

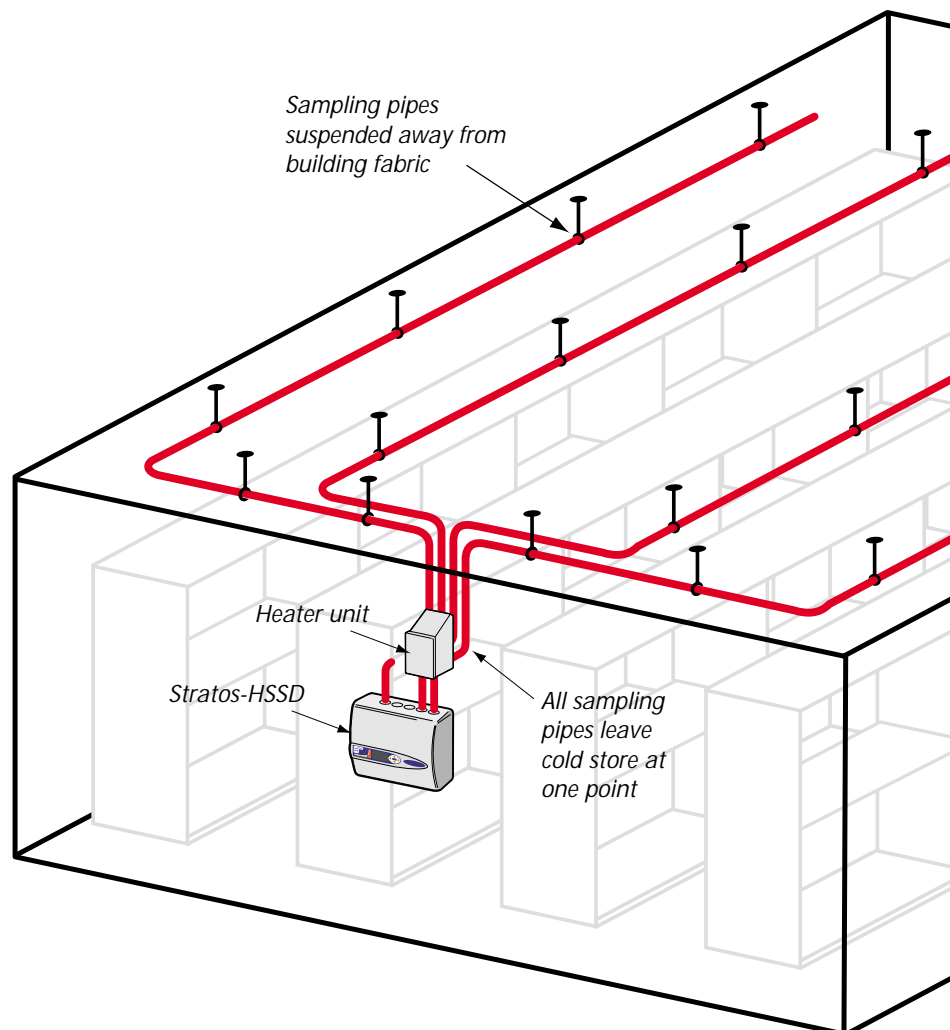
SPECIAL APPLICATIONS

COLD STORES


Introduction The application of aspirating smoke detection in cold stores requires special techniques that may not be covered by accepted Fire Codes, Standards or Regulations.

The guidelines given below are to assist the designer to achieve the most effective and reliable smoke detection system possible, given the extraordinary conditions that affect cold stores. Wherever possible we urge the designer to aim for an aspirating smoke detection system that meets or exceeds the National Codes, Standards or regulations but in this application these aims may be impractical or impossible. The designer should discuss any difficulty with the user, insurer or body having jurisdiction if any generally accepted parameter cannot be met.

Fig. 1 *Stratos system installed in cold store*

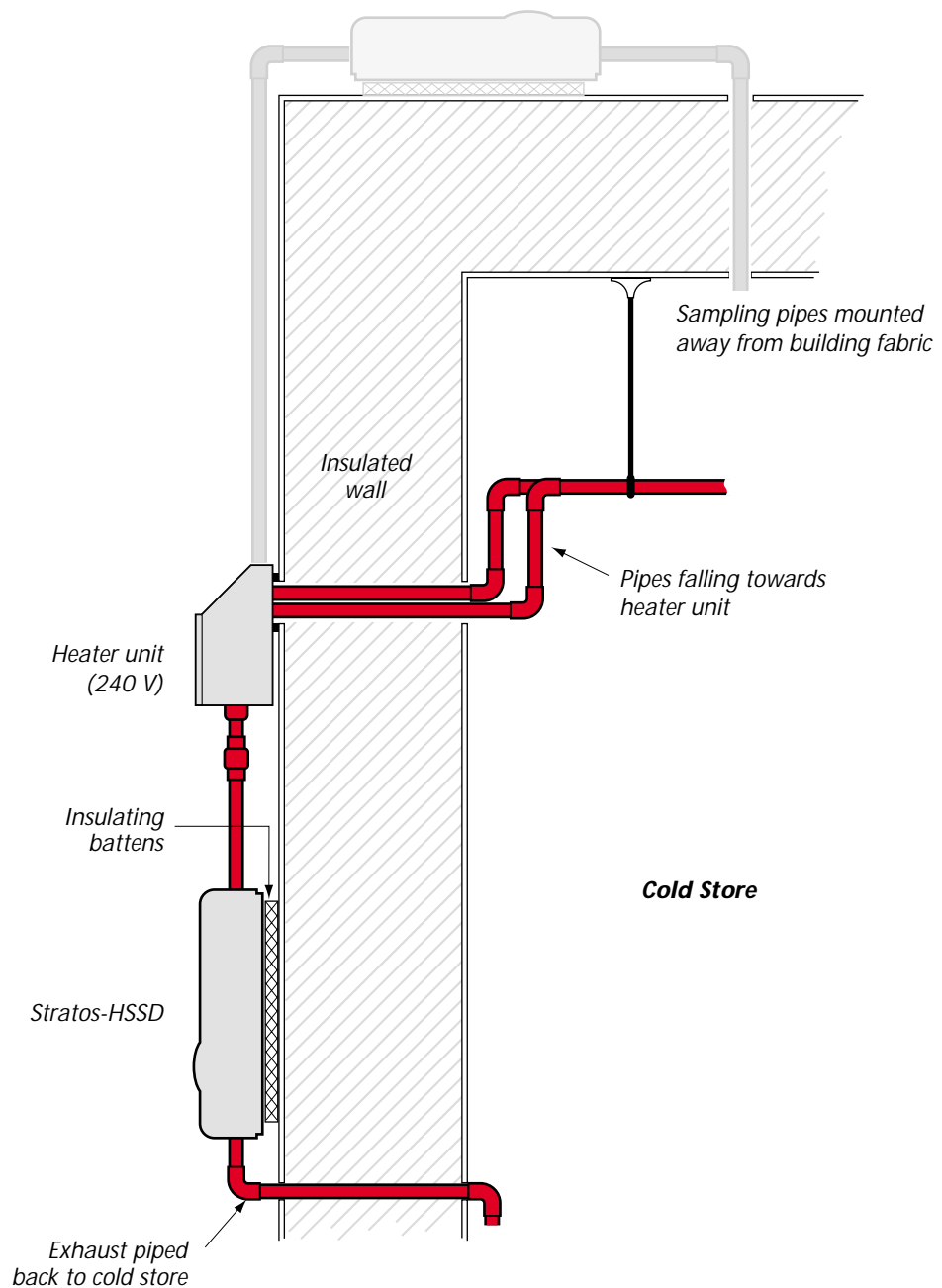


- The sampling pipe system should be installed within the cold store. We recommend ABS or light gauge Stainless Steel as suitable materials. PVC-u is not a suitable material, as it becomes brittle at low temperatures.

NB: If metallic pipe sampling networks are installed it is imperative they are bonded to earth (ground).  NB

- The sampling pipe system should be installed so that it is as far away as practical from the building fabric/structure. Much of the condensation and ice that forms is on internal surfaces that are in contact with, or in close proximity to, the building fabric. The radiation, convection and conduction of heat create significant temperature differentials even though the operating range is often well below 0°C.
- Chiller units intermittently blow air at a temperature well below the design operating temperature of the store, perhaps -35 to -40°C. If the sampling pipe system is directly in the path of this forced air stream it will become super-cooled. When the chillers stop the sampling pipe will take some time to reach the ambient store temperature and would be susceptible to icing. If practical, it is advisable to mount the sampling pipes outside this air stream.
- Sampling holes should be drilled in the side of the sampling pipes. Condensation and ice are less likely to accumulate there, which could otherwise block sampling holes drilled at the bottom of the pipe.
- The sampling pipes should be mounted at least 300mm from the ceiling/walls to reduce heat transmission from those surfaces.
- Consideration should be given to monitoring the return air to the chiller units. This has the advantage of using the air currents to draw smoke to the sampling system. Please be aware that this air movement may not be continuous and should not be relied upon to provide transport of smoke. Checks should be made with the user/consultant/insurer.
- The Stratos-HSSD unit(s) must be mounted outside the cold store as the Stratos detector unit is not designed for continuous operation at temperatures below 0° C. If mounted on an external wall or ceiling of the store the detector should be spaced off the surface with insulating battens. (e.g. 50 x 50 mm softwood) as under certain conditions condensation may form on these external surfaces. If the Stratos detector is mounted externally it should be installed in a suitable weatherproof enclosure. The enclosure must have provision to return exhaust air to the protected area.

Fig. 2 *Relative positions between sampling pipe, heater box and Stratos-HSSD for a cold store installation*



- At the point the sampling pipe(s) leave the store an air heater assembly (see below) should be fitted so that no chilled sampling pipe is exposed to the higher temperature air outside the cold store. Chilled pipe-work that does become exposed to air at higher temperatures will generate profuse quantities of surface condensation, particularly under humid conditions. This may encourage a freeze/thaw cycle and, unless carefully managed, could pose a health and safety risk. The air heater will raise the temperature of the sampled air and pipework to prevent the formation of surface condensation. Experience has shown basic trace heating may not adequate for a store running well below 0° C. Neither are surface condensation traps, particularly if no provision is made to collect water trapped by them.

- The sampling pipework leading to the heater assembly should always run horizontally or downhill. This will prevent any condensate from running back into the sampling pipes, re-freezing and perhaps causing a pipe blockage.
- If the Cold Store does not have service voids around its perimeter the heater box should be installed within a weatherproof box and the Stratos detector mounted in the roof service space. Do not mount the heater box on the roof of the cold store as this will cause the problems described in the section 'Problems you can avoid'

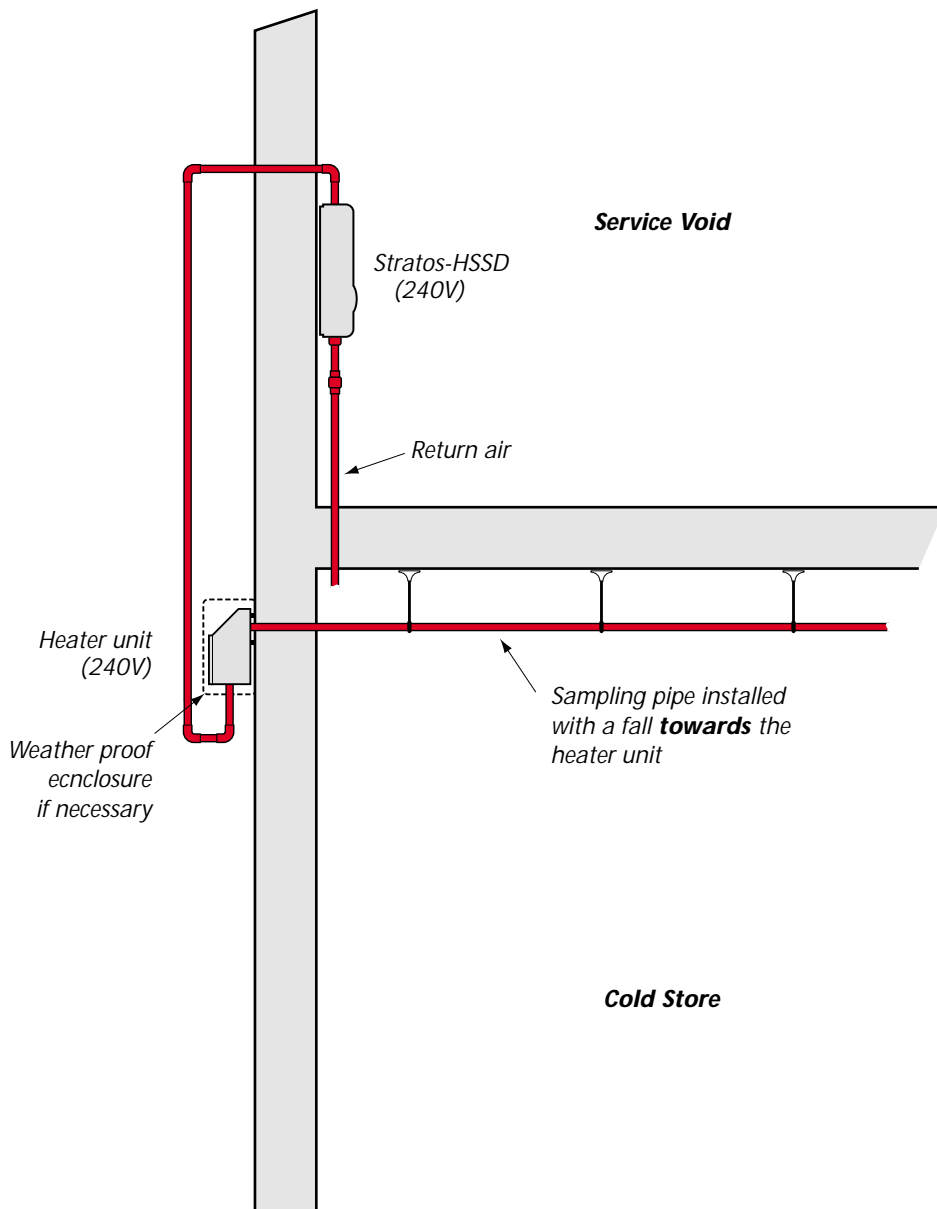


Fig. 3 Typical chilled room aspirating smoke detection

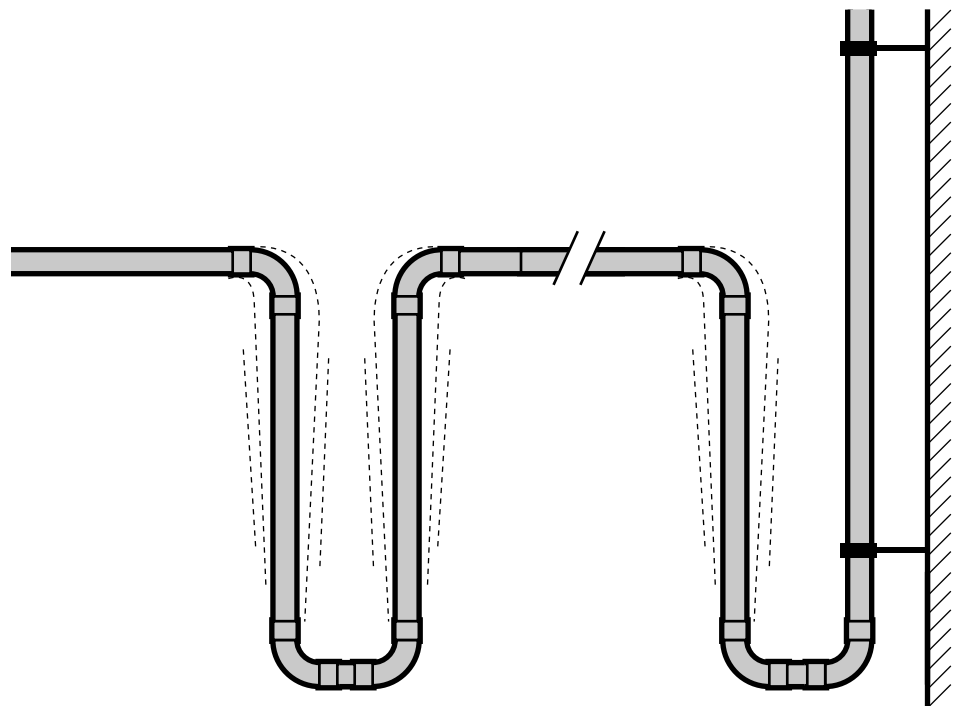
- If there are no service voids both the heater unit and the Stratos detector can be installed within a weatherproof enclosure on one wall of the building.
- The Stratos detector cabinet should be fitted with an exhaust pipe to return the sampled air to the protected area. This prevents any pressure differential between the cold store and the surrounding area from adversely affecting the airflow through the detector.
- The air heater will require an AC electrical supply and continuous monitoring of the heater operation is advisable. To achieve this a factory-fitted precision pre-set thermostat is offered that is located in the intake air stream of the Stratos. The output from this switch can be used to generate a fault warning.
- Consideration must be given to the effects of temperature change on the sampling pipe. On a new installation it is likely that the sampling pipe system will be installed at a temperature of, for example, 15°C. Once the cold store is running the same pipe system could normally operate at a temperature of -35°C. This is a difference of 50°C. Consideration should be given to the linear coefficient of expansion of the sampling pipe material and suitable provisions made during installation for the eventual variation in installed lengths. These should include ensuring movement is available in pipe support systems or that on longer pipe runs an expansion/contraction loop is provided.

Example: The Linear Coefficient of Expansion for ABS is 10.1×10^{-5} per °C per Metre. The calculation for a 40 metre length of ABS pipe dropping 50°C is as follows.

$$10.1 \times 10^{-5} \times 50^{\circ}\text{C} \times 40\text{m} = 2000 \times 0.000101 = 0.202 \text{ m.}$$

The pipe will *contract* 202 mm. (8").

Fig. 4 *Expansion/contraction assemblies. These allow longer main sampling pipe runs to expand or contract without excessive buckling.*



Stratos-HSSD® detectors are unsuitable for installation within an area if the ambient temperature is expected to fall below 0°C (minimum occasional operating temperature of the detector is -10°C). Where the air temperature in the protected area is consistently below these temperatures it is imperative the Stratos is mounted outside the protected area. The Air Heater assembly is designed to raise the temperature of air drawn from a very cold environment by drawing it through a self regulating heating element just as it leaves the protected area. In this manner the problem of condensation on sampling pipework external to the protected area is minimised. Warming the air sample will also ensure the components of the Stratos-HSSD® operate within the specified temperature tolerances and virtually eliminates the possibility of surface condensation.

Air heater for low temperature applications

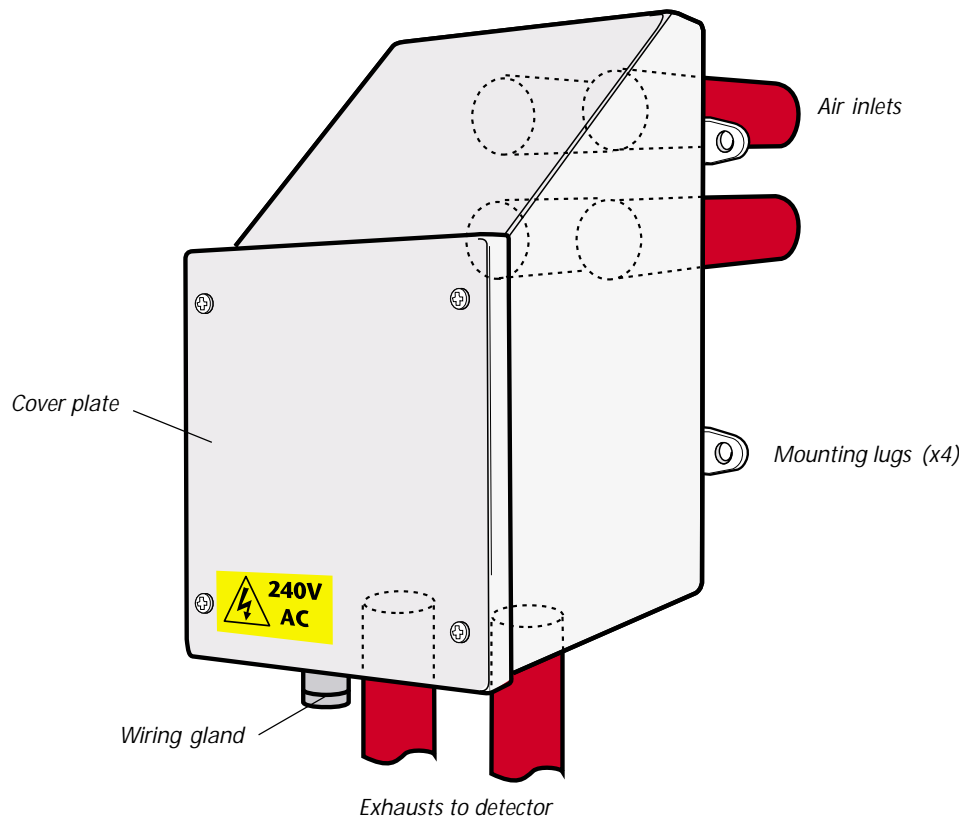


Fig. 5 Heater unit

Fabricated sheet steel enclosure and access cover. Surface finish is passivated zinc plate.

Components

Self-regulating heating element - 230 V.AC 60/200 W.

Inlets - 4 x 3/4 inch male ABS tank connector. (25mm optional). If metallic sampling pipe is to be used these can be changed to the appropriate connectors.

Outlets - 2 x 3/4 inch male ABS tank connector.

Cable entry gland.

Ceramic terminal block.

Installation The heater assembly should ideally be mounted approximately 300mm away from the Stratos-HSSD detector. To simplify interconnection, threaded socket unions should be used.

Once the position of the heater unit has been determined a penetration should be made through into the protected area corresponding to the position of the sampling pipe inlets. This penetration should be no larger than 105 x 105mm.

The heater box should not be mounted on the roof of the store and pipes run up from below. The likelihood is that the pipes leading to the heater box will become blocked with ice. The section describing avoidable problems explains why in more detail.

If the mounting site is corrugated or uneven, fix a mounting plate or board to the cold store wall. It is important that the joint between the mounting plate and wall is fully sealed.

Offer the unit up to the opening and mark the position of the holes for the four mounting fasteners.

Fix the unit to the selected location with appropriate fasteners.

Connect ABS sampling pipes to the inlets using joining sockets. (When using sampling pipes in other materials it may be necessary to fit stubs prior to fixing the heater unit.) Cap or plug off any unused inlets ensuring that the seal is airtight and cannot easily be broken.

Back fill the penetration made into the cold store using a proprietary insulation material or foam.

Connect the heater assembly to two of the Stratos-HSSD[®] inlets.

Make electrical connections to the heater unit using either a 3-core 1.5mm heat resistant flex or MICV. To simplify termination within the enclosure it is recommended the ceramic terminal block be temporarily released from its two fixing screws.

The electrical supply should be from a suitable 230 V.AC unswitched spur fused at 3.0 Amps. (This could be the same supply that feeds the Stratos-HSSD[®] detector).

The heater assembly must be earthed.

Monitoring Option To monitor the operation of the air heater element, a precision air thermostat kit is available. This monitors the temperature of the sampled air as it leaves the aspirating fan assembly. If the heater element fails, the contacts of this thermostat can be connected to signal a Common Fault. When the Stratos-HSSD is connected to an analogue addressable fire alarm system, a monitoring interface can be used to give a specific fault warning.

The above recommendations may seem to offer only a limited number of options for the installer. This is deliberate, as many of the normal techniques used to build a sampling pipe network would cause problems in this application.

Problems you can avoid

Experience has shown there is one pipe route to avoid at all costs and that is to run sampling pipe vertically from within the cold store to a warmer area outside the insulated body of the store. The common result of doing this is that the pipe will become blocked with ice. How quickly this happens depends on the relative humidity of any air that has entered the cold store and the consequent level of ice particles in the air plus the temperature differential between the store and surrounding areas. The illustration below describes how this happens.

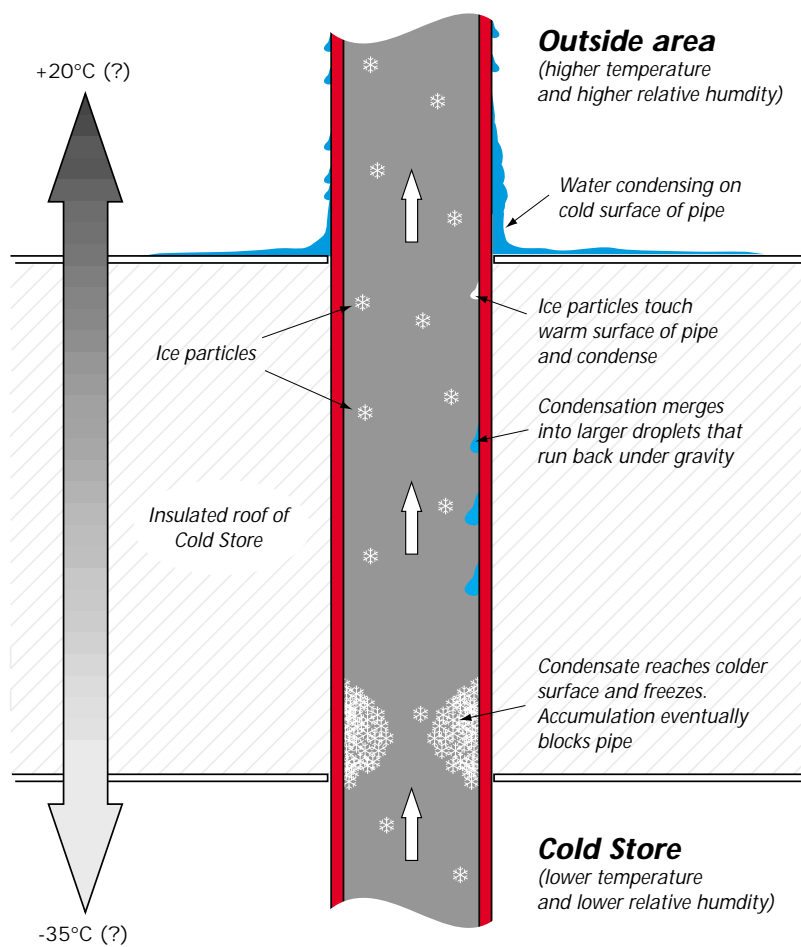


Fig. 6 Vertical runs of sampling pipe through the wall of the cold store should be avoided

This phenomenon would not occur if the air within the cold store could be guaranteed to be free of ice particles. This is unlikely, as the normal working of the store means moist air is drawn into the store each time access is made.

Extended sampling points are particularly susceptible to blocking, as their diameter is relatively small. Therefore we do not recommend using them.

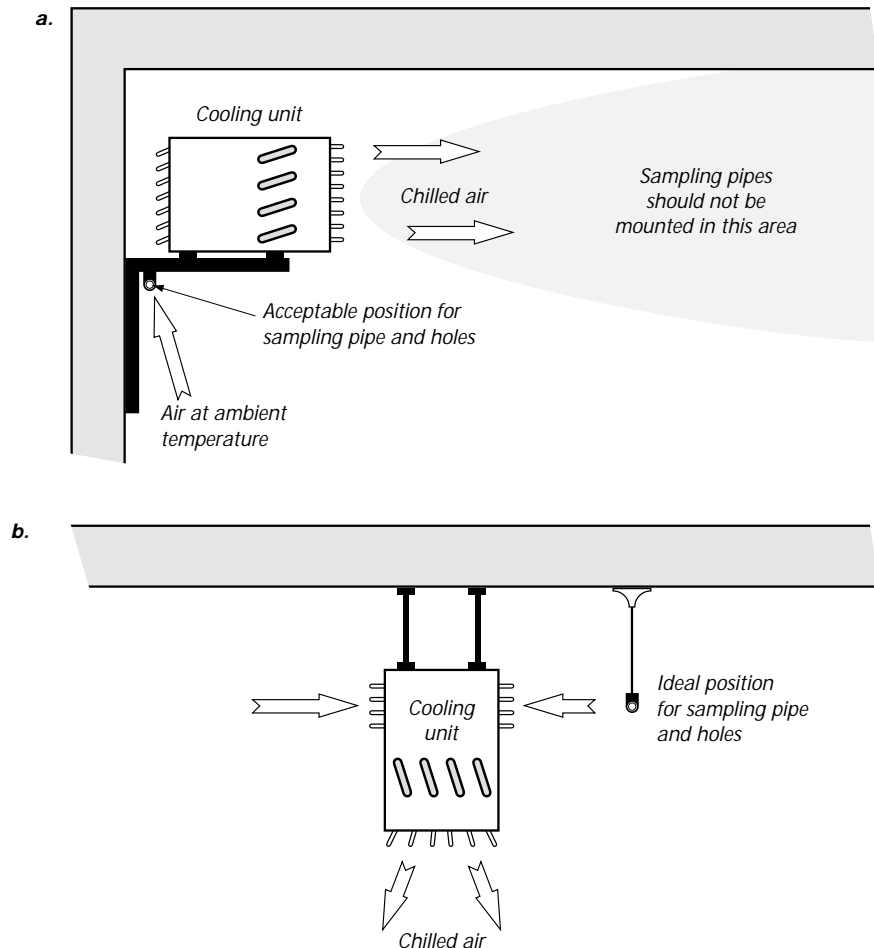
The illustration also shows that profuse quantities of condensate will form on the external surfaces of the pipe outside of the cold store. This is very difficult to control and if left unchecked can present health and safety risks as well as cause damage to the fabric of the cold store.

Chill Stores

Chill Stores are normally maintained at between 0° and +5° C, similar temperatures to a domestic refrigerator. To maintain these temperatures the Chill Store will have cooling plant of a similar type to that of a Cold Store and this plant will cool the air passed through it to well below freezing point. As a result anything in the direct blast of this stream of cold air will also be chilled to a temperature below freezing point. The cooling plant will not run continuously, only on demand from thermostatic controls. The configuration of the cooling plant varies between each Chill Store and careful checks should be made at the survey stage to determine how the plant is installed and the direction any cooled air is blown.

Any warm air that enters the Chill Store will naturally rise and pass through the dew point when, because of falling temperatures, water vapour condenses. This condensate will rise within the warm air current and if the cold air streams from the cooling plant do not deflect it, it will pass over the surfaces chilled by the plant. If these surfaces are below freezing point the condensation will tend to freeze upon them.

Fig. 7a+b Positioning sampling pipe in Chill Stores



Because of this phenomenon it is particularly important that sampling pipes are installed well away from the forced air streams of cooling plant. The sampling pipes may also be exposed to very high levels of humidity and condensation when the cooling plant goes through a defrost cycle that may cause unwanted alarms. If this happens the 'ClassiFire™ Override' or 'Remote Isolate' functions can be invoked via signal from the chiller control plant.