

Geoexchange (Geothermal) Systems for Single and Two Family Dwellings

The purpose of this brochure is to outline the permit requirement for geoexchange systems.

"This information is provided for convenience only and is not in substitution of applicable City Bylaws or Provincial or Federal Codes or laws. You must satisfy yourself that any existing or proposed construction or other works complies with such Bylaws, Codes or other laws."

Other brochure related to this topic

- [Heating System Permit](#)

Geoexchange systems are also known as earth energy systems, geothermal heat pump systems, and ground-source heat pump systems. Geoexchange systems consist of three primary subsystems:

1. **Source Side System:** the thermal exchange coupling with the earth, also known as the ground heat exchanger (GHX), allows heat transfer between the ground and the heat pump system. In heating mode, heat is extracted from the ground through the GHX. In cooling mode, heat is moved from the heat pump system and transferred to the ground through the GHX.
2. **Heat Pump System:** equipment using the principles of refrigeration to move heat across temperature gradients (also referred to as heating and/or cooling plant).
3. **Load Side System:** the distribution system that moves heat throughout the building (generally referred to as the heating, ventilating and air conditioning system or HVAC system).

The temperature of the GHX side varies in response to the "rate" (power) and cumulative "quantity" (energy) of heat extracted from or rejected into the earth, and the earth's ability to store and conduct heat to or away from the GHX. The resulting GHX temperature variation directly affects the capacity and performance efficiency of the building "load" side of the system. Therefore, the vast majority of actual geoexchange applications experience constantly changing earth source temperatures, system capacity and performance efficiency.

This mutual “thermal interdependence” relationship between the building “load” side and GHX side of the system is the most complex. The greatest challenge is to properly size the GHX, so that the GHX temperatures are kept within an acceptable operating range.

Single-Source Responsibility:

Geexchange technology requires a thorough “multi-disciplinary” cooperation and coordination throughout the design and installation process. A single source professional responsibility for the entire geexchange design, installation and performance greatly improves the chances of a successful system application.

The importance of thorough multi-disciplinary commissioning of the entire geexchange system must be emphasized. If parts of the overall system are commissioned independently from each other there is a likelihood that important system integration features may be overlooked or critical commissioning steps may be missed.

The above information is extracts from “Geexchange Energy Systems Professional Design Guidelines” and is available at www.geoexchangebc.ca.

Guidelines for Drilling Geothermal Wells

The geexchange systems currently available are generally open system or closed-loop system. The open system is not accepted in Burnaby without a written authorization from the “Ministry of Environment, Water Management Branch, groundwater section”, and must follow the Water Act, Water Protection Act and the Environmental Management Act.

The closed-loop system is mainly constructed of polybutylene or polyethylene pipe in which an “antifreeze” fluid is circulating as a heat exchange/transport medium. Common fluids used include water, calcium magnesium acetate, potassium acetate, sodium chloride and water, potassium chloride and water, ethylene glycol and water, and propylene glycol and water. Direct exchange (DX) systems use a liquid refrigerant (such as R-22) circulated through copper tubing (or other conductive, corrosive resistant metals) loops, but otherwise operates the same as other closed-loop systems.

Typical “vertical” closed-loop systems are constructed by drilling vertical or directional 4 to 6 inch diameter holes into which the closed loop pipe or tube is installed. The holes are then completely filled with an approved grout or a thermally enhanced grout material. A licensed water well construction contractor must be used to drill, install/construct, and seal the system.

Both heat/pump systems must comply with the “Guidelines for Minimum Standards in Water Well Construction – Province of British Columbia”. The Guidelines can be found at www.env.gov.bc.ca.

Heating Permit Requirements

A heating permit is required for the installation of a heating system, including forced air and hydronic heating, for single and two family dwellings. If the geexchange system is part of the heating system the following requirements should form part of the heating permit application and will also be circulated to Environmental Engineering for approval.

In addition to the regular documentation (see Heating Systems Permit brochure), such as heat loss calculation, a heating permit application with geexchange system must also include the following documentation signed and sealed by a Professional Engineer responsible for the Geoexchange System :

1. A statement indicating the type of the geexchange system and if it's vertical or horizontal installation.
2. Drilling contractor's name and license.
3. A site plan (1:250 scalable drawing) showing the proposed location of the wells, including identification of the construction materials (loops material, type of circulating fluid), system layout, approximate depth of borehole and distance from the property line and any existing service lines or proposed future service line.
4. A description of the proposed grout material to be used to seal the borehole.
5. A schematic diagram showing the geexchange system including the heat pump and any back up system required to compensate for the shortfall of the geexchange system.
6. Letter of Assurance, Schedule B, for the geexchange system, taking responsibility including the heat pump.
7. A statement/letter indicating the heating capacity of the geexchange system and confirming that the Geoexchange Engineer has reviewed the heat loss calculation by a heating contractor for the forced-air or hydronic heating system and the geexchange system is capable of supplying the required heat for the house with or without a back up system.

Upon completion of the entire geexchange system the Geoexchange Engineer should submit the Schedule C to the inspector.

Please contact the Building Department at 604-294-7130 for further questions.

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