



# Contents, Planning instructions: **Frost protection**

Section	Subject	Page
<b>1</b>	<b>Selecting the heating cable system, planning instructions diagram, steps 1-6</b>	<b>3</b>
<b>2</b>	<b>Selection of accessories</b>	<b>4</b>
<b>2.1</b>	Connection units	<b>4</b>
	a) Heating cables <b>with</b> electrical feed	<b>4</b>
	Branch Schema	<b>5</b>
	b) Heating cables <b>without</b> electrical feed	<b>6</b>
<b>2.2</b>	Fastening material	<b>6</b>
<b>2.3</b>	Additional control	<b>7</b>
	Thermostat DHB-340	<b>7</b>
	Ambient thermostat OWTA/D3521	<b>7</b>
<b>3</b>	<b>Heating cable installation</b>	<b>8</b>
	a. Storage	<b>8</b>
	b. Checking the delivery	<b>8</b>
	c. Checking the pipe systems to be heated	<b>8</b>
	d. Installation steps	<b>9</b>
<b>4</b>	<b>Operation</b>	<b>10</b>
<b>5</b>	<b>What happens in the event of malfunctions?</b>	<b>10</b>
<b>5 A</b>	Circuit breaker interrupts	<b>11</b>
<b>5 B</b>	Residual-current-device interrupts	<b>12</b>
<b>5 C</b>	No heat output or heat output too low	<b>13</b>
<b>5 D</b>	Correct heating cable power, but pipe temperature too low	<b>14</b>
<b>5 E</b>	Additional troubleshooting measures, steps 1-8	<b>15</b>
	<b>Laying instructions</b>	<b>16</b>
	<b>System check record</b> (sample)	<b>17</b>
	<b>Project data sheet</b> (sample)	<b>18</b>

# **1. Selecting the heating cable**

## **Planning instructions: Frost protection**

You should first determine the correct type of heating cable depending on the operating conditions.

For this purpose follow the steps in the Selection Guide Frost Protection. Contact Thermon.

## 2. Selection of accessories

### 2. 1. Connection units

To fabricate an electrical trace heating cable length into a single heating element both ends of the heating cable need to be terminated. Power end and remote end terminations use different accessories and techniques. Installation must be performed in accordance with the enclosed installation instructions.

**The following applies in all cases:**

One end of the heating cable must be connected to the electrical supply feeder. The other end must be terminated with an end seal or run into another connecting element.

Depending on the particular pipe network which requires heating, several electrical connecting termination accessories are available (see graphic on next page):

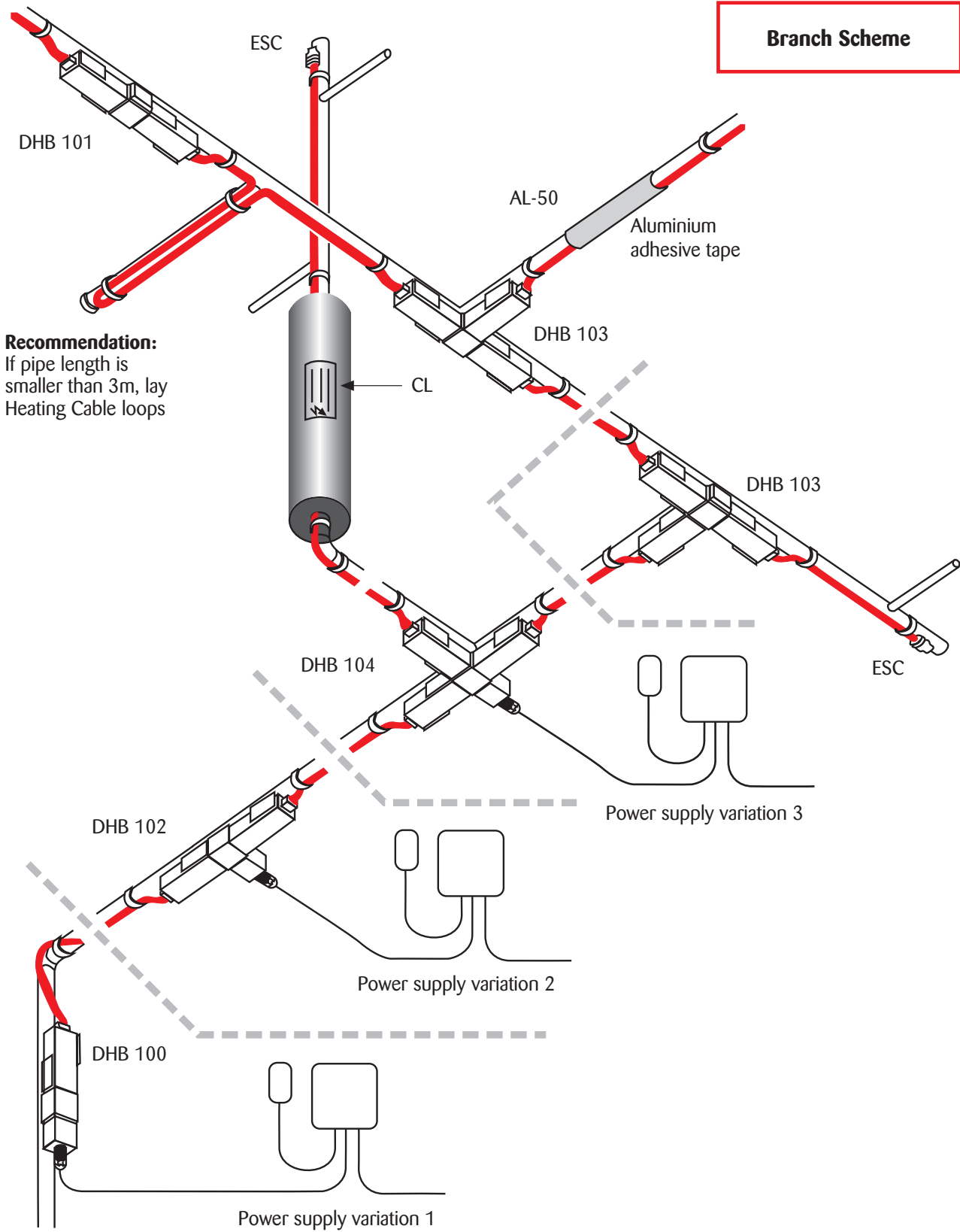
**a) Heating cables with electrical feed:**

**DHB 100:** Connection unit for a power cable to a single heating cable e.g. if the electrical supply is at the start of a single pipe.

**DHB 102:** Connection unit for a power cable to two heating cables e.g. for use if the electrical supply is in the middle of a single pipe allowing a circuit to be centrally supplied.

**DHB 104:** Connection unit for a power cable to three heating cables e.g. for use if the electrical supply is located at a 'T' branch in the pipework.

# Branch Scheme



## **b) Heating cable without electrical supply:**

**DHB 101:** For connecting 2 heating cables, e.g. where the pipe system is subsequently extended (a through connection).

**Important:** The max. permissible length for the heating cable must not be exceeded (see product specification).

**DHB 103:** For connecting 3 heating cables, e.g. in the case of branched pipe systems with long branches.

**ESC:** Heating cable termination; to be fitted at each open remote end of the heating cable. The ESC is supplied in sufficient quantities with every DHB!

### **The quantity and choice of connection units depends on:**

#### **The pipe system**

The number of DHB 103 depends on the number of T-pieces in the pipe. If a branch is shorter than 3m, however, it is permissible to install a heating cable loop.

#### **The local circumstances**

To rationalise electrical supply cabling, it may be useful to feed in centrally on a pipe via DHB 102 or DHB 104 instead of the standard supply connection unit DHB 100.

#### **The number of heating circuits**

Each heating circuit requires its own supply connection unit.

The DHB connection units are purpose made and allow simple and rapid "klik-fit" connection.

They prove more cost effective than conventional equipment due to reduction in components and labour. Only Thermon approved equipment should be used.

## **2. 2. Fastening material**

The heating cable is secured to metal pipes by fixing adhesive tape FT-1L at intervals of approximately 30cm. Alternatively, you can secure the heating cable using cable ties L 3.5-215, also at intervals of approximately 30cm.

On plastic pipes, the heating cable is secured all over with aluminium adhesive tape AL-20P in order to improve the heat transfer.

Cable ties are to be preferred if the conditions are moist or surfaces are not entirely clean.

## **2. 3. Additional control**

### **Thermostat DHB-340**

For use as a thermostat with pipe contact sensor for +5°C frost protection. Used first and foremost with unbranched pipes. Use of a thermostat with pipe contact sensor is the most cost-effective means of control, since the heating is only operational if there is a direct risk of frost to the pipe. Consequently, no heating is performed if the medium in the pipe has a temperature above the thermostat setting (e.g. if warm product were flowing in the pipe even though the ambient temperature was below freezing).

### **Ambient thermostat OWAT/D3521**

For controlling frost protection heaters as a function of the ambient temperature. Used primarily for 'blanket' control of common pipework.

The thermostat can switch heaters directly or can control a contactor in a distribution board energising many circuits as the ambient temperature falls.

The thermostat is best positioned on the north side of buildings in order to avoid direct sunlight.

### 3. Heating cable installation

#### a. Storage:

The heating cables and accessories must be stored at the site so that they remain clean and dry (over the temperature range -40°C to +60°C). Do not allow water ingress to the cable ends.

#### b. Check the delivery for:

- ▶ **Transport damage**
- ▶ **Agreement with specifications**
- ▶ **Completeness**
- ▶ **In case of deviations please contact Thermon within 3 days.**

#### c. Check the pipe systems to be heated for:

- ▶ **Complete installation (subsequent work may result in damage to the heating cable)**
- ▶ **Compliance with specifications (agreed pipe sizes and lengths in particular)**
- ▶ **Clean surfaces**

## d. Installation steps

- 1 Define the electrical supply points (following consultation with the relevant construction manager).
- 2 Perform the insulation resistance measurement for the heating cable on the heating cable drum (Megger both conductors to the braid at 500 Vdc. It is recommended that the test voltage for polymer-insulated heating cables be 2500 Vdc. The minimum acceptable level for the megger reading for any polymer-insulated heat tracing cable is 20 Megohms.)

**Important: Never energise the heating cables whilst on the drum. Damage may occur.**

- 3 Cut the heating cable in accordance with the pipe length; remember to allow extra cable for connections and pipe fittings.
- 4 Always roll the heating cable from the drum; never pull it off sideways.
- 5 Always begin with the longest pipe lengths first.
- 6 Protect the ends of the heating cables from moisture if terminations are not going to be immediately completed.
- 7 Lay the heating cable stretched out along the pipe – run the cable along the bottom side of the pipe where pipes are horizontal. Always run the heating cable along the outside of pipe bends (see laying instructions).

Secure the heating cable every 30cm with the fastening material supplied.

In the case of plastic pipes, apply self-adhesive aluminium foil over the pipework and over the heating cable in order to improve the heat transfer.

- 8 Fit the connection units as per the instructions.
- 9 Perform insulation measurements at the connection unit for each section of heating cable (min. 20 MOhm for a test voltage of min. 500V).

Enter the measured values in the acceptance record (see sample on page 17).

- 10 Release the heated pipe system for insulation.  
**Note:** Apply the insulation immediately after installing the heating cable in order to minimise the risk of damage to the heating cable.
- 11 After applying the insulation, measure the heating cable insulation resistance again (min. 20 MOhm at min. 500V).
- 12 Fit a warning “Electric Heat Tracing” every 3m along the insulation cladding or jacket.

## **4. Operation**

The heating cable requires no maintenance.

Maximum permissible operating temperatures for the heating cable must not be exceeded. Protect the heating cable from damage when performing pipe repair work. Check the heating cable once the pipe repair work has been completed – as described above.

## **5. What happens in the event of malfunctions?**

Before calling out Thermon technicians or representatives to a site, you should first perform a number of elementary steps. It is important that you fill in a complete project data sheet so that you can present this if required. Once you have completed the sheet, compare the present status once again with the project data sheet. You should also inspect the heating system, ascertain the facts as accurately as possible and describe the fault conditions.

Thermon products are manufactured using the highest quality materials consequently inherent product weakness is a rare circumstance. All Thermon products are covered by a guarantee.

Failure to operate satisfactorily may be most likely due to mechanical abuse from an external source or poor or incomplete installation technique.

The following causes of faults are the most common ones.

The list makes no claim to be complete.

# A Miniature Circuit Breakers (m.c.b.) or fuse interrupts

The first five causes should they occur would likely been seen during commissioning of the system and are essentially due to inadequate design or installation. Causes 6 and 7 are sudden failures experienced due to external abuse.

Possible causes	Measures
1. <b>M.C.B. rating too low or wrong tripping characteristic.</b>	Check the connected heating circuit length and load current and rate the m.c.b. accordingly ensuring Type 'B' or 'C' characteristic is used.
2. <b>Heating circuit too long.</b>	If the supply cable rating permits use a larger rated m.c.b. Alternatively include an additional supply point and split the circuit into two separate circuits.
3. <b>m.c.b. trips only at low ambient temperature</b>	Can occur when system has been allowed to become cold. Energise the system in sections, or flush the system with hot water (overcoming the thermal inertia of the system)
4. <b>Heating cable buswires cross-connected</b>	a) Incorrect installation practice. If the pipework configuration allows a trace heating ring circuit to be installed ensure correct polarity is maintained. b) Poor termination at remote cable end. Conductors should be isolated from each other in remote end seal.
5. <b>Faulted m.c.b.</b>	Replace m.c.b.
6. <b>Short-circuit in the supply cable, heating cable, terminations or joints</b>	Cause is usually mechanical abuse. Split circuit at supply point and by electrical test determine if fault is on supply cable or heating cable. Visually inspect supply or heating circuit for mechanical damage, e.g. evidence of damaged insulation/ pipework on heating cable circuit may locate fault. In the absence of visual detection split circuit at interconnection points and test each section to determine faulted length. Inspect interconnecting fittings for arc damage as they are opened this may indicate a termination fault. Replace damaged equipment as necessary. Isolating the faulted section will allow the rest of the upstream system to operate satisfactorily until the fault is repaired. Check the heating cable electrical integrity by performing:- a) Insulation resistance test (between heating cable buswires and cable braid, 20 MOhm at 500V minimum). b) Heating cable buswire continuity (between each individual buswire and earth braid with a low voltage instrument e.g. 11/2-12V whilst conductor and braid are connected together at remote end). c) Current draw test using a clip-on or tong-test ammeter measuring actual current against design current for given parameters.

## **B** Residual-current-device interrupts

<b>Possible causes</b>	<b>Measures</b>
1. See “Possible causes” under A 6.	See “Measures” under A 6.
2. <b>Moisture in the terminal boxes or connecting elements.</b>	Dry out the moist areas and seal the terminal boxes or connecting elements. Measure the insulation resistance.
3. <b>Notches or cuts in the heating cable or in the feeder cable from the power supply, with moisture having penetrated.</b>	Search for the damaged area of the heating cable or feeder cable and renew it.
4. <b>Capacitive leakage current too high (heating circuit or feeder cable lengths).</b>	Check the electrical design using the Thermon tables.
5. <b>Faults in the power network.</b>	Check for faults.
6. <b>Residual-current-operated circuit breaker faulty or incorrectly connected.</b>	Exchange the residual-current-operated circuit breaker or connect it correctly.

## C No heat output or heat output too low

Possible causes	Measures
1. <b>No input voltage or input voltage too low.</b>	Check the electrical power supply and its feeder cables.
2. <b>The electrical characteristics of the heating circuit do not correspond to requirements since: Branches have not been connected, the heating cable is not connected correctly or is damaged.</b>	Check the run and length of the heating cable. Connect the branches, connect the heating cable correctly, inspect the damaged area of the heating cable and replace it with a new section. Then re-check the heating power.
3. <b>High contact resistance at joint due to incorrect connection.</b>	Correct the connection (e.g. new, correct crimping) or tighten the terminals.
4. <b>The control thermostat has been wrongly connected or wrongly set or the sensor has been wrongly positioned.</b>	Correct the wiring, set the thermostat to the correct value and improve the position of the sensor.
5. <b>The pipe itself is at too high a temperature.</b>	5.1 Check the temperature of the product in the pipe. 5.2 Has thicker insulation than specified been applied?
6. <b>The heating cable is damaged and moisture has penetrated.</b>	Exchange the heating cable.
7. <b>The heating cable has been subjected to excessively high temperatures.</b>	Exchange the heating cable. Reduce the temperature of the product or select an appropriate heating cable for the high product temperature.
8. <b>The heating cable has been installed on a surface with poor thermal conductivity. (e.g. plastic)</b>	Check the heating cable configuration or attach aluminium adhesive tape over the heating cable to aid conduction.

## **D The heating cable gives the correct heating power, but the pipe temperature is below the required value**

<b>Possible causes</b>	<b>Measures</b>
<b>1. The pipe insulation is wet or damp.</b>	Remove the wet insulation and replace it with dry insulation. Eliminate the causes of the fault.
<b>2. Insufficient heating cable has been laid at valves, fasteners and other cold bridges.</b>	Fit an additional piece of heating cable, ensuring that the maximum length of the heating circuit is not exceeded.
<b>3. The thermostat has been set incorrectly or the sensor has been positioned incorrectly.</b>	Fit the thermostat correctly or position the sensor correctly.
<b>4. Incorrect thermal insulation thickness or type applied or poor insulation installation technique.</b>	Check the project plan for the system with an advisor from the responsible Thermon office. Proceed according to our recommendations.

## **E If the causes and/or troubleshooting measures referred to above do not prove successful, proceed as follows:**

The most common source of faults are mechanical abuse (whether deliberate or accidental).

The fault will generally manifest as leakage current to earth.

The residual-current-operated circuit breaker trips.

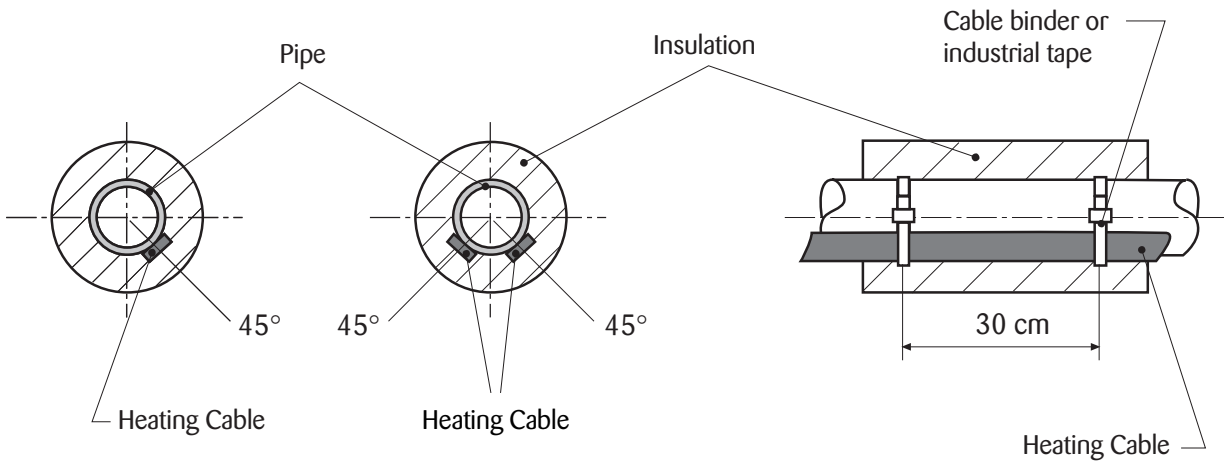
### **Procedure:**

- 1** Isolate the heating circuit and protect it against being energised while investigation is undertaken.
- 2** Detach the heating circuit supply cable in the distribution board and measure the resistance to earth at the outgoing wires. Where values lie in the KOhm range and below, the circuit has a fault. You can then restrict troubleshooting to the specific heating cable circuit.
- 3** Open the supply connection unit on-site, split the supply from the heating circuit and repeat the measurement. You will then know with certainty whether you will need to look for the fault on the heating cable or the supply cable.
- 4** If the heating circuit is at fault assess the entire insulation of the heating circuit to determine whether there is anything unusual, e.g. work on valves, flanges, etc., or external damage to the insulation. Split the circuit at other connection units to determine the faulted section of circuit. Visually inspect and if you are unable to identify anything unusual, remove the insulation from a critical point of the heating circuit. Critical points are points which are particularly prone to faults, these exclude the long straight sections of pipe, but rather pipe sections involving bends, valves, flanges and pumps.
- 5** If you are unable to identify any visible faults, cut through the heating cable and measure in both directions in order to localise the faulty section. Repeat this procedure until you have found the faulty section.
- 6** Exchange the faulty heating cable and connect it using a DHB 101 connector.
- 7** Measure the insulation resistance again. The resistance must exceed 20 MOhm to earth.
- 8** Put the heating circuit back into operation. Notify operations that they can resume work.

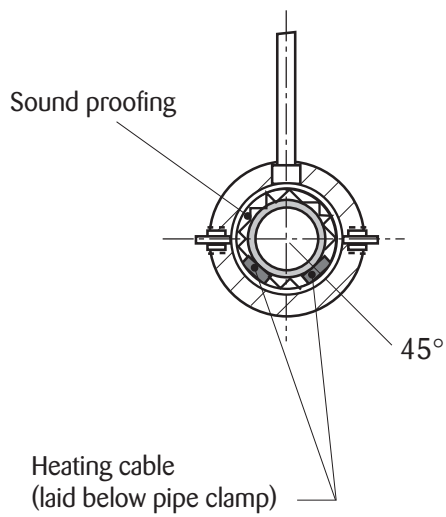
**The experience of repair personnel is invaluable for troubleshooting. Many errors can be identified through external characteristics, such that frequent cutting and measurement to discover errors will only be necessary in exceptional cases.**

# Laying Instructions

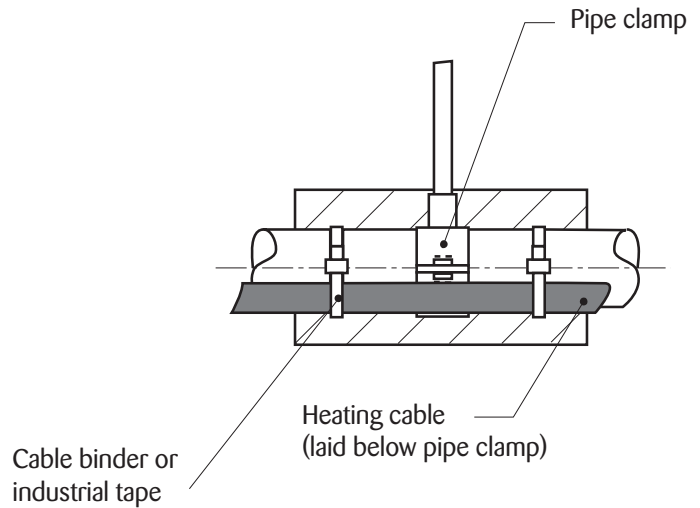
## Position of heating cable on pipe



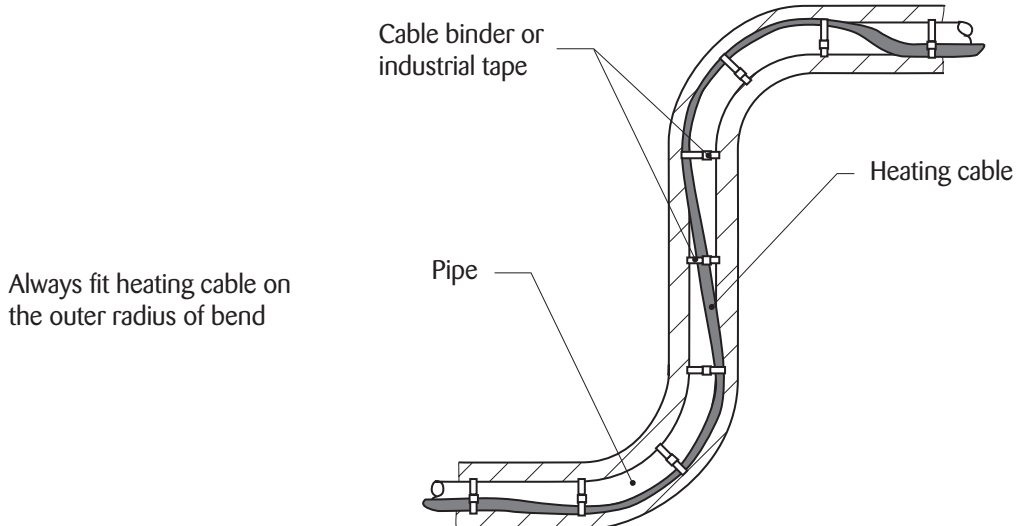
## Laying with sound proofed pipe clamps



## Laying with pipe clamps



## Laying in pipe bend



# System Check Records

(please copy first and then complete)

## for checking the Heating Cable system

Project-Name \_\_\_\_\_

Construction Manager \_\_\_\_\_

Installation Company \_\_\_\_\_

Date \_\_\_\_\_ Signature \_\_\_\_\_

### Material

#### Type of Heating Cable

- HSX ALex \_\_\_\_\_  
HSX 60-2 \_\_\_\_\_
- HSX 55-2 \_\_\_\_\_  
HSX 50-2 \_\_\_\_\_
- FLX 3-2 \_\_\_\_\_  
FLX 8-2 \_\_\_\_\_
- RGS \_\_\_\_\_

#### Equipment

- DHB-340
- OWTA/D3521

#### Connection system

- DomoClic
- Standard/other connection technology

### Heating circuits

No.	Length	Capacity	Thermostat setting	Insulation Resistance
1	m	A	MΩ	V
2	m	A	MΩ	V
3	m	A	MΩ	V
4	m	A	MΩ	V
5	m	A	MΩ	V
6	m	A	MΩ	V

### Visual Check

	ok	not ok	noted
Heating Cable fitting	<input type="checkbox"/>	<input type="checkbox"/>	
Connection	<input type="checkbox"/>	<input type="checkbox"/>	
End connections	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment connections	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment setting	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	
Time switch	<input type="checkbox"/>	<input type="checkbox"/>	Switching time ON OFF

# Project Data Sheet

(please copy and then complete)

## Frost protection FLX for pipelines and containers

Client \_\_\_\_\_ Date \_\_\_\_\_  
 \_\_\_\_\_  
 Enquiry No.: \_\_\_\_\_  
 Telephone No.: \_\_\_\_\_ Fax No.: \_\_\_\_\_  
 Project \_\_\_\_\_ End client \_\_\_\_\_

### Operating conditions

Nominal voltage 230V     Inside     Open air

### Heat Insulation

Mineral fibre (mats)     Mineral fibre (sections)     Foam  
 Other \_\_\_\_\_

### Pipe/container materials

Steel     stainless steel     plastic  
 other \_\_\_\_\_

### Container Data

#### Dimensions:

**Cylindrical**  
 - diameter \_\_\_\_\_ mm  
 - total height \_\_\_\_\_ mm  
 - total length \_\_\_\_\_ mm

**Conical**  
 - diameter top \_\_\_\_\_ mm  
 - diameter bottom \_\_\_\_\_ mm  
 - height of cone \_\_\_\_\_ mm

**Cube shape**  
 - width \_\_\_\_\_ mm  
 - height \_\_\_\_\_ mm  
 - depth \_\_\_\_\_ mm

#### Under construction:

Support legs    each \_\_\_\_\_  
 material \_\_\_\_\_  
 Saddle    each \_\_\_\_\_  
 Concrete foundation  
 Support frame  
 Wooden intermediate layer

Wall thickness \_\_\_\_\_ mm

Filling height \_\_\_\_\_ mm

### Notes

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