Permafrost Protection Systems

Heave Protection and Permafrost Prevention

Watts.com

WATTS®

Watts Permafrost Protection Systems will keep your Assets from Freezing

General Freezer Floor Cost for 100,000ft² facility:

6" of EPS insulation:
$0.60/sf/inch thickness: 100,000 x 0.60 x 6 = $360.000

6" Concrete for Freezer Floor:
$110/cu. yard.
.5 x 100,000 / 27 = 1,852 cu.yd
1,852 x 110 = $203,720

Base Floor Cost:
$563,720

Radiant Tubing:
36" on center => 33,300 ft of 5/8" tubing
Tubing and Manifolds: $26,000

HydroControl Panel:
$6,500

Base Permafrost Cost:
$32,500

The cost to protect over half-a-million dollar investment is less than $0.35/sf*

**Savings illustrated based on provided example. Actual costs may vary based on project actuals.*

Common System Components

- Manifolds with balancing
- Fasteners
- HydroControl panel:
  Sensors, alarms, flow controls, full piping arrangements
- Radiant Tubing:
  RadiantPEX+™
  RadiantPERT™
  RadiantPEX-AL™
  Onix®



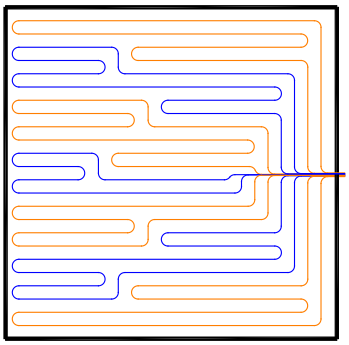

Innovative Design Solutions

System Design

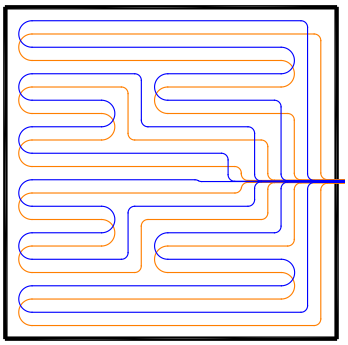
The total heat requirement is calculated based on maintaining a 40° F sub-slab temperature, taking into account the desired freezer temperature and specified floor insulation. Four to six inches of extruded polystyrene floor insulation is generally regarded as a modern standard. Energy requirements are usually 3 to 7 Btu/Hr/Sq Ft of heat delivered to the sub-slab depending on the temperature of the freezer, the amount of insulation, and the type and thickness of the sub-slab. While this is more than most projects need initially, this policy does allow for future operation of the warehouses at colder temperatures than originally contemplated. It also allows for some possible degradation of the floor insulation's performance as it ages.

Heat Sources

A wide range of heat sources can be used, including standard boilers, condensing boilers, and heat exchangers. Fluid temperatures of 55° to 75° F are common: these temperatures are based on the energy requirements which are a function of the freezer temperature, the amount of sub-slab insulation, and the spacing of the tubing. The most efficient means to heat the substrate is to use reclaimed heat ejected from the compressors cooling the freezers.



Single Serpentine, Standard



Single Serpentine, Overlap

Control Strategies

To ensure even distribution of the available heat, the primary distribution pump(s) should be designed to operate continuously. The controls cycle the heat source on and off, modulate capacity as required, or modulate mixing to maintain a constant temperature in the slab.

Since most systems operate with constant circulation, a flow switch with an accompanying alarm is installed on the system piping to alert maintenance personnel when a circulator stops functioning. Additional alarms may be added to alert personnel of other performance variations.

Heat Transfer Fluid

The most common heat transfer fluid is a mixture of water and inhibited propylene glycol. Watts conservatively suggests the use of 50% glycol solutions for added protection in case of equipment failure and the fluid is allowed to enter a freeze condition. Brine solutions are also acceptable. Automobile antifreeze should never be used.

Tubing Features

Tube spacing can vary from 24”OC to 48”OC depending on the load, freezer temperature, and substrate design. System designs may also adjust tube spacing based on available fluid temperature from the heat source. Lower available supply temperatures may result in closer tube spacing.

Common circuit lengths range from 300 to 600 feet, depending on the required flow rates and tubing size used. Most projects are designed with 1/2", 5/8", or 3/4" tubing.

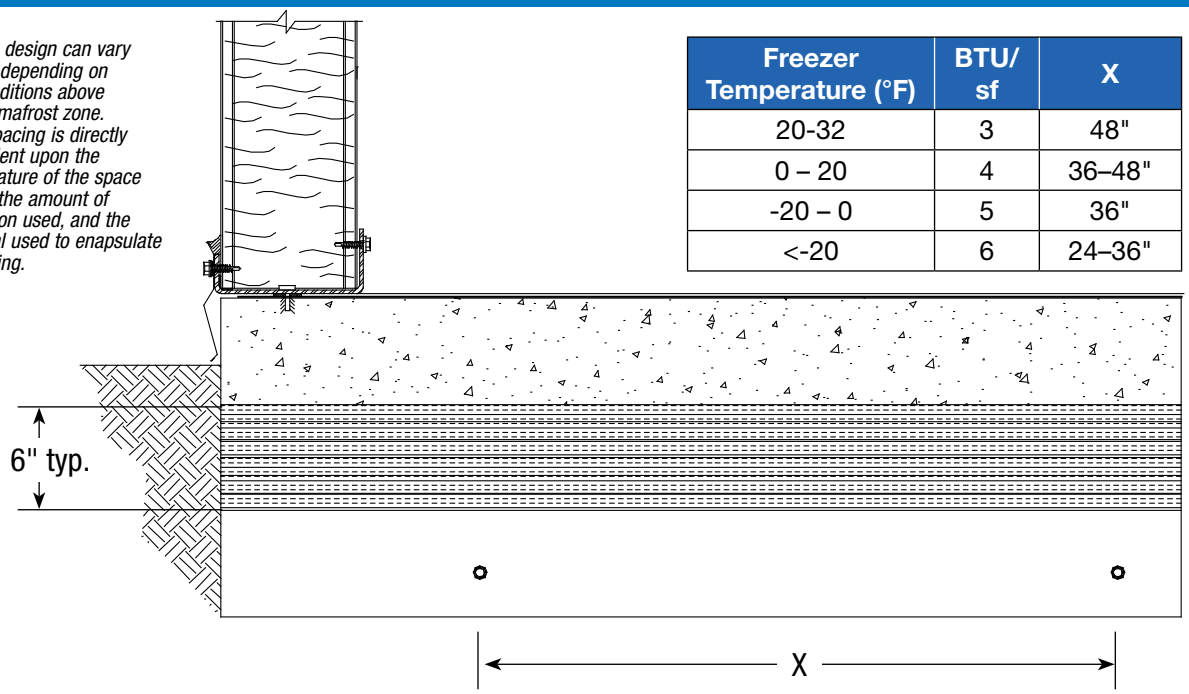
The actual pattern of the tubing can vary depending on the tubing options and system design. Two of the more common formats are a single serpentine or a double serpentine. A variation on these is to use an overlapping pattern where individual circuits are installed with twice the design spacing allowing for alternating circuits to fill in, providing a final layout at the proper spacing. This format helps diversify the heat delivery even further, allowing for a more uniform substrate temperature.

Design and Installation of Manifolds

A wide range of manifolds may be used with a permafrost system, including Watts stainless steel, custom copper tubular, and HDPE manifolds. These options are available in manifolds sizes up to 1-1/2”. Larger diameters, from 2'' to 6" ID are only available in copper or HDPE. All manifolds are available with several options, including full-port isolation valves, individual circuit balancing valves, circuit flow meters, and temperature gauges.

System design can vary greatly depending on the conditions above the permafrost zone. Tube spacing is directly dependent upon the temperature of the space above, the amount of insulation used, and the material used to enapsulate the tubing.

Freezer Temperature (°F)	BTU/ sf	X
20-32	3	48"
0 – 20	4	36–48"
-20 – 0	5	36"
<-20	6	24–36"



HydroControls

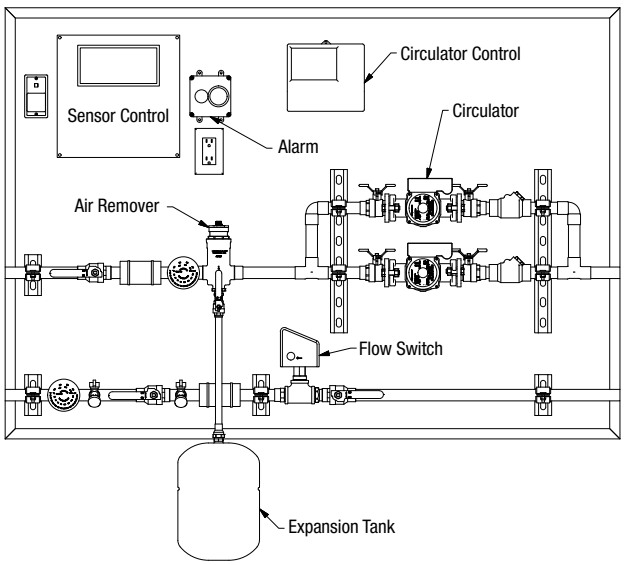
HydroControls can be viewed as the network server for the permafrost protection system. They are made with state-of-the-art mechanical and electrical components specified to provide years of trouble-free service. Each HydroControl is designed for a given system, allowing them to accommodate all of the system's requirements. Panels are available from 1" to 6" and can be constructed from a wide range of piping materials, including copper, stainless steel, and CPVC.

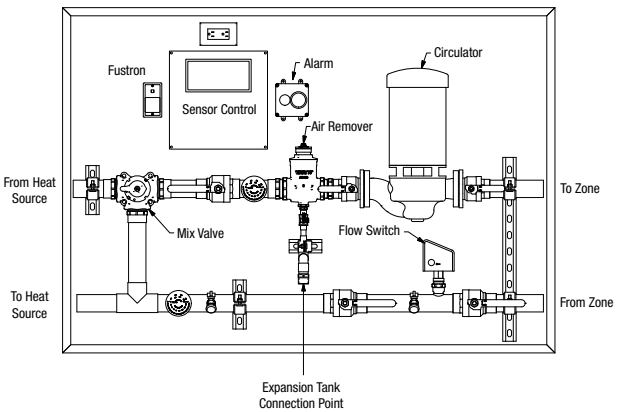
Standard Features for Permafrost HydroControls

- Pumps, relays, valves
- Set Point Controls
- Flow Switch
- Remote Audible Alarm(s)
- Service Valves
- Expansion Tank
- Temperature and Pressure Gauges

Optional Items

- Temperature Display/Alarm
- Pressure Switch
- Auto-Fill Assemblies
- Power Alarm
- Redundant Pumping
- Redundant Heat Source
- Remote Indicator (remote alarm)
- Wye Strainer





A True System Solution

Permafrost Protection Systems are mechanical systems designed to protect refrigerated warehouses from subsoil frost damage. Modern refrigerated warehouses, such as large chemical or food processing facilities, are designed to maintain products at temperatures ranging from 10° to -20°F, with blast freezers operating as low as -30° F.

In the absence of protective measures, like a Watts permafrost protection system, these low temperatures eventually lower the subsoil temperature beneath the building to below freezing causing the moisture in the subsoil to freeze and expand. This volumetric expansion causes the soil to heave, lifting the floor. Even a slight elevation can make it difficult for material handling equipment or people to safely move across the floor.

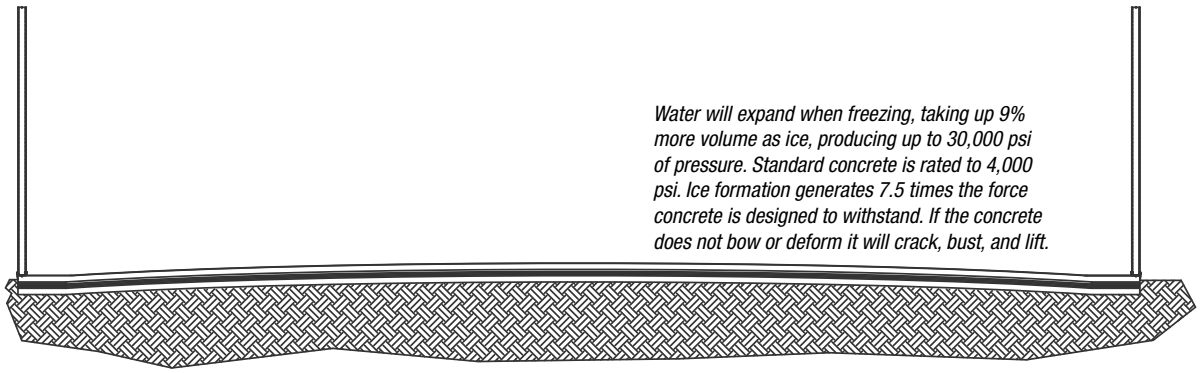
A Watts frost protection system is designed to keep this from happening. Every project is unique and Watts' wide selection of tubing options help ensure optimum performance and easy installation.

Partnering with Watts means partnering with a company offering complete system support, from design to product delivery. Watts offers a wide range of solution components, from RadiantPEX+™, RadiantPERT™, or Onix® tubing to a custom HydroControl™ mechanical panel.

Systems can be designed to operate with everything from a standalone heat source, such as a boiler or a geothermal unit, to an integrated heat exchanger designed to tie into existing plant functions. The most cost effective solution captures waste heat from the freezer's condensers via a heat exchanger and then the HydroControl panel circulates the evacuated heat into the subsoil, warming the soil without adding operational costs to the building. Special controls and alarms monitor the system and alert maintenance personnel in the event of a component failure.

Once the substrate beneath a freezer begins to freeze, the structure is compromised. By the time someone notices the effects on the floor it's too late. A Watts permafrost system is the perfect addition to any freezer system.

Let Watts help keep your assets from freezing.



Water will expand when freezing, taking up 9% more volume as ice, producing up to 30,000 psi of pressure. Standard concrete is rated to 4,000 psi. Ice formation generates 7.5 times the force concrete is designed to withstand. If the concrete does not bow or deform it will crack, bust, and lift.

Watts is the only radiant manufacture to offer a complete range of tubing options for use in permafrost systems.

Each project is unique, why settle for less than perfection?

Onix® is kink and crush resistant, making it the ideal solution when needing to counter abusive jobsite conditions or complicated installations.

RadiantPEX+™ is the industry standard tubing, combining durability with cost savings.

RadiantPERT™ offers the same performance as our standard RadiantPEX+ with increased flexibility

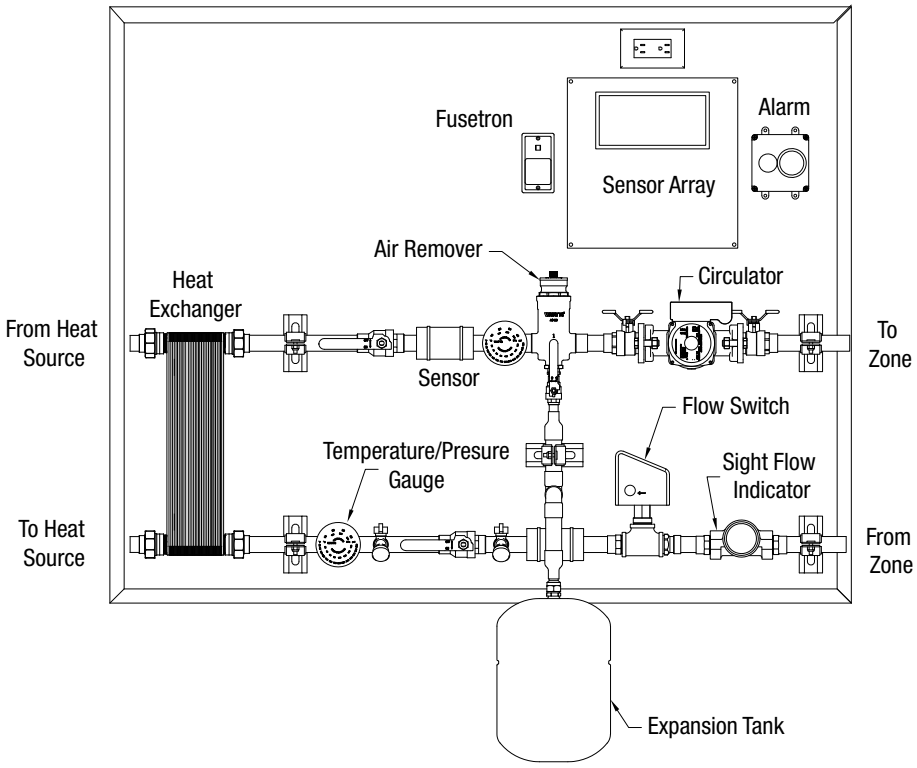
Do You Have a Demanding Application?

Watts Permafrost System – Fully Designed, Fully Supported

HydroControl™ Panels are custom solutions designed for each permafrost protection system, allowing for specific system needs to be designed directly into the panel.

Control strategies vary from system to system and may include:

- Mixing and flow controls
- Visual and Audible Alarms
- Temperature Sensors
- Visual Flow Indicators



Stainless Steel Manifolds

Custom Copper Manifolds

Manifolds are available in a wide range of options, including Stainless Steel, Copper, and HDPE (special order).Copper and HDPE manifolds can be designed for project specific attributes. All manifolds are available with the following options:

- Trunk isolation valves
- Vent/Purge Assemblies
- Circuit Balancing and Isolation Valves
- Circuit Actuators (Stainless Steel Manifolds Only)
- Flow Meters (Stainless Steel Manifolds Only)
- Temperature Gauges
- Manifold Brackets (Copper and Stainless Steel Manifolds Only)

Manifold	Base Trunk	#Circuits	Circuit Spacing
Copper	1"–6"	Unlimited*	2" Standard‡
Stainless Steel	1", 1-1/2"	2–12	2"
HDPE	2"–6"	Unlimited*	Per Design‡

* Copper and HDPE manifolds can be designed with unlimited number of circuits but will result in manifold sections to be field assembled. This is to accommodate shipping limitations.

‡ Circuit spacing is generally 2" on center, but can be wider on Copper and HDPE manifolds to accommodate installation requirements.

Partner with Watts

- Breadth & depth of offerings means getting the right product for the right application, all from a single vendor
- Industry leader for over 30 years with permafrost installed systems
- Durability in design with high-grade material suited for even the most challenging applications
- Design and full system support

WATTS®

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