FLEXTRACE®

TEMPERATURE MAINTENANCE SYSTEMS

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www.flexelec.com

FST - FST/T - FST/I - FST/TP - FST/TF
Self-regulating cables

CSTB Ex CE

Characteristics

- Can be cut to length on site.
- Will not self-destruct by overheating.
- Power supply: 230 V.
- Available as 10, 15, 25, 30 or 40 W/m at + 10°C.
- FST : self-regulating cables, thermoplastic insulation.
- FST/T : with tinned copper braid for mechanical protection and earthing.
- FST/I : with stainless steel braid for mechanical protection and earthing.
- FST/TP : with tinned copper braid and outer thermoplastic anticorrosion sheath.
- FST/TF : with tinned copper braid and outer fluoropolymer sheath, ideal for the chemical industry where corrosive substances may be present.

Applications



Self-regulating cables of the FST range are used to protect against freezing or to maintain moderate temperatures.

Cables of type FST/T, FST/I, FST/TP and FST/TF comply with the technical evaluation document issued by the CSTB.

Cable FST/TP/30 is recommended for protecting against freezing in gutters.

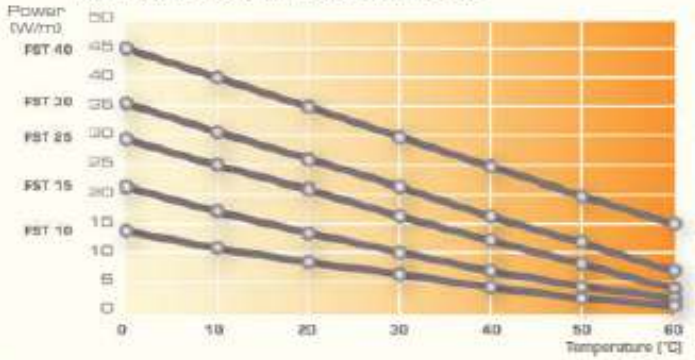
Cables of type FST/T, FST/I, FST/TP and FST/TF can, with the appropriate accessories, be used in an explosive atmosphere.

To ensure that these heating elements enjoy a long service life, we recommend using a control device.





Power output according to pipe temperature



	FST 10	FST 15	FST 25	FST 30	FST 40
Insulation	Thermoplastic				
Dimensions					
FST	4 x 11 mm				
FST/T - FST/I	4.7 x 11.8 mm				
FST/TP - FST/TF	6 x 13 mm				
Power at 10°C	10 W/m	17 W/m	25 W/m	31 W/m	40W/m
Permissible surface temperature	Unenergized circuit: max. + 85°C Energized circuit: max. + 65°C				
Start-up current					
+10°C	0.07 A/m	0.1 A/m	0.13 A/m	0.16 A/m	0.21 A/m
0°C	0.08 A/m	0.12 A/m	0.16 A/m	0.19 A/m	0.26 A/m
- 20°C	0.12 A/m	0.15 A/m	0.21 A/m	0.24 A/m	0.32 A/m
Max. circuit length	198 m	154 m	124 m	110 m	88 m
Temperature class	T6 (85°C)				T4 (135°C)

Use

Consult the pages of the catalogue devoted to the corresponding general operating principles, general instructions for use and accessories.

ATEX certificate: SIRA N° 03ATEX3312 Ex II 2G

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TECHHNICAL GUIDE

GENERAL INSTALLATION

AND INSTRUCTIONS FOR USE OF ALL FLEXELEC PRODUCTS

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BASIC RULES

Your temperature maintenance system will give trouble-free operation provided it is fitted in accordance with good engineering practice. You should fit and connect up the cables and flexible heating elements as indicated below. Read the instructions carefully: it will be more costly to have to carry our repair work afterwards than to "waste" time reading these instructions to the end and installing your system in keeping with the recommendations given. (BS 6351 Part3)
It is prohibited to use the system in any way that does not respect the precautions for use.
Before beginning to fit the heating element, make sure that thermal insulation is fitted immediately afterwards: our products could be damaged by tools or solder, etc. falling on them if too much time elapses between these two operations.

Warning:

In no event should the heating element be held in the air or enclosed within insulating material while it is operating.
Do not energise the heating element before fitting it.
Do not immerse the heating element.
Do not fit the heating element if it is damaged.
Do not touch the heating element when it is energised.

Assembly and commissioning are subject to standards (BS 6351 Part3), safety instructions and accident prevention rules in force in each country.
It is prohibited to modify the devices in any way.
Clean and wipe the outside of the part to be heated.
Also check that no sharp parts such as welds, welding flash, metal parts, etc. could damage the heating element.
The whole of the heating element must be in contact with the part to be heated.
In no circumstances should the heating element cross over or overlap itself.
Cover the whole of the heating element and the part to be heated with thermal insulation of recommended thickness.
Stick the warning label on the thermal insulation .
The heating element should be energised only when fitting operations are finished.
Connect up to a suitable, properly protected electric power supply.
The electrical protection systems (fuses, circuit-breakers, etc.) must be provided on the site as per the applicable standards in force.

SPECIAL INSTRUCTIONS

Ensure that the flexible heating element chosen is fully appropriate for the requirements of the installation. For this purpose, consult the **FLEXELEC technical documents.**
Check whether the project requires straight or spiral heat tracing and if extra lengths need to be provided for valves, flanges, pumps, etc.

Heat loss calculations for flanges, valves, piping supports or other elements may turn out to be complex because of difficulty in measuring the exact heat transfer surfaces. Many accessories such as flanges and valves are manufactured according to standards, while others, such as filters or pumps differ from one manufacturer or application to another.
To determine heat losses, follow the recommendations below:

Type	Diameter	Equivalent cable length
Flanges	≤ DN 200	0.3 m
	> DN 200	1.0 m
Valves	≤ DN 200	1.0 m
	> DN 200	3.0 m

Note: The extra length of cable calculated in these 4 cases may not be used in full for practical reasons. All constant power cables or self-regulating heating tapes have maximum circuit lengths depending on their power rating and voltage.
Consult the **FLEXELEC technical documentation.**

When fitting heating elements, do not:

- allow them to come into contact with sharp edges,
- apply excessive pulling force to them,
- allow them to be crushed in any way.

The cables must be terminated as soon as possible afterfitting to prevent damp entering by non-sealed ends.

- Inspect the heating elements and accessories as soon as you receive them to check that they have not been damaged during transit. It is recommended to carry out measurement of insulation resistance at this stage.
- For constant power cables, check that sufficient length has been provided to allow for the incorporated cold tails.
- Allow an extra 0.5 m of self-regulating heating cable to connect to another cable or for a branch joint.
- Always begin heat tracing at the power supply end.

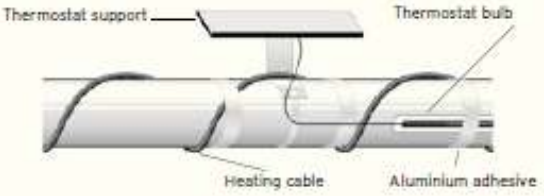
FITTING THERMOSTATS AND JUNCTION BOXES

To protect against freezing, air thermostats are generally used. These must be fitted in the area most exposed to freezing and can be fixed to the piping or any other support. If they are fitted to piping the heating cable can be connected directly into the thermostat. Self-regulating heating cables can be connected directly to a junction box (a thermostat is not strictly necessary , but strongly recommended). Supports exist for fixing the junction box or thermostat onto the piping.

Bulb and capillary or temperature probe thermostats are normally used for production lines to control the surface temperature and must be fitted immediately adjacent to the power point. Supports exist for fixing the thermostat onto the piping.

First fix the thermostats and junction boxes in the planned locations. For bulb thermostats, the bulb must always be fixed as shown below:

Spiral tracing





INSTRUCTIONS

FITTING HEATING CABLES

(the term "cables" also refers to other flexible heating elements).
The first rule is never to cross heating cables or lay one on top of another.

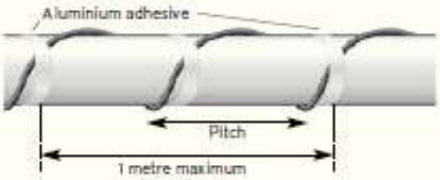
It is not essential to completely cover the heating element with aluminium adhesive, but this is recommended for the following reasons:

- The heating cable will not be trapped in the thermal insulation.
- Thermal efficiency will be improved through better contact between the heating cable and the piping.
- This eliminates the risk of hot spots on the heating cable.
- This type of fitting is strongly recommended on flanges, valves, taps, etc.

Straight tracing

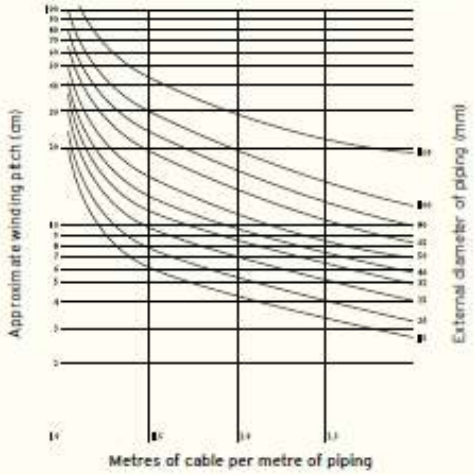


Spiral tracing



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TRACING PIPING EQUIPMENT: ELBOWS, FLANGES, VALVES AND PIPING SUPPORTS

Notes: - Inverting the screw pitch either side of the equipment makes it easier to remove.
- Ensure that the heating cable is properly in contact with the equipment.
- Smooth over any sharp edges as necessary (with an aluminium tape, for example).

Type	Straight tracing	Spiral tracing
Elbows	 Trace on the outside of the elbow	 Regular pitch, adjacent turns must not touch on the inside
Flanges		
Small diameter valves		
Large diameter valves		

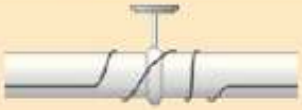
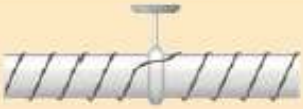
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PIPING SUPPORTS

Type	Straight tracing	Spiral tracing
Screwed collars		
Welded flat iron bars		
Welded columns		

TRACING A BRANCH JOINT

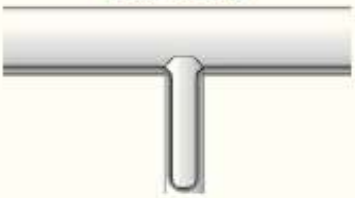
Branch joints or nozzles are often of a smaller diameter than the main pipe. Return tracing must therefore be avoided on long nozzles as these would increase the installed power to the point of multiplying it by two (straight tracing) and causing local overheating.

Short nozzles: 1.5 m maximum.

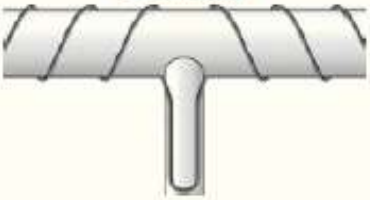
Long nozzles: greater than 1.5 m.

For long nozzles, break the circuit and fit a junction box to allow the heating circuit to branch off.

Straight tracing



Spiral tracing

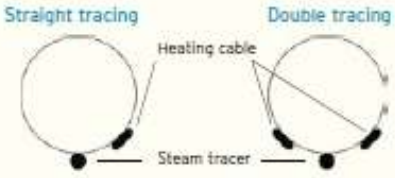


FITTING A HEATING CABLE TO PIPING WITH A STEAM TRACER

Check that the cable sheath will withstand the temperature of the steam.

Never use spiral tracing, which would cause the cable to come into contact with the steam tracer.

Use single or double straight tracing.



TRACING TWO PIPES SIDE BY SIDE

Never spiral the heating cable over the piping.

Use double straight tracing.



INSTRUCTIONS

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INSPECTION

Before fitting the thermal insulation, perform the following inspections:

- Throughout the cable installation process.
- As soon as possible once the installation is finished and before connecting up to the electric power supply.

Installation inspection

The following inspections must be made:

- The heating cables and temperature probes (if any) are in close contact with the piping; there is no air gap between these devices and the piping.
- No cable loops are hanging in mid air.
- No heating cable is trapped under piping supports, thermostat supports or junction boxes, etc.
- No heating cable is crossed over or laid on top of another, or twisted about itself.
- All the heating cables are fixed to the piping with appropriate fixing materials.

Circuit continuity and insulation resistance inspection

The following procedure is designed to check that the various heating cables are operating properly.

- Constant power cables

1. Check the resistance and continuity of the circuits using a multimeter.
2. Check the insulation resistance between the conductors and the earth using a 2500 V DC (500V DC min) megohmmeter.

   Whatever the length of the cable, the minimum insulation resistance must be 10 megohms.
3. The results of the above tests must be recorded and stored.

- Self-regulating heating cables

Check the insulation resistance using a 2500 V DC (500V DC min) megohmmeter.

Whatever the length of the cable, the minimum insulation resistance must be 10 megohms.

1. Between conductors and piping if the cable is not braided.
2. Between conductors and braid if any.
3. For cables with braid and sheath, **perform 2 tests:**
   - **Test 1:** between conductor and braid,
   - **Test 2:** between braid and metal piping
4. As before, record and store the test results.

MAINTENANCE

Visual inspection

Visually inspect the piping with tracers to check that neither the insulation nor the cable have been damaged.

Tracer inspection

The following inspection procedures must be carried out at least once a year (before winter) for installations protecting against freezing or twice a year for production installations.

Thermal insulation

- The heating cables must always be protected by thermal insulation.
- During inspection operations, be very careful not to damage the heating cables.
- The thermal insulation must always have the same temperature limit as the heating cables.
- The heating cables must never be trapped within the thermal insulation.
- The thermal insulation must be appropriate for the environmental conditions prevailing.
- Apply labels warning that electrical heat tracing is in use on the outside of the thermal insulation at intervals which make it possible for them to be seen clearly, wherever the person working on the piping may be. Do not forget to place them on both sides of the thermal insulation.

Before any inspection work, switch off the electric power supply.

- Remove the lid from junction boxes and thermostats.
- Disconnect the heating cable from the electric power supply.
- Check, as described above, the insulation resistance rating and, for constant power cables, the resistance rating. Make a note of these figures and store them.
- Compare these figures with those from the previous inspection. If they are the same, reconnect the heating cable and replace the junction box lids.
- With the thermostat still electrically insulated, carry out the inspection as above. Check that the power cables are properly connected to the right terminal block. Using a multimeter, check that the thermostat cuts off power to the heating cables by lowering and raising the temperature setpoint to minimum and then to maximum.
- If the thermostat operates, do not forget to put the setpoint back to the initial temperature.
- Replace the thermostat lid.
- Visually inspect the installation in order to detect any damage to piping or insulation.
- Connect the electric power supply back up.

PIPING QUESTIONNAIRES

THESE QUESTIONNAIRES ARE INTENDED TO HELP YOU TO CHOOSE THE RIGHT PRODUCT



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A Temperature maintenance

Temperature maintenance is the operation which aims to keep the temperature of a device constant.
This implies that the products and their containments must already be at this same temperature.
If this is not the case, then the application comprises a heating dimension, and part B of the questionnaire must also be completed.

Temperature to be maintained				°C
Min. ambient temperature				°C
Nominal Diameter	mm	OR	outside diameter of the piping	mm
Length of piping				m
Piping material *The material that the piping is made of is important information since it will influence the choice of power rating of the cable or braid.*				
Max. surface temperature of the piping *The max. temperature of the piping is sometimes a decisive criterion, for example if there are high temperature steam cleaning cycles.*				°C
Type of substance being conveyed *This is important, as it must be ensured that, in the event of leakage the insulation of the heating cable will not be chemically attacked.*				
Thickness of the insulation				mm
Type of insulation				
Thermal conductivity of the insulation				W/m.K
Max. temperature acceptable for the insulation				°C
Available voltage				V
Safe area		OR	ATEX hazardous area *(indicate the temperature class)*	
Network geometry: nozzles, "T", any diagram				
Other *flanges, pumps, valves, max. or min. temperature acceptable by the fluid, etc.*				

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B Heating

Heating may be static or involve a flow.

Fluid density				kg/dm³
Specific heat of the fluid				kJ/kg.K
Initial temperature				°C
Temperature to be reached				°C
Min. ambient temperature				°C
Time allowed for heating				h
Fluid flow rate				kg/h
Inside diameter	mm	OR	Piping thickness	mm
Specific heat of the piping material				kJ/kg.K

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VESSEL - HOPPER QUESTIONNAIRES

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A Temperature maintenance

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Temperature to be maintained	°C
Min. ambient temperature	°C
Outside diameter of the vessel or dimension of the edges if rectangular	mm
Height or length of the vessel	mm
Cylindrical height available for tracing	mm
Bottom: flat, rounded, etc.	
Feet: number, insulation, etc.	
Vessel material *The material that the vessel is made of is important information since it will influence the choice of power rating of the cable or braid.*	
Max. surface temperature of the vessel *The max. temperature of the vessel can be a decisive criterion, for example if there are steam cleaning cycles*	°C
Type of substance contained *This is important, as it must be ensured that, in the event of leakage the insulation of the heating cable will not be chemically attacked*	
Thickness of the insulating lagging	mm
Type of insulating lagging	
Thermal conductivity of the insulation	W/m.K
Max. temperature acceptable for the insulation	°C
Available voltage	V
Safe area [ ] OR ATEX hazardous area *(indicate the temperature class)*	
Obstacle on the surface of the vessel: nozzles, feet, ... any diagrams	
Other *flanges, pumps, valves, max. or min. temperature acceptable by the fluid, etc.*	

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B Heating

Heating may be static or involve a flow.

Fluid density	kg/dm³
Specific heat of the fluid	kJ/kg.K
Initial temperature	°C
Temperature to be reached	°C
Min. ambient temperature	°C
Time allowed for heating	h
Fluid flow rate	kg/h
Max. vessel capacity	kg or m³
Max. fill rate	%
Vessel thickness	mm
Specific heat of the vessel material	kJ/kg.K

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PRODUCT QUESTIONNAIRES

IN ORDER TO DETERMINE A SPECIAL PRODUCT MADE TO THE MEASUREMENTS YOU REQUIRE, ANSWERS TO THE FOLLOWING QUESTIONS ARE NECESSARY. THESE WILL BE USED TO DEFINE THE BEST PRODUCT FOR YOUR NEEDS.



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A Cords

Linear ohmic value	ohm/m
Type of insulation *PVC/Silicon elastomer/Fluoropolymer*	
Outside diameter	mm
OR	
Final circuit length	m
Power	W
Voltage	V
Type of insulation *PVC/Silicon elastomer/Fluoropolymer*	

B Cables - Tapes

Total length	mm
Heating length	mm
Power	W
Voltage	V
Type of insulation	
Braid	
Braid material *tinned copper, stainless steel, glass silk*	
Outside diameter	mm
Number of power cables	1 or 2
Length of power cables	mm
Type of insulation for the connection between heating and cold part(s) *(sleeving, moulding, etc.)*	
Other	

C Mats

Length	mm
Width	mm
Other geometry details *diagram and dimensions*	
Power	W
Voltage	V
Power cable length	mm
Location of power cable *diagram and dimensions*	

OPTIONS

Adhesive surface for permanent fitting *(YES / NO)*	
Type of removable fitting *Hook + spring / Velcro / Eyelets + silicon tape*	
Location for thermostat probe *(YES: state diameter / NO)*	
Temperature limiter *(60°C / 80°C / 150°C / NO)*	
PT 100, J Thermocouple *(YES / NO)*	
Location of options *diagram and dimensions*	

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D Hoses

There are so many different types of pipe that these questions are only a basis to help us define the product.
Please contact us to provide us with more complete information.

Nominal inside diameter *standard: maximum - 25 mm*	mm
Total hose length	m
Operating temperature	°C
Max. operating temperature	°C
Voltage	V
Power	W
Type of probe *(P = PT 100, N = NiCrNi or F = FeCuNi)*	
Max. pressure	bar
Type of connections	
Other	

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