and Borings) to reflect the 2013 statutory amendments and to accommodate varying BGHE construction methods. The new rules went into effect on March 22, 2021.

This document provides a summary of the major rule changes for BGHEs. For questions about the specific rule changes, contact the MDH Well Management Section at 651-201-4600 or health.wells@state.mn.us.

Summary of New Rules

Clarified and Added BGHE Definitions

- **Bored Geothermal Heat Exchanger (BGHE):** An earth-coupled heating or cooling device that consists of a closed-loop piping system installed in a boring in the ground to transfer heat to or from the surrounding earth with no discharge. This includes piping installed in a boring for thermal conductivity testing and does not include a closed-loop piping system installed in a boring 15 feet or less below ground surface.
- **BGHE contractor:** A person issued a limited well/boring contractor license to construct, repair, and seal BGHEs.
- **BGHE piping:** Pipe and fittings of a BGHE installed and buried below ground surface, including:
 - the pipe loop installed in a boring,
 - the buried pipe between the boring and header or manifold,
 - the buried header or manifold, and
 - the buried supply and return pipe between the buried header or manifold and the heat pump.
- **Directional drilling:** A drilling method that utilizes a steerable drill bit to cut a bore hole for installing underground pipe, also known as horizontal directional drilling or HDD.

Limited BGHE Contractor Certified Representative Applicants

Applicants must have three years of experience constructing, repairing, and sealing BGHEs; or in well drilling. The BGHE experience must be obtained under a licensed well contractor or limited BGHE contractor, unless it was obtained during directionally drilling BGHEs that were not regulated by MDH at the time of construction. The well drilling experience must be obtained under a licensed well contractor, and the applicant must also be accredited by the International Ground Source Heat Pump Association, certified by the National Groundwater Association, or have an equivalent certification.

BGHE Permits and Records

Only licensed well contractors and limited BGHE contractors can construct, repair, or seal BGHEs.

A BGHE must not be constructed until a permit has been issued by MDH. The application must be complete and signed by the licensed contractor and the property owner or their agent. The application must include a plan diagram showing the location of the BGHE borings, property lines, and structures. Incomplete applications cannot be processed and will be returned to the applicant. For the updated BGHE permit application form, visit: [Bored Geothermal Heat Exchanger \(BGHE\) and Groundwater Thermal Exchanger Device \(GTED\) Construction Permit Applications \(www.health.state.mn.us/communities/environment/water/wells/lwcinfor/bghegtedprmts.html\)](http://www.health.state.mn.us/communities/environment/water/wells/lwcinfor/bghegtedprmts.html).

Following permit approval, the licensed contractor must notify MDH of the proposed construction starting time at least 24 hours before starting construction of the BGHE borings.

BGHE construction records must be submitted within 60 days of the completion of the BGHE and must include the following information, in addition to what is required for all records:

- The number of pipe loops in each boring.
- The results of the required pressure test.
- GPS coordinates for the location where each pipe loop enters a boring, or GPS coordinates marking the corners or perimeter of the loop field.
- A scaled map showing the location where each pipe loop enters a boring, with angles and directions from survey property corners, a permanent benchmark, or the corner of a permanent structure. For directional BGHE piping, a scaled map showing the location of the entire length of each pipe loop and a cross-sectional profile showing the depth profile of the pipe loops.

BGHE Construction

New Piping Materials and Connections

High-density polyethylene (HDPE) and cross-linked polyethylene (PEX) are allowed. The pipe must have a minimum pressure rating of 160 pounds per square inch at 73 degrees Fahrenheit. The following requirements apply for the different pipe materials:

- **HDPE:** The pipe must meet ASTM Standards D3035 or F714, and the walls of the pipe must be SDR 11 or thicker. Socket fusion, butt fusion, and electrofusion connections are allowed. Socket fusion and butt fusion connections must be made in accordance with ASTM Standard F2620. Socket fittings must meet ASTM D2683. Electrofusion connections must meet ASTM Standard F1055.
- **PEX:** PEX pipe must be designated as PEXa. All components of the PEXa system must be from the same manufacturer. The pipe must meet ASTM Standard 876. The fittings must meet ASTM Standards F1807, 1960, or 2080. The fittings must also meet ASTM Standard 877. Fittings must not be buried in a pipe loop boring or between a pipe loop boring and the heat pump unit, unless the fitting is located in a vault or other structure accessible from the ground surface or building floor.

Revised Pressure Testing Requirements

The licensed contractor must conduct a successful pressure test of the BGHE piping after it is installed in the bore hole(s). The pipe must be pressure-tested with potable water at a pressure of 1.5 times the system operating pressure or 100 psi, whichever is greater. Pressure must remain constant for 30 minutes without adding water.

Grout

Neat-cement grout or cement-sand grout must be used in bedrock and borings with flowing artesian groundwater conditions. Neat-cement grout, cement-sand grout, bentonite grout, or thermally enhanced grout can be used in unconsolidated materials without flowing artesian conditions.

Graphite is allowed as a thermal enhancement material in thermally enhanced grout. Thermally enhanced grout must consist of:

- Maximum of 17.5 gallons of water per 50 pounds of bentonite.
- Thermal enhancement material:
 - Maximum of 200 pounds of sand per 50 pounds of bentonite, with at least 80 percent of the sand passing U.S. Sieve No. 50.
 - OR
 - Maximum of 20 pounds of graphite that meets ANSI/NSF Standard 60 per 50 pounds of bentonite.

Marking and Accessibility

BGHE piping must be marked from the point where the pipe loop exits the bore hole to the point where the pipe is exposed above ground surface or a building floor by a tracer wire, an underground marking tape detectable from the surface, or a ferromagnetic metal marker above the point where the pipe loop exits the bore hole.

The ends of each BGHE pipe loop must be accessible within a building or buried no deeper than 10 feet below ground surface and must not be built over or made inaccessible. BGHE piping must not be installed on another property without the property owner's written consent.

New Heat Transfer Fluids

Propylene glycol and ethanol products are allowed as heat transfer fluids:

- Propylene glycol must be food grade or USP grade. A propylene glycol with additives, including corrosion inhibitors or dyes, must be certified as meeting the NSF Category Code HT1 (info.nsf.org/USDA/psncllistings.asp).
- Ethanol products must be designed by the manufacturer for use in BGHE systems, and they are only allowed for use after approval by MDH. For approval, submit a complete list of product ingredients and concentrations with the BGHE permit application. Ethanol must be used with safety precautions, including that it can only be used in water solutions with 20 percent or less ethanol by volume, and concentrates must not be brought into the building where the heat transfer fluid will be used. Follow safety precautions and procedures specified by the manufacturer and the requirements of NFPA Standard 30.

No other fluids or additives may be used for heat transfer fluids, except potable water. A permanent sign must be attached to the heat pump identifying the heat transfer fluid in the BGHE and specifying that only approved heat transfer fluids may be used.

Revised Setback Distances

The minimum required isolation distances between a water-supply well and a BGHE are:

- 50 feet from the buried piping of a BGHE or any other closed loop geothermal heat exchanger that is unregulated or not constructed in accordance with the revised rules,
- 35 feet between the well and the buried piping of a BGHE or any other closed-loop geothermal heat exchanger that is more than 15 feet below ground surface and constructed in accordance with the revised rules, and
- 10 feet between the well and the buried piping of a BGHE or any other closed-loop geothermal heat exchanger that is less than 15 feet below ground surface and constructed in accordance with the revised rules.

The point where the drill bit penetrates ground surface for a BGHE boring must be at least 10 feet horizontally from a contaminant source that has contaminants directly entering the soil.

BGHE piping that extends under or within 3 feet horizontally of a building must be at least 10 feet below the lowest part of the building, including foundation and footings.

Backflow Prevention

Water make-up lines to the BGHE must be protected with backflow prevention according to the Minnesota Plumbing Code, Minnesota Rules, chapter 4714 (www.revisor.mn.gov/rules/4714).

To obtain this information in a different format call 651-201-4600.
Wellmgmt\RM BGHE\BGHE Rules Summary 03-18-2021