Freeze Protection of Pipework
The Problem

Thermal insulation alone will not prevent freezing of pipes. For example, a 25mm diameter water pipe at +5°C, fitted with 25mm thick thermal insulation, will freeze within one hour in an ambient temperature of just -10°C!

Frozen water pipes can burst, causing loss of supply, flooding and damage. Wax can form in heating fuel oil lines causing a blockage and subsequent boiler shutdown. Freezstop Micro from Heat Trace Limited eliminates these problems safely and efficiently.

The Solution

The Freezstop Micro system was developed for use on almost all pipes - metallic or plastic. However plastic pipes must be foiled under and over the heating cable to help to dissipate heat into the pipe. Heating cables prevent hot and cold water pipes from freezing, fuel oil lines and pipes containing other fluids, or chemicals from clogging or crystallising.

Safe, Efficient, Reliable

Freezstop Micro is a self-regulating heating cable especially developed for this application. The self-regulating effect causes the cable to generate progressively more heat as the pipe cools down and less heat as the temperature rises. Thus, it is energy efficient and can never overheat or burnout - even when overlapped.

Freezstop Micro is Inherently Temperature Safe, energy efficient and reliable. It operates automatically and requires virtually no maintenance.

Inherently Temperature Safe - means that, "the cable’s ability to self-regulate at a temperature level below the maximum product rating and withstand temperature of the insulating materials, without the need for temperature control”

Complete System

Freezstop Micro comprises the Freezstop Micro heating cable, together with a range of easily installed termination kits and ancillary items. A simple frost thermostat can be used to ensure that the system energises only during winter temperatures. The power supply can be fed from a local distribution board, or consumer unit, fitted with suitably rated circuit breakers. System design and installation is easy .... even for inexperienced electricians.
A Freezstop Micro system can be designed in 4 steps.

**STEP 1** - Determine heating cable type and thermal insulation thickness
**STEP 2** - Calculate heating cable length required.
**STEP 3** - Determine the number of heating circuits / distribution board requirements
**STEP 4** - Define the number of system components needed.

The Freezstop Micro system has two(2) heater cable outputs - 11W/m and 17W/m.

The following Tables match the right power output heating cable with the thermal insulation thickness required to maintain pipes at +5°C for different minimum ambient temperatures and pipe sizes. Figure for plastic pipes are shown in blue

**Calculation Basis for Tables:**

Decimal numbers indicate heating cable spiralled to pipe (spiral ratio)
e.g. 1.3 = 1.3m of heater per metre of pipe. Whole numbers mean straight-traced cables.
e.g. 2 means 2 cables straight traced.
11 = Heating Cable Cat Ref 11FSM2-CT
17 = Heating Cable Cat Ref 17FSM2-CT

Supply voltage 230V (other voltages also available )
Insulation k-factor is based on 0.037W/mK, an average to include various materials such as, glass fibre, mineral wool, 'Armaflex' nitrile rubber, etc., are all suitable.

For conditions other than as stated, consult your local Heat Trace Ltd representative.

Cable length needed is pipe length multiplied by the number of cables, or the spiral ratio.

### FOR MINIMUM AMBIENT TEMPERATURES DOWN TO -15°C

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Insulation Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9</td>
</tr>
<tr>
<td>½&quot;</td>
<td>1 x 11</td>
</tr>
<tr>
<td>¾&quot;</td>
<td>1 x 17</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1.1 x 17</td>
</tr>
<tr>
<td>1¼&quot;</td>
<td>1.2 x 17</td>
</tr>
<tr>
<td>1½&quot;</td>
<td>1.2 x 17</td>
</tr>
<tr>
<td>2&quot;</td>
<td>1 x 17</td>
</tr>
<tr>
<td>2½&quot;</td>
<td>1.2 x 17</td>
</tr>
<tr>
<td>3&quot;</td>
<td>1.3 x 17</td>
</tr>
<tr>
<td>4&quot;</td>
<td>1.5 x 17</td>
</tr>
<tr>
<td>6&quot;</td>
<td>1.5 x 17</td>
</tr>
</tbody>
</table>

**NOTE** When installing heating cable onto plastic pipes additional power is required. In addition, to help heat transfer into the pipe, it is recommended that aluminium foil should be placed around the pipe to aid heat transfer into the pipe.

Key - Steel Pipes
Plastic Pipes

Examples from above table:
2" metal pipe with 25mm insulation = 1m x 11FSM2-CT for each metre of pipe.
4" plastic pipe with 20mm insulation = 1.4m x 17FSM2-CT heater for each metre of pipe.

### FOR MINIMUM AMBIENT TEMPERATURES DOWN TO -30°C

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Insulation Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9</td>
</tr>
<tr>
<td>½&quot;</td>
<td>1.2 x 17</td>
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<tr>
<td>¾&quot;</td>
<td>1.3 x 17</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1.3 x 17</td>
</tr>
<tr>
<td>1¼&quot;</td>
<td>2 x 17</td>
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<tr>
<td>1½&quot;</td>
<td>2 x 17</td>
</tr>
<tr>
<td>2&quot;</td>
<td>1.3 x 17</td>
</tr>
<tr>
<td>2½&quot;</td>
<td>1.5 x 17</td>
</tr>
<tr>
<td>3&quot;</td>
<td>1.5 x 17</td>
</tr>
<tr>
<td>4&quot;</td>
<td>2 x 17</td>
</tr>
<tr>
<td>6&quot;</td>
<td>1.5 x 17</td>
</tr>
</tbody>
</table>

**NOTE** When installing heating cable onto plastic pipes it is recommended that aluminium foil should be placed around the pipe to aid heat transfer into the pipe.

Key - Steel Pipes
Plastic Pipes

Examples from above table:
2" metal pipe with 25mm insulation = 1m x 11FSM2-CT for each metre of pipe.
4" plastic pipe with 20mm insulation = 1.4m x 17FSM2-CT heater for each metre of pipe.
Design Guide

STEP 2
Calculation of Heating Cable Length

Total length required = heater length in metres (m) - from STEP 1
+ 0.3m per power connection
+ 1.0m per T splice or T power connector
+ 1.0m per valve
+ 1.0m per un-insulated pipe support
+ 0.3m per pipe flange
+ double traced allowance *

* When a T branch line is less than 2m long, it is usually more economical to double trace the short branch in a loop down and back. Therefore, add the length of each such branch in calculating total heating cable length. (See typical pipe layout image.)

STEP 3

All heating circuits must be provided with adequate over-current earth leakage protection.

i) LDP's are recommended with 230V, 16A Type C circuit breakers to BS EN 60 898 and should be fitted with a suitably rated residual current device. (Not supplied)

ii) More than one heater circuit may be connected to a circuit breaker provided that the maximum heater length does not exceed the breaker capacity. (See table below)

iii) The number of circuits will normally be determined by the piping layout.

Minimum number of heating circuits = Total heating cable length / Maximum heater circuit length

Circuit breaker vs. Maximum Cable Length (230V)

<table>
<thead>
<tr>
<th>Heating Cable Maximum Length (m)</th>
<th>11FSM2</th>
<th>17FSM2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Startup Temp</td>
<td>0°C -20°C</td>
<td>0°C -20°C</td>
</tr>
<tr>
<td>16A</td>
<td>128</td>
<td>124</td>
</tr>
<tr>
<td>102</td>
<td>88</td>
<td></td>
</tr>
</tbody>
</table>

Note. In addition to over current protection, all heating circuits must be provided with a 30mA residual current device (rcd). A 30mA, 30ms rcd should be fitted to each LDP. Suitable distribution panels should be selected with the correct circuit capacity. Select a panel having circuit capacity equal to or larger than the number of circuits.

System Components

STEP 4

Determination of System Components

Heating Cable Product Data

Maximum pipe temperature | Catalogue Reference | Nominal W/m Output @ 5°C Metal Pipe | Plastic Pipe
-------------------------|---------------------|-----------------------------------|-------------------|
65°C                     | 11FSM2-CT           | 11                                | 8.2               |
                          | 17FSM2-CT           | 17                                | 12.5              |

Freezstop Micro xxFSM2-CT self-regulating heating cable is designed for freeze protection of metal and plastic pipes. Heat Trace recommend braided and overjacketed heaters for all applications. It is recommended plastic pipes are foiled over and under the heater run to aid heat transfer, using adhesive aluminium foil tape.

Operating Voltage
- 230V (Nominal)

Power output multiplier factor
- 11FSM
- 17FSM

<table>
<thead>
<tr>
<th>220V</th>
<th>230V</th>
<th>240V</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.94</td>
<td>1.00</td>
<td>1.06</td>
</tr>
<tr>
<td>0.95</td>
<td>1.00</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Nominal dimensions
- 5.6 x 7.9 mm

Minimum bending radius (20°C)
- 20mm

See FSM Technical Data Sheet for more detailed information on heating cable.
Ancillary Components

**FT-HTP** - Adhesive black fixing tape (12mm wide x 30m)  
A self-extinguishing conformable PVC adhesive tape. Used for low temperature applications only.  
Dimensions: 12mm wide x 33m roll  
Max Withstand Temp: 80°C  
Min Application Temp: 0°C  
Adhesive: Rubber resin

**FT-ALUM** - Adhesive aluminium foil tape (75mm wide x 50m) (recommended for use with plastic pipes.)  
A 30 micron aluminium foil, coated one side with an acrylic, pressure sensitive adhesive. The tape is backed with a strong polythene coated release paper. Flame retardant and water resistant.  
Dimensions: 75mm wide x 45m roll  
Max Withstand Temp: 110°C  
Min Application Temp: 0°C  
Adhesive: Acrylic

Heat Shrink Termination Kit

**HTK1** - Universal Heat Shrink Termination Kit for power end termination and remote end termination.  
Universal heat shrink termination kit, c/w all components necessary to terminate the power connection end and the remote end of the heating cable. Kit is complete with M20 x 1.5 plastic gland with slotted bush for heating cable. (Junction box not supplied.)

**Power Connection Kit (HPS)**  
**End Seal Kit (HES)**

**HSK-T** Heat Shrink T Splice Kit for 3-way heating cable joint.  
A 3-way T splice kit for joining 3 cables together at a pipe branch. Complete with all the necessary adhesive-lined heat shrink items: earth/braid sleeves and conductor bullet crimps.
**General Information**

The above illustration shows a typical pipe system layout, demonstrating the possible positions of components, terminations and splices. Where there are short branch pipes, of around 1 metre or less, it is usually more economical to double run the heater in a "hairpin" loop, as shown in the above illustration, rather than carry out an inline splice at the pipe T junction.

**Terminations**

The standard power termination, remote end seal and the in-line splice kits all use adhesive lined heat shrink materials. There is an alternative available using silicone rubber sleeves, boots and silicone sealant, however, the sealant requires 24 hours for full cure.

**Control Thermostat**

Consideration may be given to controlling the system using a simple air-sensing thermostat for energy efficiency. However, the heater is safe to run without thermostatic control due to the fact that the FREEZSTOP MICRO cable is Inherently Temperature Safe and cannot overheat under its own power.
OTHER SYSTEMS AVAILABLE FROM HEAT TRACE

G-TRACE SYSTEM - ROOF & GUTTER SNOW & ICE PREVENTION SYSTEM

SNOMELT SYSTEM - SNOW & ICE PREVENTION SYSTEM FOR RAMP & WALKWAYS, ETC.

HOTWAT - INSTANT HOT WATER AT EVERY OUTLET

A FULL RANGE OF HEAT TRACING SYSTEMS FOR INDUSTRIAL AND HAZARDOUS AREA APPLICATIONS ARE ALSO AVAILABLE - PLEASE CONTACT HEAT TRACE LIMITED DIRECT

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