

***TESH & MI**

Installation Guidelines

**SERIES
HEATING CABLES**



**ISO 9001
REGISTERED**

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Introduction

These installation instructions have been made in such a way to comply with the regulations as per the norm EN IEC 60079-14 for hazardous areas (where applicable). Furthermore, any other applicable national and local codes must be applied.

Note:

- In all cases heat tracing systems must be protected by means of earth fault protection of 30 mA to (preferred) 300 mA.
- Materials with **IND** in the product reference are for use in non-hazardous areas only.
- Materials with **Ex** in the product reference are for use in hazardous as well as in non-hazardous areas.



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Upon receipt of Thermon heat tracing materials

Check the supplied materials and quantities against the packing list. In case of deviations please contact Thermon within 3 working days.

A) Inspection of the series heating cable

1. Check the printing or label on the heating cable to make sure that the correct type has been received (if applicable).
2. Check the printing on the cold lead cable to make sure that the cable with the correct conductor size has been received (if applicable).
3. Inspect visually for any damage incurred during shipment.
4. Store in a dry place.
5. Cables should be handled with care to avoid crushing, twisting or kinking.

Caution:

Do not connect power to the heating cable while it is on the reel or in the shipping carton.

B1) Inspection of accessories for heat tracing cable using IND and EX expediter or wall mounted JB-K type.

Cable relevant accessories

Whenever cable entry, power termination or end termination is involved, Thermon series cable accessories are related to the cable dimensions.

M20-PT100/TES-Exe : Gland for TES cables.

M25-TES2-Exe : Gland for TES cables.

MI cold lead cable is supplied with brass M20 or M25 glands.

General accessories

- circuit switches
- thermostats (TED1-..., T1-/T2-..., TC1-..., TS-...)
- junction boxes (JB-K...)
- SS mounting bracket (XP-1...) for junction boxes/ thermostats
- fixing tape (FT-1L/FT-1H)
- aluminium tape (AL-20H/AL-30H)
- SS clamps (ABA-25/ABA-40)/ SS B-type banding (B-4/B-10/B-21)
- SS punch strip
- SS banding + seals
- Tool type LN
- Caution Labels (CL-E-...)
- Insulation Entry Kit (IEK-TES)
- Power and End Termination Kits (PETK-5, -6 and -7)

- Connector set (CETI 1525, TESFIT and CKTES-1 and -2)
- Cable protectors

B2) Inspection of accessories for heat tracing cable using expediter or wall mounted Terminator type.

Cable relevant accessories

Whenever cable entry, power termination or end termination is involved, Thermon series cable accessories are related to the cable dimensions.

M20-PT100/TES-Exe : Gland for TES cables.

M25-TES-Exe : Gland for TES cables.

Z . - R-XP/WP type: TES

Z . - MI-WP type: MI

MI cold lead cable is supplied with brass M20 or M25 glands.

General accessories

- circuit switches
- thermostats (ZT-...)
- junction boxes (ZP-...)
- SS mounting bracket (XP-1-....) for junction boxes/ thermostats
- fixing tape (FT-1L/FT-1H)
- aluminium tape (AL-20H/AL-30H)
- SS clamps (ABA-25/ABA-40)/ SS B-type banding (B-4/B-10/B-21)
- SS punch strip
- SS banding + seals
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- Insulation Entry Kit (IEK-TES)
- Power and End Termination Kits (PETK-5, -6 and -7)
- Connector set (CETI 1525, TESFIT and CKTES-1 and -2)
- Cable protectors



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Installation sequence of a heat tracing system

1. Ensure that all piping, instruments and equipment to be traced is completely installed, tested and released.
2. Equipment surfaces should be clean. Any loose scale, oil or rust should be removed. Sharp edges should be avoided.
3. Coating on pipes must be dry before heating cable is installed.
4. Determine which heating circuits can be made from which reels (make a reel schedule if applicable). Install the correct heating cable lengths as indicated in the design. **Any deviation from these lengths will result in a change in output and current!** In most cases series heating cable is supplied by Thermon at the designed length.
5. Start - if possible - to install the long heating circuits first.
6. Take the correct reel for the line to be traced. If the required length of heating cable has been determined, the connection between the cold lead cable to the heating cable can already be made in the workshop (if applicable).
7. A power termination in a junction box or thermostat with (TES only) or without non-metallic expediter can be installed to the heating cable in the workshop. See table 7.1 for further information about non-metallic expediter. The maximum allowed heat output is 16 W/m for which the TES cable can be directly terminated in the junction- or thermostatbox. Above this wattage use a cold lead connector. MI cable must always be provided with cold lead connectors.
8. After installation in junction- or thermostatbox, the heating cable can be meggered. Megger conductor to the braid on both sides of the cable with a 500 - 2500 Vdc test voltage for TES and 1000 Vdc for MI conform the local electrical board. The measured insulation resistance shall not be less than 50 MΩ.

Caution:

- In case electronic thermostats are used in the system, disconnect them before meggering the heat tracing system.
- The loop resistance of the heating cable circuit must be measured.

9. Mount the junction- or thermostatbox on the pipe. For horizontal pipes it is recommended to mount the junction- and thermostatbox with non-metallic expediter in an upright position. If a junction- or thermostatbox with non-metallic expediter is mounted horizontal or on the bottom side of a pipe, moisture can accumulate on the grommet inside the non-metallic expediter. To prevent this, the knock-out hole must be opened for draining purposes. Open one hole at horizontal mounting and all holes at the bottom side mounting. Ensure that the junction- or thermostatbox is not mounted too close to pipe mounted fittings, since the outside diameter of the insulation can be such that the junction- or thermostatbox is partly or totally covered by insulation. With a “single phase + neutral” or a “two phase” system, the cable will start from and end at one point. With a “three phase” system three cables should be laid out over the pipe and at the end be connected in star into a termination box.

10. When preparing the cable for application to the surface to be heated, carefully unroll the coil. Do not pull into a spiral. Layout the cable on the pipe. Mount this cable by means of fixing tape (FT-1L/FT-1H) for TES and SS tie wire for MI. Take care not to over flex the hot to cold junction. This part of the cable can be supported by simply re-tying the first loop containing the joint. Cover TES cable with aluminum tape prescribed per design or recommend by Thermon for an output > 10 W/m. For MI, avoid repeated bending and straightening of cable.

Caution:

- FT-1L for max. pipe temp. up to 85 °C
 FT-1H for max. pipe temp. up to 260 °C

| Application | Application | |
|--------------------|-----------------------|------------------|
| | Max. pipe temperature | Area |
| Black (Terminator) | 232 °C | (Non-) Hazardous |
| Brown/black (XP) | 200 °C | (Non-) Hazardous |
| Grey (XP) | 120 °C | Non-Hazardous |

Table 7.1 application XP (Plus)



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Installation sequence of a heat tracing system

Note:

Stainless steel tie wire for MI cable to be supplied by electrical contractor.

Ensure that the heating cable is mounted on the pipe at the right location (see page 11). The heating cable is to be fixed to the pipe every 300 mm by means of fixing tape or SS tie wire. If plastic pipes are traced, the heating cable must, after having been fixed to the pipe, also be covered with aluminium tape. If the plastic pipes have a low temperature resistance, the pipe must be wrapped with aluminium foil before the heating cable is mounted.

Note:

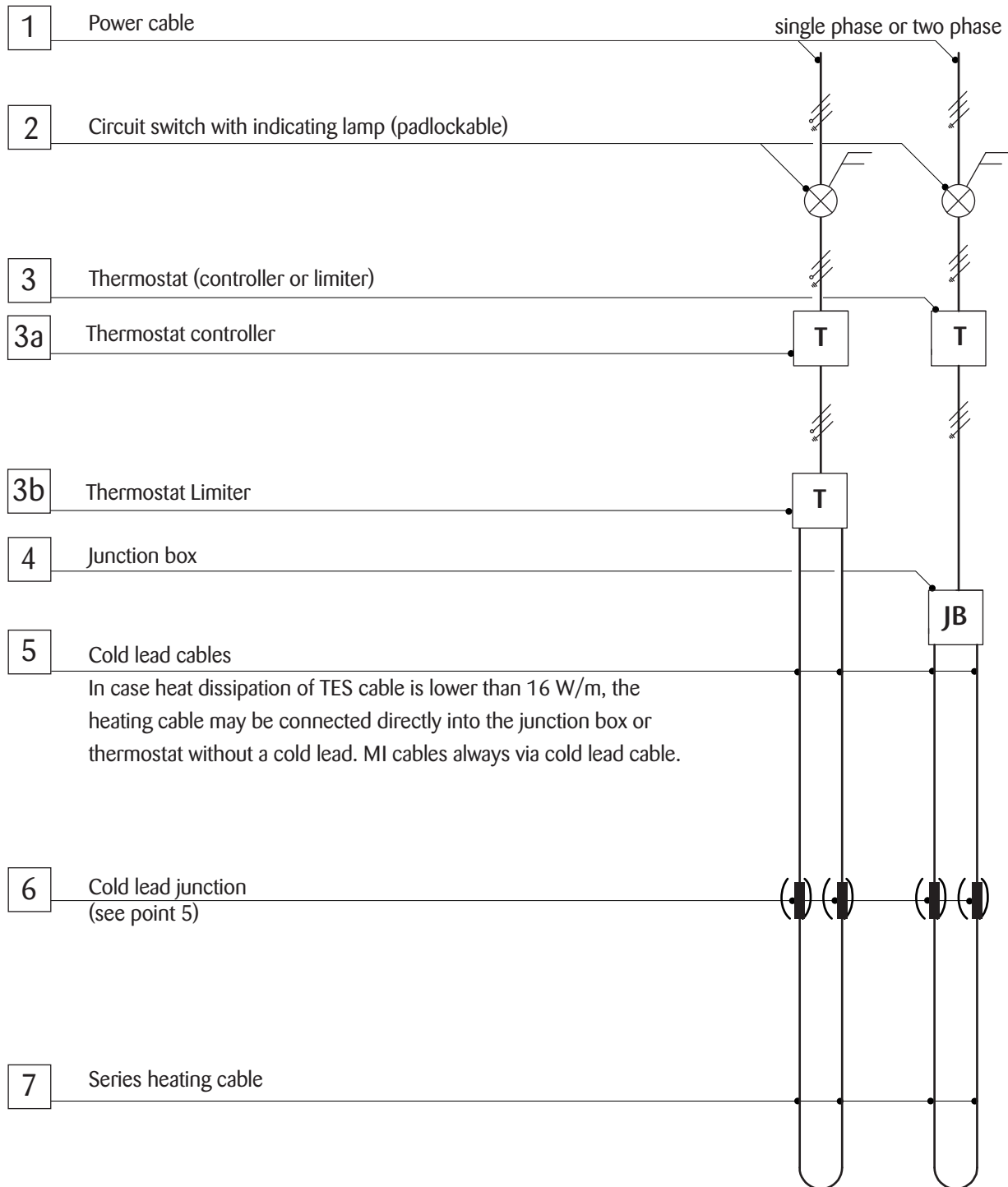
Do not overtighten the SS tie wires around the MI heating cables. The SS tie wires should be tightened in such way to permit hand movement of the cable between tie wire and the pipe, but not to allow the cable to move freely under its own weight. This is essential as it permits for movements of the cable during its heating cycle, when otherwise restricted movement can lead to cable failure due to fatigue.

11. Ensure the correct amount of cable is allowed on locations where additional heat losses can be expected (such as pipe supports, flanges, valves, instruments etc., see page 12 and further). **The heating cables may never touch or cross one another.**
12. In case the heating cable cannot be terminated at once, the heating cable's ends must be sealed off temporarily with for example some RTV-2 silicon sealant.
13. If applicable, connect a cold lead cable to each end of the heating cable.
14. Protect the heating cable against damage at those locations where damage could typically occur (at insulation end plates at valves, pumps etc, see page 21).
15. Inspect, megger and measure the loop resistance of the heating cable again before thermal insulation is installed (page 22) and note down the readings in the checklist (page 23).
16. Note down the actual installed length of heating cable in the checklist (page 23) and/or isometric.
17. Set the thermostat (if applicable) at the desired temperature and note down the setting in the checklist (page 23). We recommend, in case a thermostat controller/limiter is mounted to the pipe, to mark the controller knob with C and the limiter knob with L, by means of for example a permanent marker.
18. Make sure that all openings in the junction boxes and/or thermostats are closed so that no moisture can penetrate.
19. After the thermal insulation has been mounted, the heating cable must be inspected, meggered and the loop resistance must be measured again (page 22). Note down the readings in the checklist (page 23).
20. Apply caution labels to insulation weather barrier at 3 meter intervals.



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Typical heat tracing system switching in-line

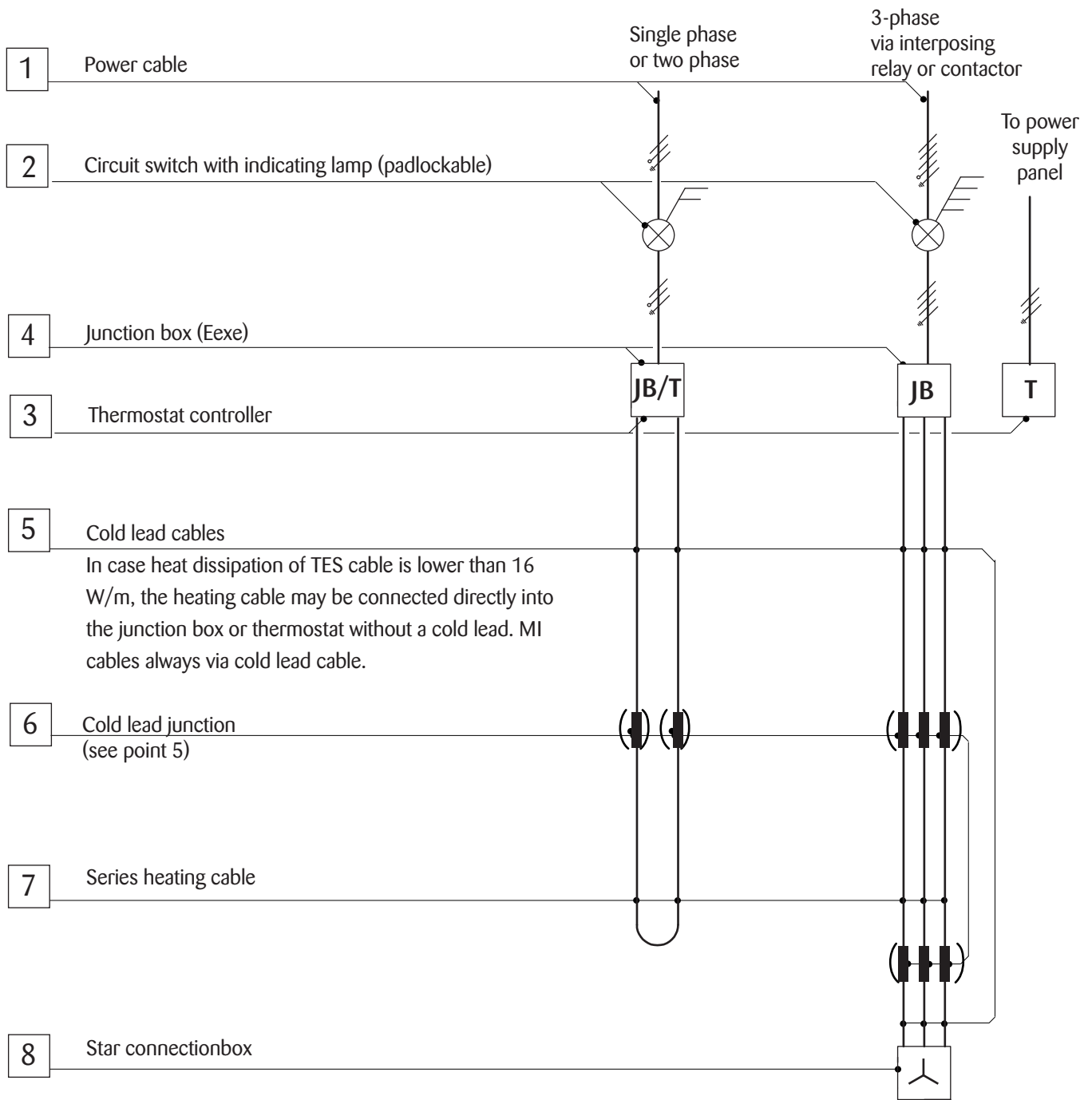


Note:
For using thermostat limiters, see page 22-documentation



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Typical heat tracing system using stabilized design



Note:

For using thermostat limiters, see page 22-documentation



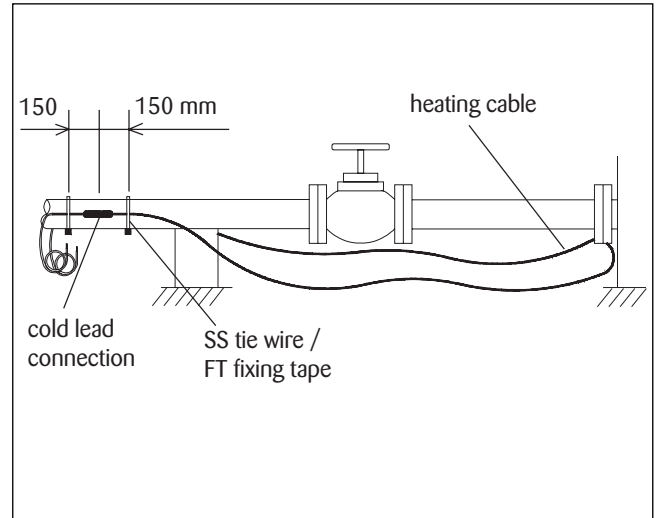
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Installation of TES and MI cable

- 1 With a single or two phase system: unroll the cable, loop it and lay it alongside the pipe section, so that both passes can be installed simultaneously.

Note:

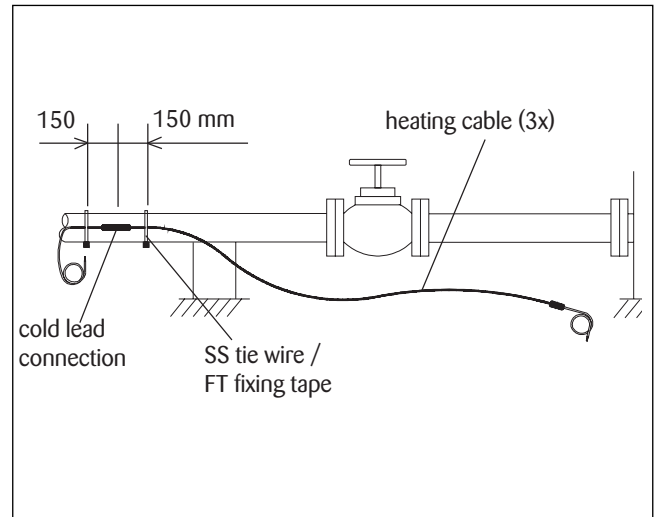
First attach the cold lead connection to the pipe before unrolling the heating cable.



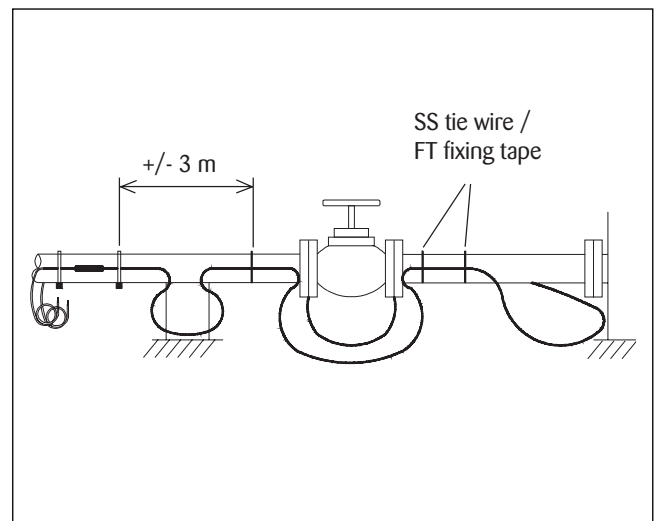
- 2 With a 3-phase system: unroll the cable and lay it alongside the pipe section. The cables can be installed separately or simultaneously.

Note:

First attach the cold lead connection to the pipe before unrolling the heating cable.



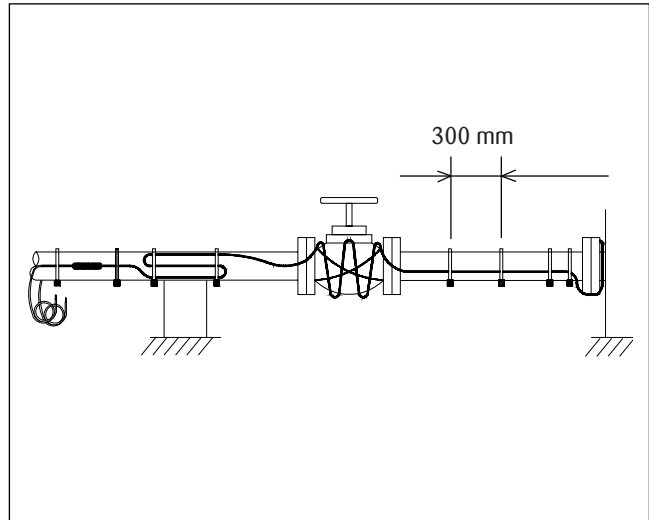
- 3 Temporarily secure the heating cable to the pipe at approx. 3 m. interval, using SS tie wire / FT fixing tape, starting with the cold lead section (power end) and working towards the end of the pipe. Loops of cable for the recommend allowance are to be left at each heat sink - valve, flange, pump, pipe support etc.- until final fixing of the cable. For installation on valve, pipe support etc. see page 12 and further.



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Installation of TES and MI cable

- 4 After possible re-adjustment, the cable can be secured at 300 mm interval using SS tie wire/FT fixing tape. The cable loops at heat sinks, valves, pipe supports, etc. can be formed into position.



- 5 On small flanges and joints, where it is impractical to bend the heating cable to achieve close contact across the surface, the heating cable and flange should be wrapped with aluminium foil.



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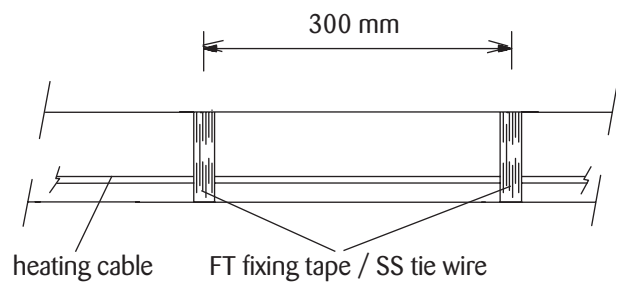
Installation on pipe work

In principle the heating cable is mounted parallel to the pipe and fixed by means of FT fixing tape or SS tie wire. Only if prescribed in the design, the cable must be covered with aluminium tape.

Description:

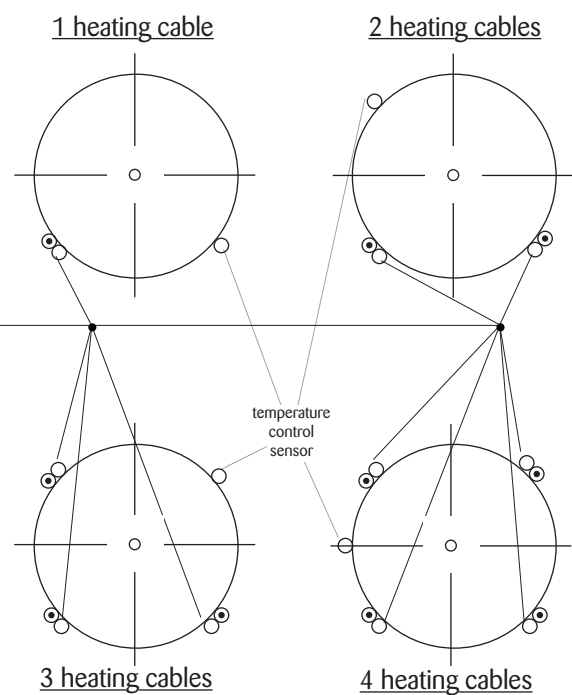
FT-1L tape for max. 85 °C
FT-1H tape for max. 260 °C

Stainless steel tie wire to be supplied by electrical contractor.



For multiple parallel passes refer to illustration alongside.

Temperature limiter sensor (if applicable)



Note:

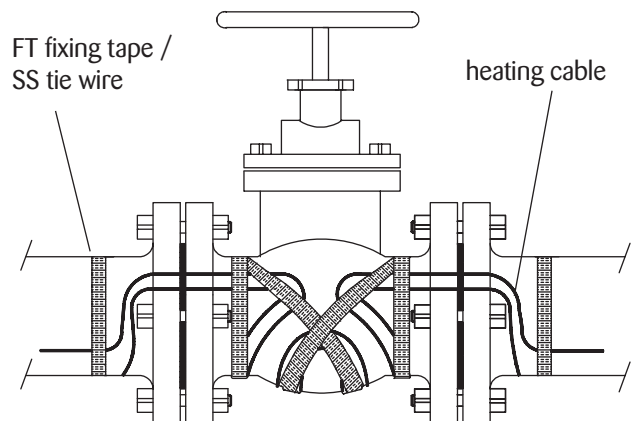
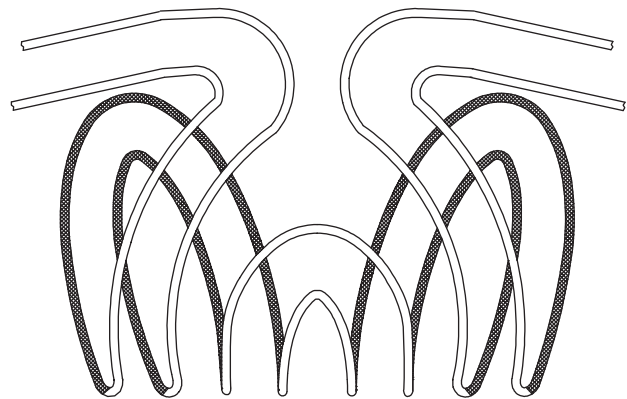
For using thermostat limiters, see page 22-documentation.



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Installation on valves

| TYPICAL CABLE ALLOWANCES PER VALVE * (single pass) in mm | | | | | |
|--|--------------------------------------|-----|---------------------------------|---------------------------------|---|
| N O M I N A L | P I P E S I Z E | DN | S C R E W E D | F L A N G E D | B U T T E R F L Y |
| NPS | | | | | |
| | 1/2" | 12 | 150 | 300 | -- |
| | 3/4" | 20 | 220 | 450 | -- |
| | 1" | 25 | 300 | 600 | 300 |
| | 1 1/2" | 40 | 450 | 600 | 450 |
| | 2" | 50 | 600 | 750 | 600 |
| | 2 1/2" | 65 | | 900 | 750 |
| | 3" | 80 | | 1050 | 750 |
| | 4" | 100 | | 1500 | 900 |
| | 6" | 150 | | 2400 | 1050 |
| | 8" | 200 | | 3300 | 1200 |
| | 10" | 250 | | 4200 | 1350 |
| | 12" | 300 | | 5000 | 1500 |
| | 14" | 350 | | 5900 | 1650 |
| | 16" | 400 | | 6900 | 1800 |
| | 18" | 450 | | 8100 | 1950 |
| | 20" | 500 | | 9000 | 2100 |



Note:

- The heating cables should not touch or cross one another.
- When prescribed in design apply aluminium tape over the heating cable.
- Min. bending radius of the heating cable is 5-6 x cable diameter.
- Apply additional SS tie wire/fixing tape in such a way that heating cable makes close contact with the valve.

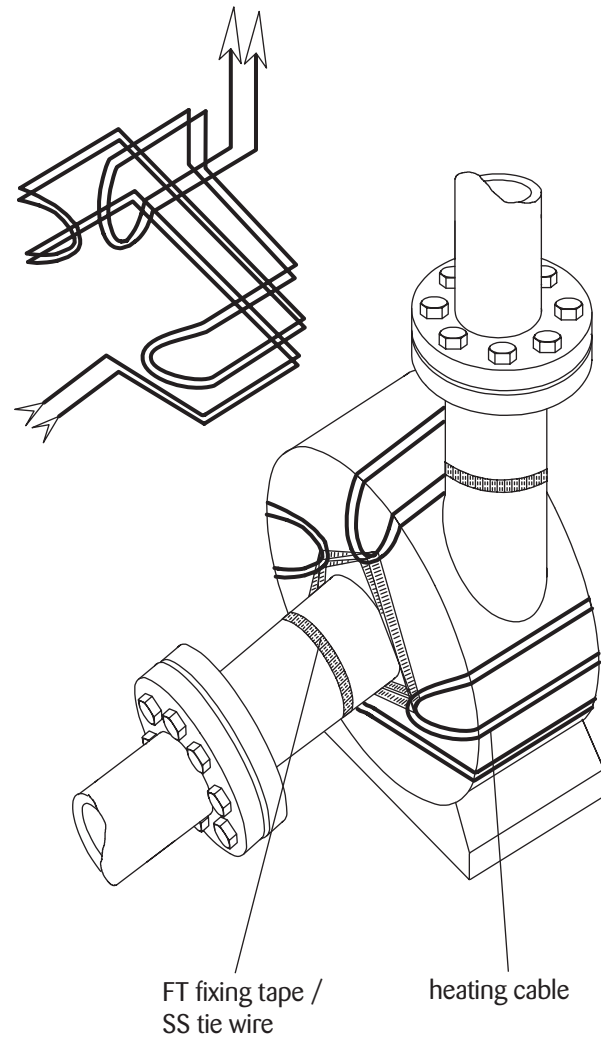
* Allowances for valves up to 600 Lbs and a single pass of heating cable



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Installation on pumps

| TYPICAL CABLE ALLOWANCES PER PUMP (single pass) in mm | | |
|---|--------------------------------------|------------------|
| N O M I N A L | P I P E S I Z E | P U M P |
| NPS | DN | |
| ½" | 12 | 600 |
| ¾" | 20 | 900 |
| 1" | 25 | 1200 |
| 1½" | 40 | 1200 |
| 2" | 50 | 1500 |
| 2½" | 65 | 1800 |
| 3" | 80 | 2100 |
| 4" | 100 | 3000 |
| 6" | 150 | 4800 |
| 8" | 200 | 6600 |
| 10" | 250 | 8400 |
| 12" | 300 | 10000 |
| 14" | 350 | 11800 |
| 16" | 400 | 13800 |
| 18" | 450 | 16200 |
| 20" | 500 | 18000 |



Note:

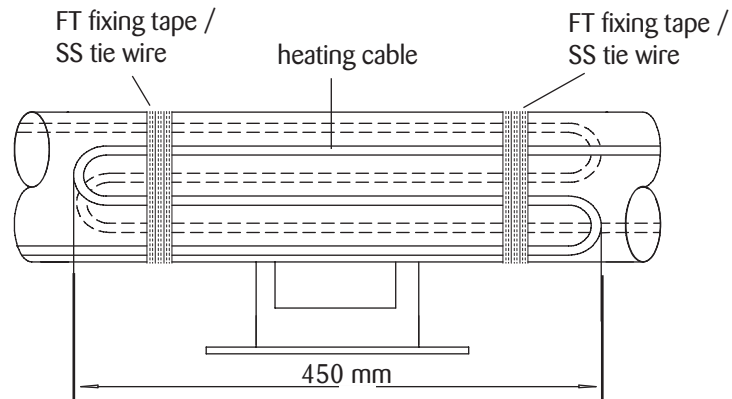
- The heating cables should not touch or cross one another.
- When prescribed in design apply aluminium tape over the heating cable.
- Min. bending radius of the heating cable is 5-6 x cable diameter.
- Apply additional SS tie wire/fixing tape in such a way that heating cable makes close contact with the pump.



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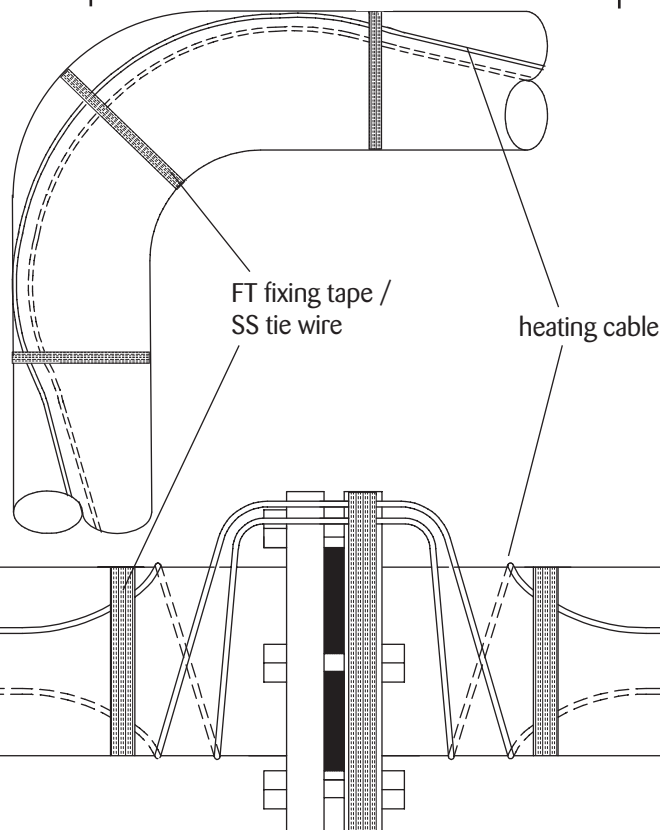
Installation on pipe supports, bends and flanges

For lines of 2" and larger



Note:

Install the cables on the outer side of the bend as shown



Note:

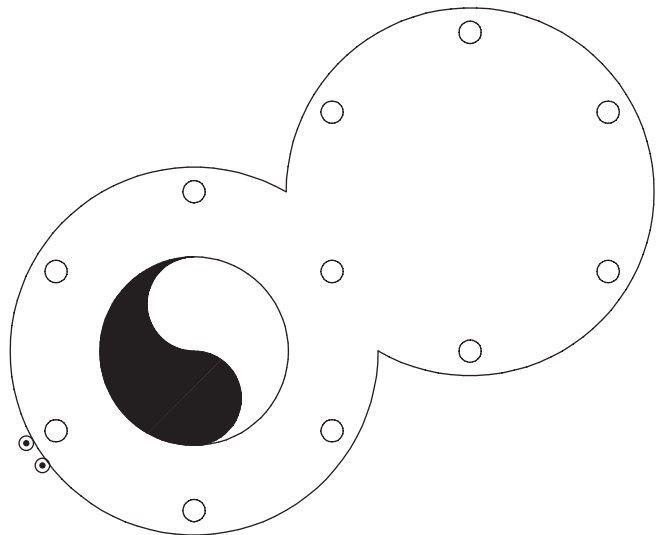
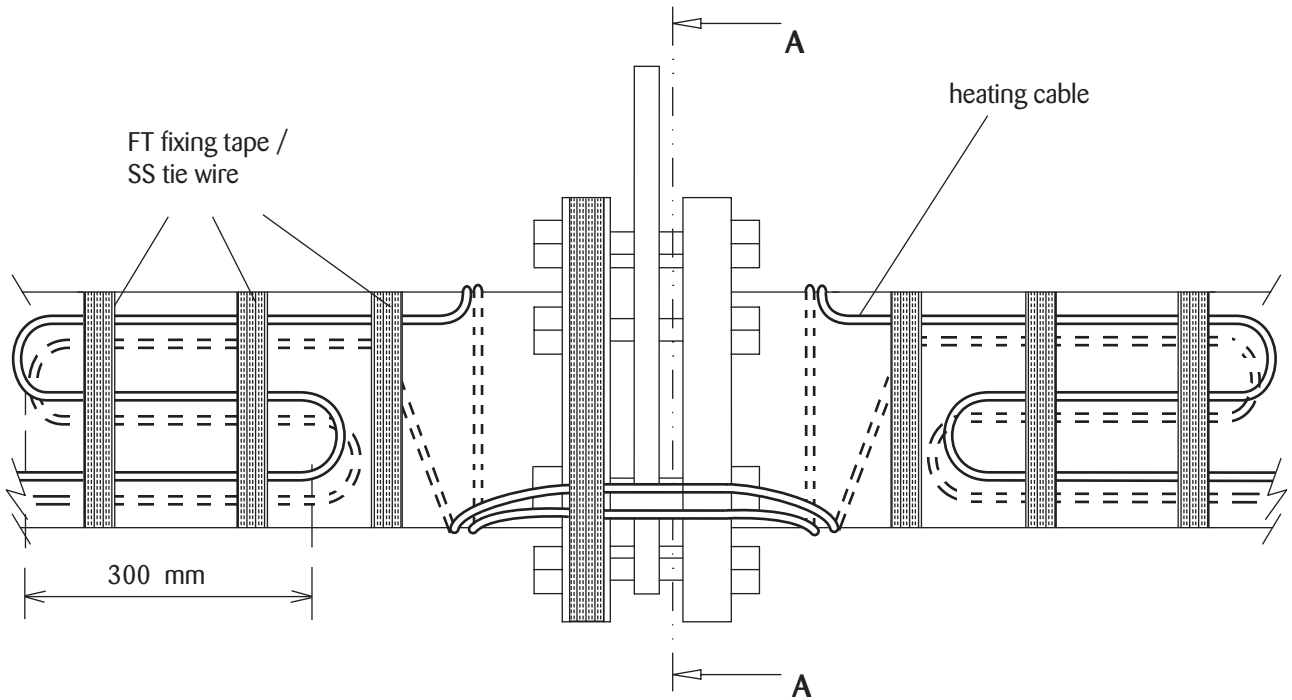
- The heating cables should not touch or cross one another.
- When prescribed in design apply aluminium tape over the heating cable.
- Min. bending radius of the heating cable is 5-6 x cable diameter.
- In each heating cable a loop must be made on the flange if the pipe diameter allows for this.
- It is preferred to isolate the pipe support from the pipes.



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Installation on spectacle blinds

For uninsulated spectacle blinds for lines of 2" and larger



Section A-A

Note:

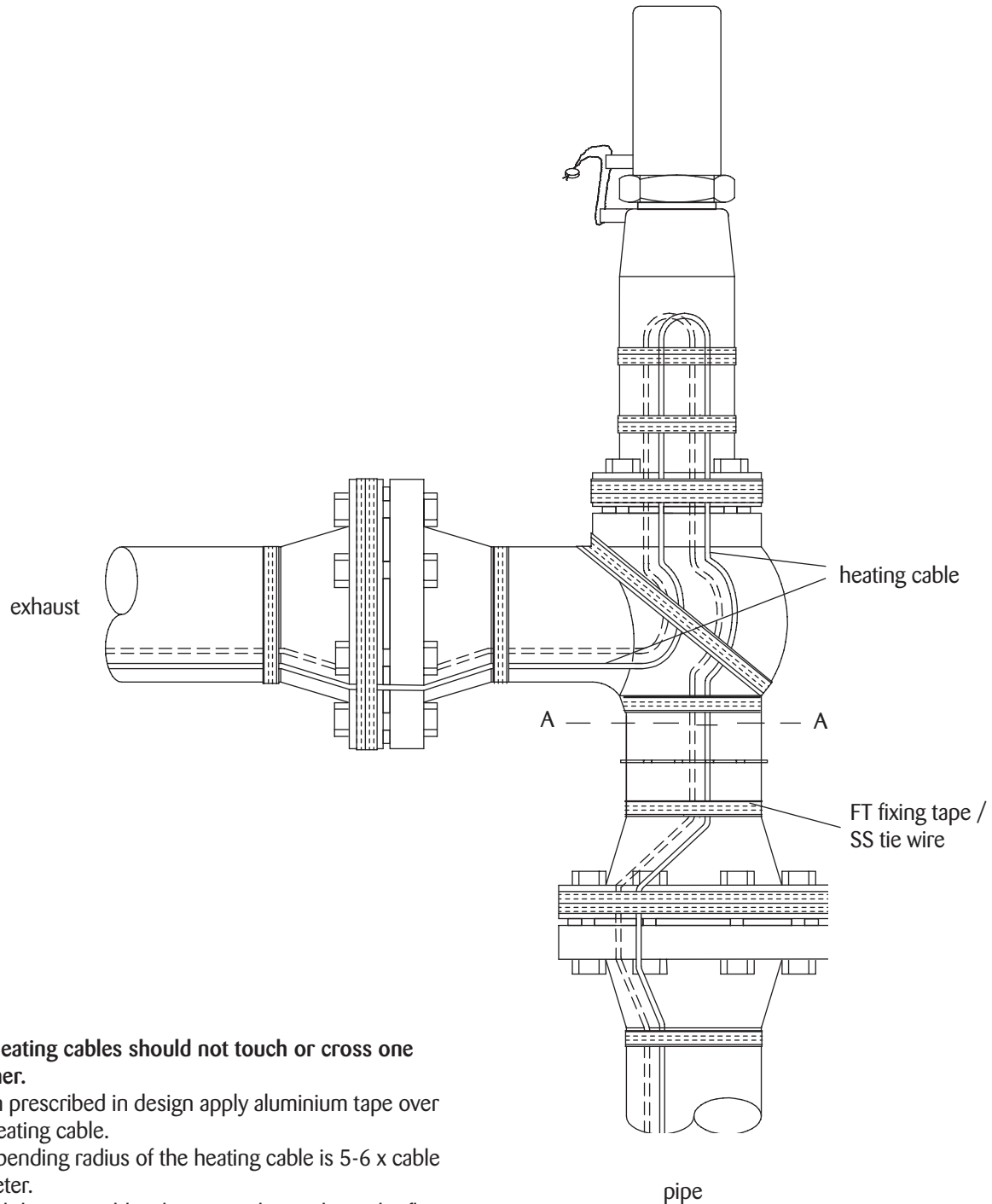
- The heating cables should not touch or cross one another.
- When prescribed in design apply aluminium tape over the heating cable.
- Min. bending radius of the heating cable is 5-6 x cable diameter.
- In each heating cable a loop must be made on the flange if the pipe diameter allows it. Also extra loops before and after the flange must be made.



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Installation on safety valves

For lines of 6" and larger
(for cable length see valve allowances on page 12)



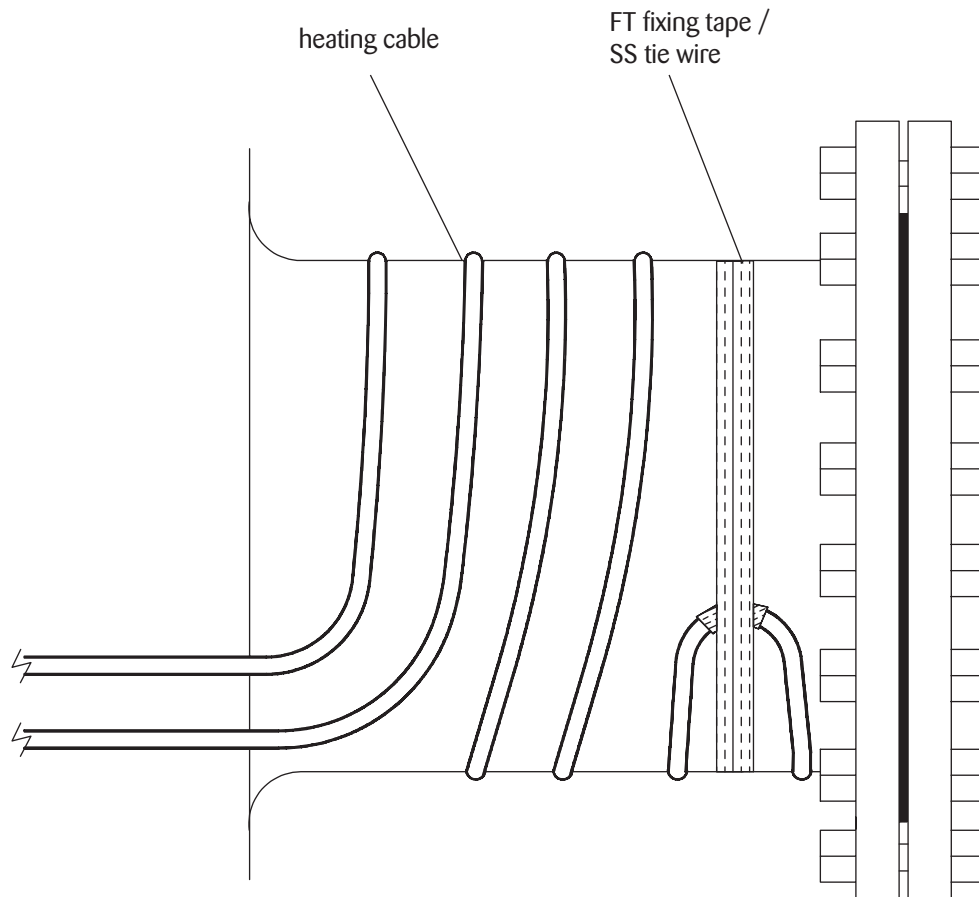
Note:

- The heating cables should not touch or cross one another.
- When prescribed in design apply aluminium tape over the heating cable.
- Min. bending radius of the heating cable is 5-6 x cable diameter.
- In each heating cable a loop must be made on the flange if the pipe diameter allows for this. In case of process heating, the valve and the piping up to section A - A to be traced as an individual circuit.



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Installation on manholes



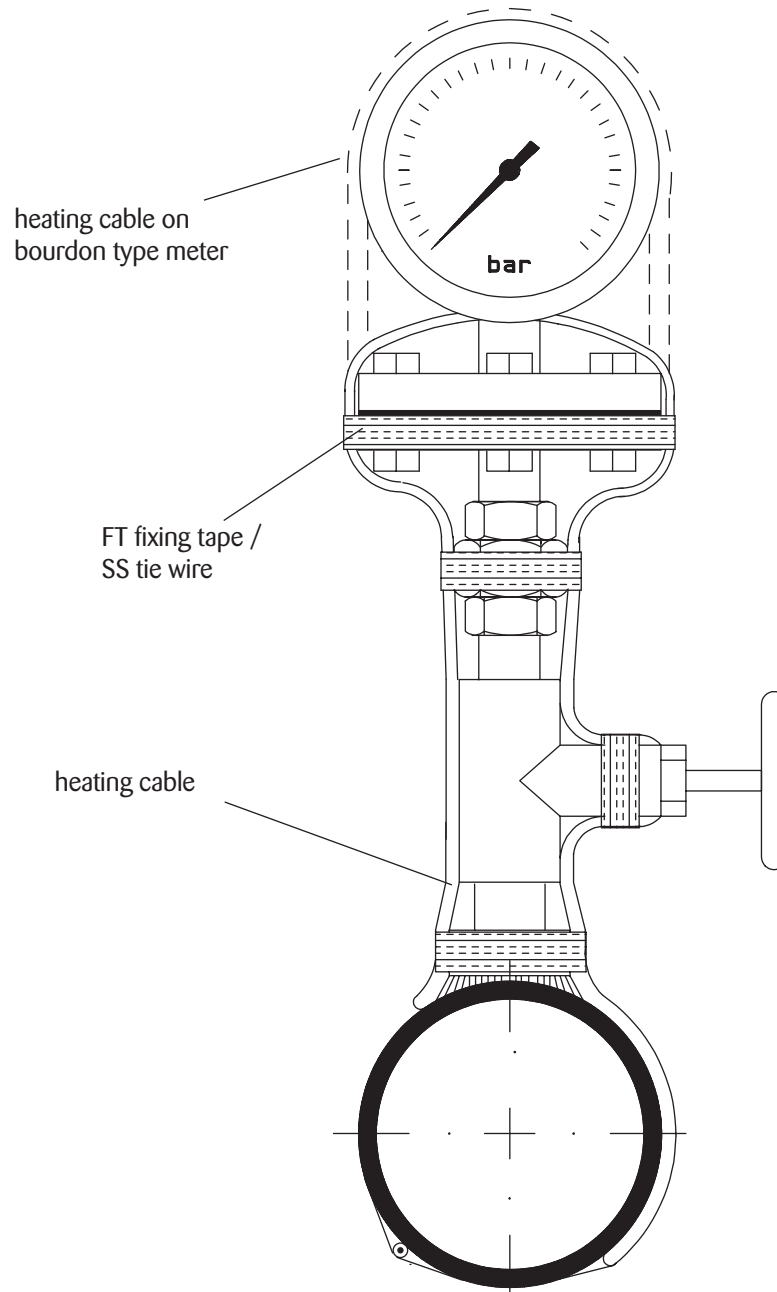
Note:

- The heating cables should not touch or cross one another.
- When prescribed in design apply aluminium tape over the heating cable.
- Min. bending radius of the heating cable is 5-6 x cable diameter.
- First mount the loop in the heating cable by means of tie wire/fixing tape as shown.
- No heating cable to be installed on the manhole cover.



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Installation on pressure gauges



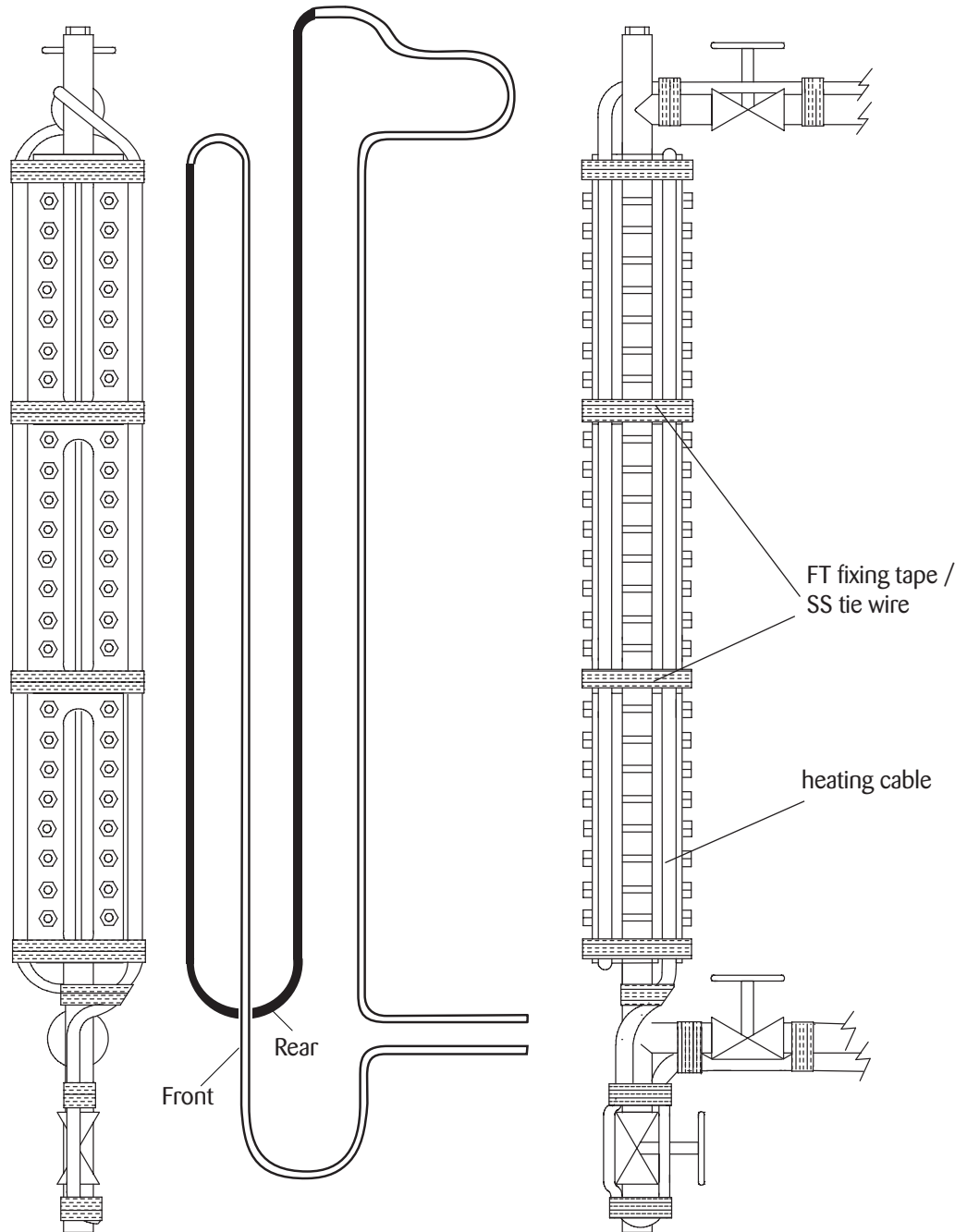
Note:

- The heating cables should not touch or cross one another.
- When prescribed in design apply aluminium tape over the heating cable.
- Min. bending radius of the heating cable is 5-6 x cable diameter.
- One heating cable is installed over the gauge, the other heating cable(s) continue(s) straight on.



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Installation on level gauges



Note:

- The heating cables should not touch or cross one another.
- When prescribed in design apply aluminium tape over the heating cable.
- Min. bending radius of the heating cable is 5-6 x cable diameter.



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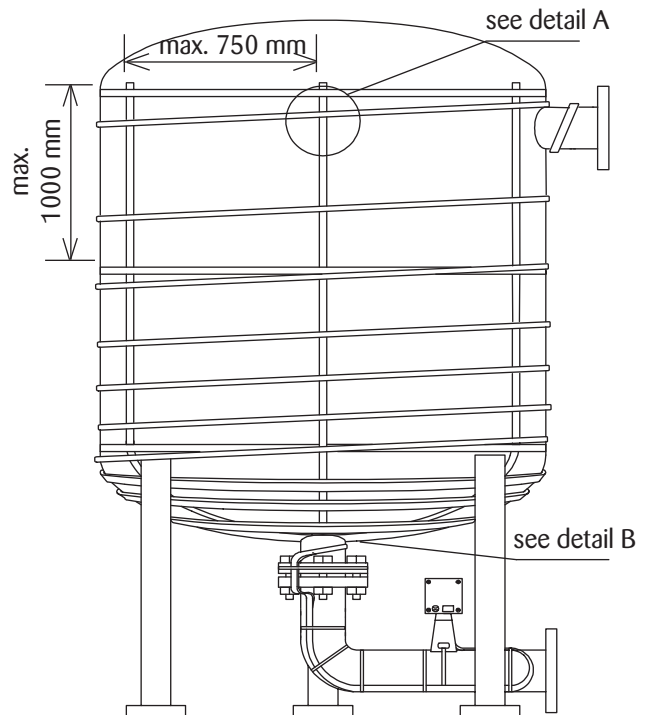
Installation on vessels or tanks

1. Mount banding (not too tight) at the upper side of the vessel or tank.
2. Push the required number of punch strips of sufficient length between the banding and the tank vessel wall. Hang up the punch strips to the banding. The open side of the lips in the punch strips must point downwards (see detail A). Space the punch strips equally over the circumference of the vessel/tank (max. spacing 750 mm).
3. Tighten the upper banding.
4. Bend the punch strips to the middle of the vessel/tank bottom. Put a tie wire through the last slot of the punch strips. Twist the ends of the tie wire until the punch strips are tight against the wall and bottom (see detail B).
5. First mount a banding at the lower side of the vessel/tank and the other banding at a distance from each other of max. 1000 mm.
6. Bend the lips of the punch strips upwards where heating cable will be installed.
7. Place the heating cable in the upwards bended lips **(the lips are a support only and should not be tightened over the heating cable!)**.
8. Connect the heating/cold lead cables into the power supply box.
9. With a single phase + neutral or a two phase system, the heating cable must be laid out along the vessel/tank wall as a loop (so two heating cables parallel to each other).
10. With a three phase system, the end of the three cables must be connected to the end box, where a star connection can be made.
11. Cover the heating cable over the total length with aluminium tape.

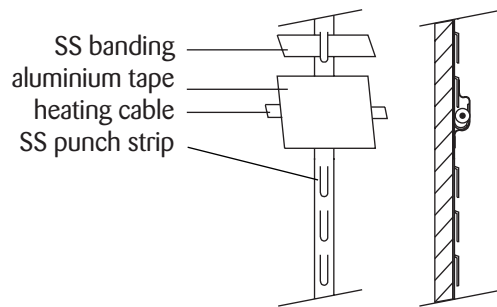
Description:

SS punch strip
 AL-20H aluminium tape
 AL-30H aluminium tape
 SS banding
 SS banding seal

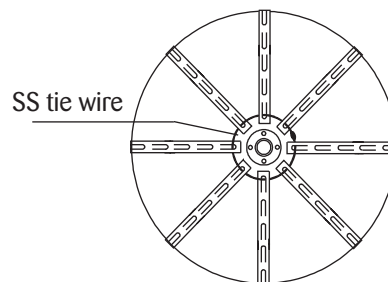
Stainless steel tie wire to be supplied
 by electrical contractor



Detail A

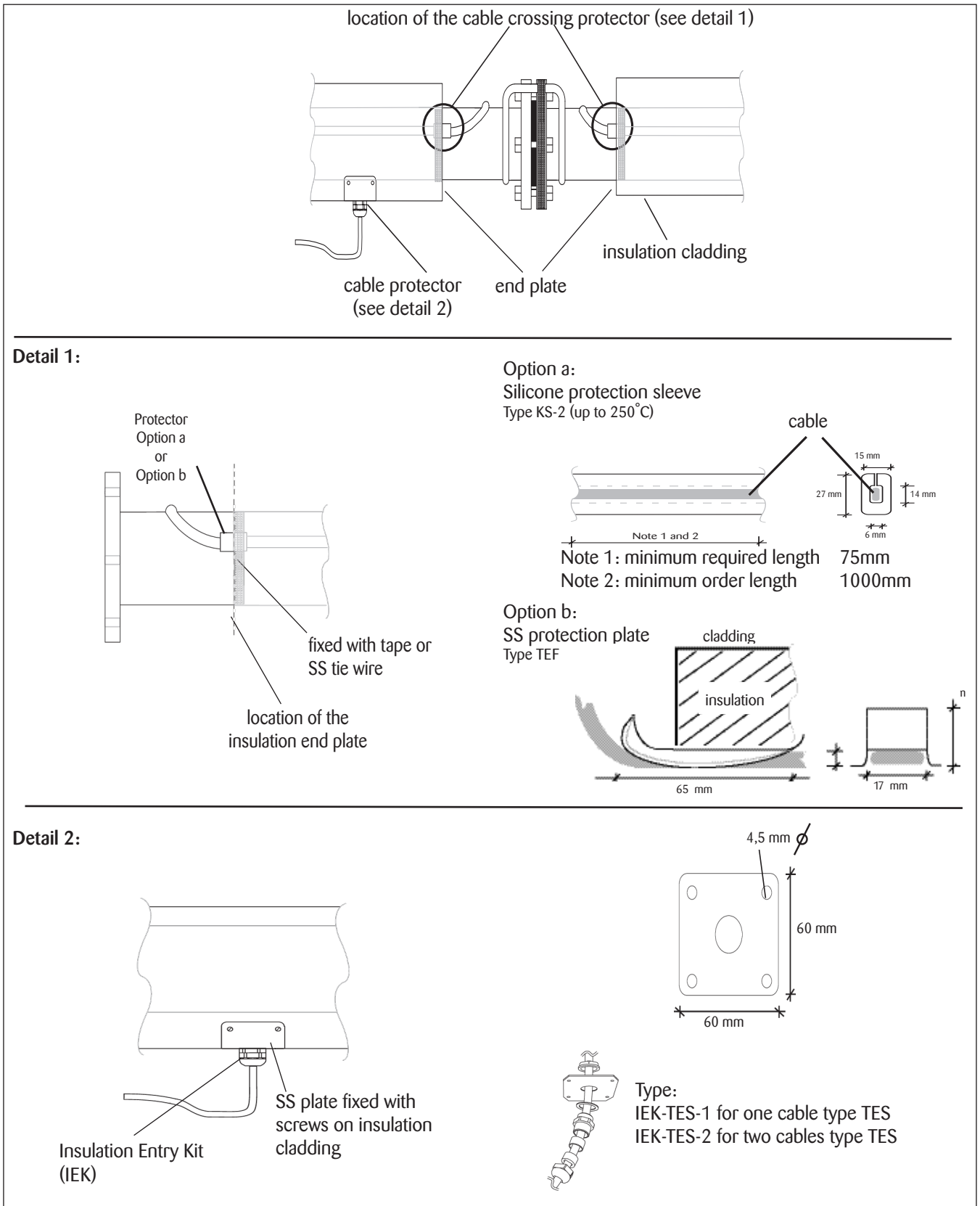


Detail B (without heating cable)



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Installation of cable protectors



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Inspection and testing of heating cable and documentation

Before thermal insulation is installed

1. Inspect the heating cable for possible damages along the length of the total circuit.
2. Megger the heating cable to ensure electrical resistance integrity. This will verify that the cable has not been damaged during installation of the heat trace circuit. The cable should be tested between heating cable bus wires and the heating cable metallic braid with a 500 - 2500 Vdc test voltage for TES and 1000 Vdc for MI conform the local electrical board. The measured insulation resistance shall not be less than 50 MΩ. Measure also the loop resistance. Note down the readings in the check list (page 23).

Caution:

In case electronic thermostats are used in the system, disconnect them before meggering the heat tracing system.

After thermal insulation is installed

1. Megger the heating cable to ensure electrical resistance integrity. This will verify that the cable has not been damaged during installation of thermal insulation of the heat trace circuit. The cable should be tested between heating cable bus wires and the heating cable metallic braid with a 500 - 2500 Vdc test voltage for TES and 1000 Vdc for MI conform the local electrical board. The measured insulation resistance shall not be less than 50 MΩ. Measure also the loop resistance. Note down the readings in the check list (page 23).

Caution:

In case electronic thermostats are used in the system, disconnect them before meggering the heat tracing system.

2. If applicable, inspect the heating cable at the entries in the insulation cladding and at insulation end covers.

Documentation

1. Stabilized design can be used for series heating cables to assign a lower T-class through the use of the Thermon CompuTrace software or Thermon Engineering.
2. If stabilized design is used, the end user must record the system parameters and the area T-class, and keep these records for the time the heating cable is in operation.
3. If stabilized design is used, no temperature limiting device has to be used.
4. In non-hazardous area's a limiter can be used when the product is the limiting factor.

Caution:

A limiter must always be installed on the heating cable.



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CHECKLIST

for installation of series heating cables

| General information | | | | Check on electr. components | Date | Initials | | |
|---|---|----------------|-------------|-------------------------------|--|---|-------------|-----------------|
| Thermon project no. | | | | Circuit switch | | | | |
| Unit | | | | Thermostat | | | | |
| Customer ref. no. | | | | Junction box | | | | |
| Electrical contractor | | | | | | | | |
| Ref. no. | | | | End termination | | | | |
| Inspector | | | | Thermostat settings | Reading | Initials | | |
| System information | | | | Control point | °C | | | |
| Line no. | | | | Limiter | °C | | | |
| Equipment no. | | | | Earth protection | Date | Initials | | |
| Circuit no. | | | | | | | | |
| Circuit switch no. | | | | Braid connected to earth | | | | |
| Thermostat no. | | | | Braid interconnected | | | | |
| Junction box no. | | | | Earthing of glands (metal) | | | | |
| | | | | Voltage check | Reading | Initials | | |
| Reel no. 1 | | | | Junction box | V | | | |
| Reel no. 2 | | | | General check | Date | Initials | | |
| Reel no. 3 | | | | Unused entries plugged off | | | | |
| Circuit length (in meters) | | length 1 | length 2 | length 3 | All components closed | | | |
| | | | | | Insulation entries | | | |
| Megger test* before mounting of insulation | | Reading | Date | Initials | Megger test* after mounting of insulation | Reading | Date | Initials |
| 1 Phase or 2 Phase | L - Earth | M Ω | | | 1 Phase or 2 Phase | L - Earth | M Ω | |
| 3 phase | L ₁ - Earth | M Ω | | | 3 phase | L ₁ - Earth | M Ω | |
| | L ₂ - Earth | M Ω | | | | L ₂ - Earth | M Ω | |
| | L ₃ - Earth | M Ω | | | | L ₃ - Earth | M Ω | |
| Resistance test before mounting of insulation | | Reading | Date | Initials | Resistance test after mounting of insulation | Reading | Date | Initials |
| 1 Phase or 2 Phase | L _x -N / L _x -L _y | Ω | | | 1 Phase or 2 Phase | L _x -N / L _x -L _y | Ω | |
| 3 phase ** | L ₁ - L ₂ | Ω | | | 3 Phase ** | L ₁ - L ₂ | Ω | |
| | L ₂ - L ₃ | Ω | | | | L ₂ - L ₃ | Ω | |
| | L ₁ - L ₃ | Ω | | | | L ₁ - L ₃ | Ω | |
| Remarks | | | | Copies to: | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| * Minimum 50 M Ω | | | | Checklist sequence no. | | | | |
| ** Reading = 2 x 1-phase resistance | | | | | | | | |



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