Understanding Thermosyphon Foundation Systems

ARE THESE THERMOSYPHONS WORKING?

MEASURE TEMPERATURE

- Track results to see trends over time.

CONTACT VISUAL INSPECTIONS

- Prior to freezing season.
- During freezing season.
- Check for leaks.

IN THE WINTER THE THERMOSYPHON PINS SHOULD BE WARMER THAN THE AIR TEMPERATURE.

THERMOSYPHONS ARE BEING USED ACROSS THE NORTH

- Iqaluit, NU
- Kugluktuk, NT
- Inuvik, NT
- Yellowknife, NT
- Burwash Landing, YT

...AND NOT JUST FOR BUILDINGS!

THERMOSYPHONS HELP PROTECT AND MAINTAIN EXISTING PERMAFROST

20 YEARS

WITH THERMOSYPHONS

- Heat from the building can seep into the ground and cause permafrost to thaw faster.

WITHEOUT THERMOSYPHONS

- Heat from the building can seep into the ground and cause permafrost to thaw faster.

PERMAFROST COVERS MUCH OF NORTHERN CANADA

Continuous
Discontinuous Suggestionally
Sporadically

THERMOSYPHONS ARE BEING USED ACROSS THE NORTH
THAWING PERMAFROST
Northern buildings at risk

Many buildings in the north are built on a strong foundation of permafrost. Climate change is warming the air and ground and weakening and thawing that permafrost. Buildings are increasingly being built with exposure, but effective thermosyphons, as an adaptation to the warming climate.

A THERMOSYPHON IS...
A passive refrigeration device

Insulation

Water supply and waste water lines

Using sumps and underground services

Final site grading to reduce seepage

Building insulation

Other features (e.g. sumps or septic tank)

Thermosyphon a two-phase passive refrigeration device, when it thaws.

Active layer the ground on top of permafrost that settles and loses strength when it thaws.

Thaw sensitive permafrost ground with ice-rich permafrost that settles and loses strength when it thaws.

Permafrost ground that stays frozen for more than two years in a row.

Active layer the ground on top of permafrost that freezes in the winter and thaws in summer.

Useful Background Information

What you need to know

Consider site-specific factors that affect how well the thermosyphon system may work. There are many things to understand prior to installing thermosyphons, this is a partial list:

- Inside air temp during summer and winter
- Building insulation, including below ground
- Thickness of ground ice
- Projected climate over the building’s life
- Expected snow build-up, plan to manage snow
- Management of water and good drainage
- Building’s heating system (in-floor vs. radiators)

DO YOU NEED THEM?

Gather information to help building designers confirm if thermosyphons are a good option

USEFUL BACKGROUND INFORMATION

- Is the building on thaw sensitive permafrost?
- Determine the ground’s ice and water content
- Identify surficial geology (soil conditions)
- Identify the depth of the active layer
- Drill borings, install ground temp sensors
- Assess surface and groundwater flow
- Review local/traditional knowledge of site

WATER SUPPLY AND SEWAGE

- The building does not sit on permafrost
- Significant surface water is present in summer
- The ground is thaw stable permafrost
- The building is unheated

BUILDING DESIGN

Incorporating Thermosyphons

Factors to consider:

- Plan for unexpected events and changes
- Review the design and construction plans
- Have documents of the full system design

Follow Best Practices for:

- Evaporator layout, pipes, and radiators
- Groundplane, site excavation, use of gravel
- Final site grading to reduce seepage
- Using sumps and underground services
- Water supply and waste water lines
- Building insulation
- Other features (e.g. sumps or septic tank)

CONSTRUCTION

Site prep, installing the system

Building in thaw sensitive permafrost areas is a challenge. Good planning is essential.

Ensure materials are ordered, shipped, and installed at the right time of year. Usually, site preparation has to be done in the summer, when you can compact soil and ground effectively.

Doubtful permafrost is left as possibly by installing a thermosyphon foundation system. Quickly.

Make sure ground temperature measuring sensors are installed with the thermosyphon system.

Let the prepared site freeze for six weeks before beginning the soil and foundation.

Under absolutely necessary, don’t excavate a permafrost area if it must be done. It becomes even more important to let the site freeze back for a winter.

Monitor the process, including any changes to the design.

DO YOU NEED THEM?

Ground conditions and materials

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