Installation & Design Manual

Freezer and Sub Floor Heating Design
Frost Heave Protection
Duplex Heating Mat Installation

PLEASE NOTE

The floor sensor MUST be installed such that it may be REMOVED for service if required!

The sensor probe should be installed into a conduit with no more than one wide-angle bend. This should be installed from the floor to a junction box or the control box located directly near the heated area.

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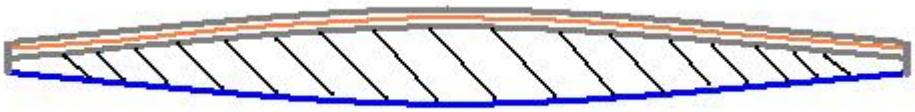
Overview Frost Heave Prevention for Freezer floors on ground.

The earth beneath freezer floors that are more than a couple of meters wide will slowly freeze, possibly causing the floor to lift.



Beneath larger rooms without frost heave protection, the earth has been known to freeze gradually to a depth of at least 3 meters, even with the presence of insulation in the floor. This causes a dome shape upward heave to the freezer floor of up to 400mm at the centre. Although this can take years to become apparent, the structural failure of the floor can be serious.

Will this happen to all freezers on ground?
Provided that the floor incorporates at least 150 – 200mm of polystyrene floor insulation or an equivalent, and the room is no more than 3m wide, frost heave is unlikely. This may be increased to rooms up to 4m wide provided that the sub base to the room is well drained to a depth of 600mm and even further if the floor is well elevated above the surrounding ground level.

How is frost heave prevented?
Three different methods of prevention are employed:

1) The use of a system of vented pipes laid at around 500mm spacing to provide for cross flow ventilation beneath the room. This method is not common because it requires unobstructed airflow across opposite sides of the room, free from other external obstructions or buildings.

2) The Installation of polyethylene pipe work either in or below the base concrete slab. A closed circuit of warm water is circulated through the pipe work that runs at 600mm centres, using condenser heat captured from the refrigeration plant. This is more expensive to set up, but is justified for very large rooms eg. 400m² or larger.

3) The most common method of prevention requires **deviflex**™ type electric heating cables run at around 300 – 500mm spacing.

Note: The integrity of the vapour barrier below the insulation is very important. Failure can lead to water soaking into the insulation; dramatically reducing it's thermal resistance. Sub-floor heating is installed at low rate to balance the small rate of heat movement up into the room and is not designed to cope with insulation failure.

Information required for quotation:

Inside floor area.

The rooms design type.

Location of Cold Tails and Control Box.

Door heater elements if required.

Freezer and Sub-floor Heating

Cable type:
The cable type should be a **deviflex**™ heating cable, which comes complete with cold tails terminated. **deviflex**™ heating cable is also approved by AS/NZS 60335.2.96:2002 for embedding in concrete or screeds. All other aspects of the AS/NZS 3000:2007 wiring rules and regulations regarding your pending installation should also be taken into account and all construction material specifications and building codes be followed.

Electrical Loading:
There are three categories of freezers depending on the design temperature.

Design Temperature	- 5° to + 5°C	- 25° to - 5°C	- 50°C to - 25°C
Room Type	***Coolroom***	***Freezer***	***Blast Freezer***

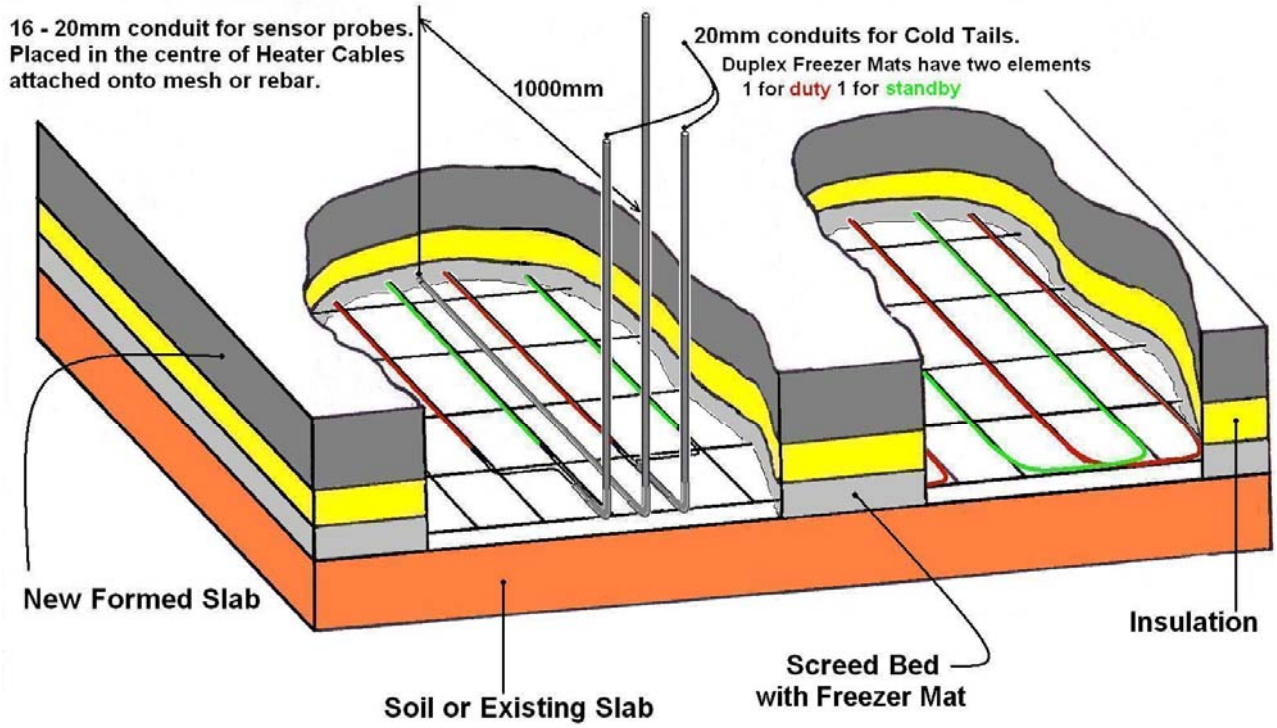
As a guide, typical design outputs of the frost heave protection system range from 10 W/m² to 30 W/m² depending on the room's type and application. This is based on a minimum of 150mm of thermal insulation, with a K factor of 0.05 W/(m·K), separating the freezer area from the base slab.

Circuit Design and Spacing:
Floor Heat Australia recommends a duplex freezer mat using **deviflex™** cables together with a specified system fail-safe Control Box best suited for your frost heave prevention installation.

Each circuit of a twin cable system should be designed to achieve the required loading at a spacing not exceeding 500mm between cable runs and with the cable commencing at a maximum of 200mm from the inside walls. The primary duty heater circuit should be connected to the supply and the other used as a stand-by system or spare.

Where the freezer room is small and the range of heating cables does not allow the design to be achieved at 240V, designs should be determined using a PELV, protected extra low voltage supply of either 32V, 24V, 12V.

The supply voltage must be clearly labeled at the termination of the cables.



At no point in the installation should heating cables be allowed to become embedded in the thermal insulation.

Duplex Heating Mats:

Floor Heat Australia's duplex freezer mats come complete and ready to be rolled out, with the cold tails terminated and sensor conduit already tied down onto a 100mm x 110 mesh. If installation is direct onto soil before reinforcement mesh is placed and the concrete slab is poured, consideration should be given to the location of the systems fail-safe Control Box, sensor probe and cold tail location.

If the installation is on soil or over an existing slab a screed is to be used before installing insulation materials. The Duplex cables should be covered by at least 50mm of concrete where the mix aggregate should not exceed 10mm and for larger areas a 62 - 72 steel reinforcement mesh be added above the heater cable mesh. This is to prevent major cracking up of the screed slab, as concrete can crack as it dries. Care should be taken when placing this extra mesh as not to damage the heater cables by downward pressure or sharp objects during the concrete pour. It's best to place the reinforced mesh on the screed when you have coverage over the duplex heater mesh. It is also very important to ensure that there are no air pockets around the heater cables as this will create hot spots and damage the cable.

Fastening Multiple Cables:

If your licensed contractor is installing the cables they should be fastened into position at intervals of no more than 1200mm, using fixings that do not damage the cable insulation. Cable bending radius should be no less than 15 times the diameter of the cable.

Twin circuits should **NOT** be run together using the same fixings. Rather they should be run at midway spacing, side by side or at right angles. If the cable is being incorporated into the base slab a screened **deviflex™** type cable should be fastened directly to the reinforcing mesh. If the cable is being installed over the surface of an existing base slab, **deviflex™** cables can be used in conjunction with suitable fixing strips maintaining an even spacing. Crossing over of heater elements may occur between the duty and standby cables, in this instance it is permissible, as only one element is on at any one time.

Termination & Control:
If only one heater cable is installed, the cold tails should be run via a conduit to an external wall into a junction box. If two or more circuits are to be installed, the cold tails should be bunched together, appropriately de-rated and run in conduits up the wall to a junction box or direct to the Control Box. It is important, however, that the cold tail joints and sensor conduit remain embedded inside the slab or screed perimeter of the room.

Fail-Safe Control Box:
The control box comes complete with the necessary circuit breakers, contactors and thermostats to suit your job. We recommend you order the control box with the freezer mat.

A change over switch may also be added to select either of the twin circuits installed. This is handy if the system goes into an alarm state and a service technician needs to be called.

Where the room size is small and the consequences of Frost Heave failure is small, the heater element may be left on permanently without a control box.

In all other cases a capillary or electronic remote sensing thermostat must be provided to sense the sub-floor temperature and control the heating cable accordingly. A contactor must be used in all cases where the load exceeds 75% of the thermostat's switching capacity.

Thermostat Sensor:
To provide for the installation of a floor sensor, a conduit capped at the end in the screed and sealed at the other end to stop debris ingress. This should be installed in the floor cable area, running one meter in from the external wall to a point midway between cable runs. Conduit size plus any bends must be such to allow the easy insertion and removal of the sensor.

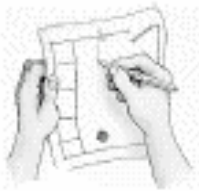
Thermostat Settings:
For frost heave prevention, thermostat settings should be 10ºC. For condensation prevention below suspended slabs, the setting should generally be 18ºC. A higher setting of up to 25ºC is necessary for tropical climates.

Earthing of installation:
For 240V systems the earth braided/shield of the heating cable **MUST** be connected to the buildings MEN earthing system.

The 'Cold Tails' have a center core that is called the cold tail conductor. An earth in the form of a braided/shield surrounds this conductor.

On PELV low voltage systems all metal parts of the installation must be grounded to earth.

Testing:
Heating cables must be tested using a 1000 V insulation tester, before, during and after covering to ensure satisfactory insulation levels are maintained. Please record the Ω ohm values and store in the control box



Draw up a plan of the cable layout on this page