

# **Installation Guide**





# **Electric Floor Heating**

In-Slab and In-Screed Applications



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# 1 INTRODUCTION

#### Dear Customer,

Thank you for purchasing our Australian manufactured product. We are proud to share that Devex Systems is celebrating 40 years of supplying comfort to Australian families. The expertise that we have gained over these past four decades, is due in part to the careful criteria used for choosing our manufacturing partners. Over the years, we have refined our products and systems to ensure excellence with every installation.

Since October 2018, we have been producing our own line of high-quality cables, mats, thermostats and gas boilers. With significant investments in local fabrication and cutting edge heating solution technology, we have crafted a product line with energy efficiency and the specific needs of Australians in mind. Known as X brand, the product line features innovative technologies adapted to our Australian conditions.

These include the XCable™ and Xmat™, with hand-made terminations that ensure consistent quality and allowing us to offer our customers a market-best 20-year manufacturer's warranty. The Xthermostat™ is user-friendly and specifically designed for Australian households and commercial buildings. Finally, the Xboiler™, a condensing boiler with superior efficiency and low NOx emissions, is an environmentally friendly solution perfect for hydronic system integration.

The following pages will help you with the installation of our XCable for both in-slab and in-screed applications. Should you have any problems during the installation, contact us on **1800 636 091**.

Please note that the use of the term "heating cable' refers to pre-made lengths of electric heating cables, including heating cables supplied on a mat or mesh. Xcable™ heating cables are used in a wide variety of applications including direct acting, storage and background floor heating systems.

Other uses include ice and snow melting as well as agricultural and industrial applications. They can be suitable for use in concrete slabs, sand/cement screeds, mortar beds, levelling beds and specialist applications. Floor heating cable applications are often covered with carpet, tiles, vinyl, timber or other floor finishes, including polished concrete toppings.

Modelim is a twin conducting electric heating floor mat that generates very low EMF. For use directly on concrete, fibre cement sheet or F-Board insulation, the mat is also used within thin adhesive beds or floor levelling compounds for a minimal increase in floor height.

This Installation Guide presents Devex Systems recommendations for design and installation of inslab and in-screed under floor heating cable systems for indoor applications. It provides guidance for heating cable positioning, electrical data and system configurations.

The installation Instructions for the X □ □□t<sup>™</sup> are not covered in this document. For more information on our X □ □□t<sup>™</sup> product, please refer to the following link https://www.devexsystems.com.au/efh-specification-installation-guide/.



## 2 CABLE AND APPLICATION OVERVIEW

# 2.1 Heating Cable Type

This Installation Guide is for in-slab and in-screed installations using the following heating cable types:

| Heating Cable type | Heating Cable type                                      |  |  |  |  |
|--------------------|---|--|--|--|--|
| CK-17              | In-Screed Electric Heating Cable (c/w Single Cold Tail) |  |  |  |  |
| CT-30              | In-Slab Electric Heating Cable (c/w Single Cold Tail)   |  |  |  |  |

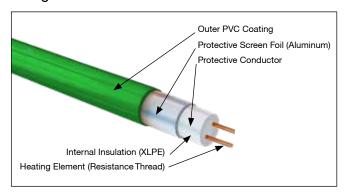
## 2.2 Applications

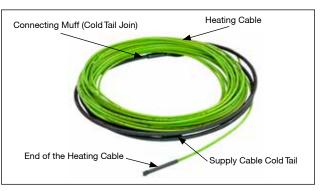
We have heating cables that are suitable for the following applications and other under floor heating and specialist purposes. Please contact us for your customised application.

| Applications |                       |                |                   |                  |                 |                      |                    |                 |                         |               |
|--------------|-----------------------|----------------|-------------------|------------------|-----------------|----------------------|--------------------|-----------------|-------------------------|---------------|
| Cable        | Conscreed the Consess | Incest throwns | Fries Arous Cross | Frost protective | Ice and snow my | Heating directly und | Healing hed (s.th. | Heating of woon | In Slab (storage) toors | in Bulling in |
|              | CK-17<br>In-screed    | <b>✓</b>       | ✓                 | <b>✓</b>         | <b>✓</b>        | <b>✓</b>             | ×                  | ×               | ×                       | ×             |
|              | CK-30<br>In-slab      | ×              | ×                 | ✓                | ✓               | ✓                    | ×                  | ×               | ×                       | ✓             |

# 2.3 Single vs Two Cold Tails

A twin core heating cable (with a single cold tail) is easier to install than a single core heating cable (which has two cold tails). This is because with two cold tails the end of the heating cable must be brought back to the start of the cable run to then both go to the thermostat location.





Example: X Cable CK-17 and CT-30 heating cables (twin cables with a single cold tail)



## 3 SAFETY INSTRUCTIONS

Heating cables must always be installed in accordance with local building regulations and the electrical AS/NZS 3000 Wiring Rules, as well as the guidelines in this Installation Guide. Please read the following safety requirements carefully.

- De-energise all related power circuits before installing or servicing the heating system.
- The outer screen around each heating cable must be earthed in accordance with local electricity regulations.
- Supply must be through a Residual Current Device (RCD) that will trip with more than 30 mA earth leakage.
- Heating cables should be connected via a switch providing all pole disconnection.
- The heating cable must be equipped with proper size circuit breaker (or fuse) according to local regulations.
- The maximum heat density (W/m length) of the heating cable must not exceed the heat required for the specific application.
- The switchboard/distribution board must clearly identify the floor heating system.

## 4 CABLE REQUIREMENTS

Further information outlining the specifications particular to each cable is available on separate data sheets.

- It is not recommended to install heating cables where the temperature of the cables can be lower than -15°C.
- The maximum permitted operating temperature of the cables is 60/65°C (refer to the cable specifications).
- Heating cable bending diameter must be at least 6 times the cable diameter (7.5 times for CT-30 heating cables).
- The heating cables are designed and rated for a nominal 230V supply. They will therefore operate at a higher power and current if your installation supply voltage is higher (by Ohm's Law). The single phase installation voltage supply must comply with AS/NZS 60038, being 230V -2% to +10% (222V to 253V). Power cables, thermostats and protective/control equipment must be rated to allow for this tolerance. (i.e. a single 2.3kW heating cable runs at 230V consumes 10A, but if the supply voltage is 250V, then it will consume almost 11A and operate at 2.7kW.)



## **5 IMPORTANT**

These instructions must be read prior to commencing the installation. Failure to comply with the Installation Guide may render the **warranty null and void**.

- Heating cable installation must be carried out by a licensed electrician.
- Electrical switchboard must label all rooms with heating cables.
- 'As Installed' drawings and/or photographs of each cable installation should show the installed heating cable(s) and sensor location(s) and kept on file with a copy provided to the customer.
- Heating cable must not be cut or shortened. However, cold tails may be cut or extended.
- Cold tail termination(s) to the heating cables must be embedded in the floor and not subjected to strain at any time.
- Fixings ensure that all heating cable lengths are securely fastened.
- Correct spacing must be calculated for each type of cable to suit the application (refer Heating Cable Spacing table, page 9).
- All Devex Systems floor-heating installations must be controlled using an Xthermostat™ floor sensing thermostat.
- XCable must be installed in a concrete slab or screed except when controlled to only operate in snow/ice conditions (refer Cover over Heating Cables table, page 8)
- Thermostat floor sensor cables need to be in their separate conduit for easier access during repairs or replacement.
- Ensure that customers are aware that coverings or objects with high a thermal resistance are NOT
  placed directly on the floor. Also advise them that all large items need to be adequately ventilated
  underneath.



# 6 GENERAL INSTRUCTIONS

### 6.1 Check-List

The following section is a general check list to assist during installation.

- Heating cable connections are considered as electrical wiring and should be installed by a licensed electrician in accordance with AS/NZS 3000 Wiring Rules or other relevant regulations.
- Check to ensure that the heating cable selected is suitable for the area and type of heating required.
   Verify with the builder the floor heights, floor constructions method and floor surfaces. Refer to the heating cable specification sheets to verify suitability.
- Determine the correct spacing for the cable runs. Please refer to "Heating Cable Selection and Spacing" in section 6.4.
- Ensure that the cables are embedded in thermally conductive flooring material without air pockets or voids and must be placed above any thermal insulation.
- Distance of the cable to a screed surface must be at least 20mm, whilst the distance to a slab surface at least 25mm. Alternatives products and design are available should these requirements not be possible. Please contact us for options.
- Thermal insulation is recommended under heating cables to reduce heat loss downwards. Good thermal insulation is eco-friendly by improving heat up time and by reducing energy consumption. Poor thermal insulation may reduce the probability of reaching the desired comfort level programmed.
- Although the heating cables have been checked prior to leaving the factory, a quality verification during installation is essential. Check that the resistance values (ohms) are the same as specified on the cable label (within -5% to +10%) and that the size of the cable is what is required for the particular job. A 500V insulation resistance tester (i.e. Megger) should be used to check the cable insulation and a continuity monitor should be connect to the heating cable during the construction phase. The continuity tester may be used to check the cable continuity during the installation, but does not replace the need to use 500V Insulation Tester to verify the cable's integrity. Insulation resistance and cable resistance values should be checked immediately prior to pouring the concrete or placing the screed over the cables.
- Adequate steps must be taken to void mechanical damage to heating cables during cable installation
  and building construction. It is also important to avoid mechanical strain, twisting, tangles, kinks,
  tight bends, pinching, crushing, etc. Care must be taken to avoid straining the connection joint or
  terminations by pulling or stretching cables.
- If only the outer sheath is punctured or cut causing a loss of insulation resistance between the
  cable screen and the surrounding concrete/screed, the damaged area is to be cut and repaired.
  The repair location should also be clearly marked on the installation layout drawing/photo. If in
  any doubt, then the damaged area must be repaired using the appropriate repair kit available from
  Devex Systems.



## 6.2 Cover over Heating Cables

We recommend using thermal insulation in all areas where the heating cables are installed. Insulation boards should be used to build-up the floor height where a screed exceeds 30mm. Screeds exceeding 30mm should be avoided.

|                   |                       | Cable Depth            |                        |                              |  |
|-------------------|-----------------------|------------------------|------------------------|------------------------------|--|
| Installation Type | Target<br>Depth<br>mm | Maximum<br>Depth<br>mm | Minimum<br>Depth<br>mm | Notes                        |  |
| In-Slab           | 40                    | 75                     | 25                     | Must not vary more than 20mm |  |
| In-Screed         | 20                    | 25                     | 18*                    | * with tile coverage         |  |

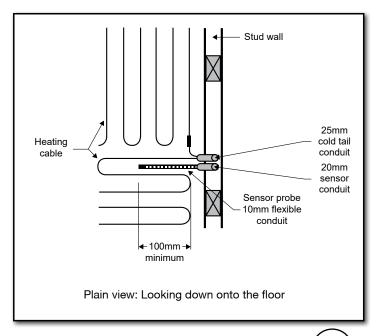
## 6.3 Conduits Installed by the Site Electrician

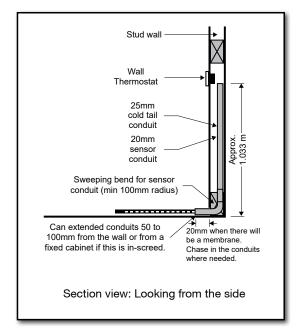
Conduits for the power cabling and for the sensor probe must be installed before beginning your under floor heating system installation.

- Each heating cable requires a 25mm empty conduit for larger areas (though 20 mm is the minimum for small areas). This conduit is for the power cable cold tails, and it is to run from the top of the finished concrete floor level to the switch or thermostat position. A draw wire is essential if any conduit fittings or couplings are used.
- The sensor probe requires a 16 or 20mm conduit for each floor sensing thermostat with no more than two wide radius bends from the thermostat/connection point. We recommend a 10mm OD flexible conduit (min 7mm ID) to run inside each conduit. Then seal at the end with electrician's tape to prevent ingress of water, cement or glue. The 100mm conduit is readily available from Devex Systems. Sensor probes must be installed in a conduit so they can be replaced at any time in the future.

#### 6.3.1 Conduit Installation

The following example shows a typical installation for a twin heating cable (with one cold tail). Conduits are shown for an in-screed installation with a waterproof membrane.

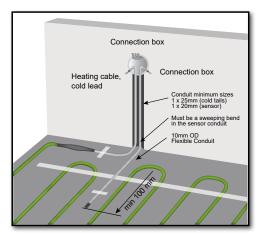






#### 6.3.2 Conduit and Sensor

This following example shows a conduit and sensor installation method.



## 6.4 Heating Cable Selection and Spacing

The cable type depends on the floor construction method (please refer to section 2 "Cable and Application Overview). Only select heating cables that are appropriate for the floor construction.

- In-slab: XCable<sup>™</sup> CT-30 heating cable
- In-screed: Xcable<sup>™</sup> CK-17 heating cable
- In a thin floor (or undertile glue bed): Please refer to the separate Installation guide for the X mat<sup>™</sup>

|                                     | Heating Cable Spacing C-C |                         |                          |   |                                       |  |
|-------------------------------------|---------------------------|-------------------------|--------------------------|---|---------------------------------------|--|
| Heating Cable Type                  | Design<br>Watts<br>W/m²   | Target<br>Spacing<br>mm | Maximum<br>Spacing<br>mm | Spacing<br>from Walls<br>and Fixtures<br>mm | Minimum<br>Spacing<br>permitted<br>mm |  |
| In-Slab in a DRY area application   | 150                       | 200                     | 200                      | 200   | 100                                   |  |
| In-Slab in a WET area application   | 200                       | 150                     | 150                      | 100   | 100                                   |  |
| In-Screed in a DRY area application | 175                       | 100                     | 130                      | 100   | 75                                    |  |
| In-Screed in a WET area application | 220                       | 75                      | 100                      | 100   | 50                                    |  |

The cable spacing C-C (Centre to Centre distance in mm), is the distance from the centre of one heating cable to the centre of the next. The cables should not be closer than the minimum spacing required. The spacing between cables must also be even to insure that the floor heating is even.

Spacing for a supplied cable (spacing to be within the above table guidelines)

$$\frac{\text{C-C}}{\text{(mm)}} = \frac{\text{Area to be heated (m}^2) \times 1000}{\text{Cable length (m)}}$$

Area loading (design)



#### 6.4.1 Free Design and Quote

Devex Systems provides an obligation free design and quoting service. This service applies for supply and install and supply only services as well as any fixings and thermostats.

#### 6.4.2 How to Estimate the Heated Floor Area?

The Installation area of a heating cable/mat must be calculated based on the total area (m²) of the room. However, the area under any fixed objects (i.e. bath, toilet, shower, vanity, cabinet, cupboards, etc...), must be excluded.

Other factors specific to the area should be taken into considerations to limit the potential damage to the heating system. These may include floor level variations, fixtures, drains (including strip drains) and wall (minimum distance between 100-150mm).

To avoid damage to the heating cables that are embedded into the floor, any permanent fixtures or pieces of furniture should be removed from the heating plan area. These can include fixed joinery, built-in wardrobes, fixed cabinets and non-movable beds.

#### 6.4.3 Choice of Heating Cable

The choice of heating cable must be appropriate for the type of installation as well as having the correct length to fulfill the area requirements. For example, the heating power density needs to be suitable for the area heated. We recommend that the exposed floor section be heated to a minimum of 100 W/m² (although some applications can be as high as 290W/m² - see the "Heat Cable Type" table on page 9.

In essence, the application will define the cable type and recommended spacing for a particular application will determine the heating requirement.

#### Heating Power Density (watts per square metre)

If the installation area is large, then more than one heating cable may be required for the heated area. The cables are controlled by the same thermostat, however a contactor is needed to avoid the thermostat overloading (a thermostat's maximum load is 12A).



## 7 INSTALLATION FOR IN-SCREED AND IN-SLAB

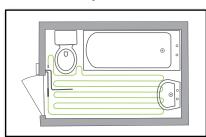
### 7.1 In-Screed

### 7.1.1 In-Screed Installer Summary

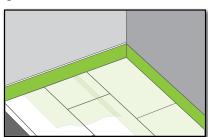
Please follow the step-by-step installer summary for in-screed heating cable installation.



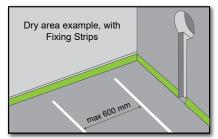
- Cable heating system
- Heating cable
- Thermostat (with floor sensor)
- Sensor flexible conduit (10mm)
- Mesh and ties (or fixing strip)



Draw a plan showing the actual heated area, heating cable, cold tail location, floor sensor position, thermostat and connection box (if any).



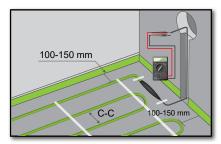
Install appropriate thermal insulation on the existing floor.



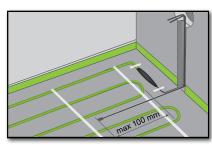
4 Lay wire mess (if wet area) and attach the heating cables in place. Use fixing strips if dry area. Cable tie points are spaced max 600mm apart.



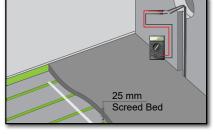
Wet Area on mesh and membrane



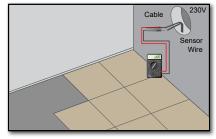
Check the heating cable resistance and its insulation resistance values. Install the heating cable spaced from walls 100 to 150mm. Ensure that the cable spacing requirements are adhered to.



Install individual conduits for the power cables and the floor sensor). Check the resistance of the sensor before installing it (15k ohms when at 25°C.)



Check the cable resistance and the insulation resistance values again before pouring concrete or laying the screed bed.



Check the cable resistance and the insulation resistance values again when installing the thermostat (they are usually installed later).

#### **Important Notes:**

- Heating cables must be securely attached to the floor or mesh before pouring the concrete/screeds so that the cables cannot lift or vary their spacing. Air pockets around the cables must be prevented.
- Heating cables must never touch or cross over each other or failure is likely.
- Not complying with the full Installation Guide will void the warranty.
- Please contact Devex Systems on 1800 636 091 if unsure of any aspect of the installation.



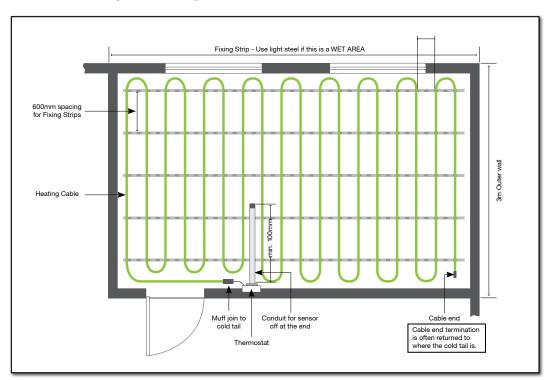
#### 7.1.2 In-Screed Cable Installation

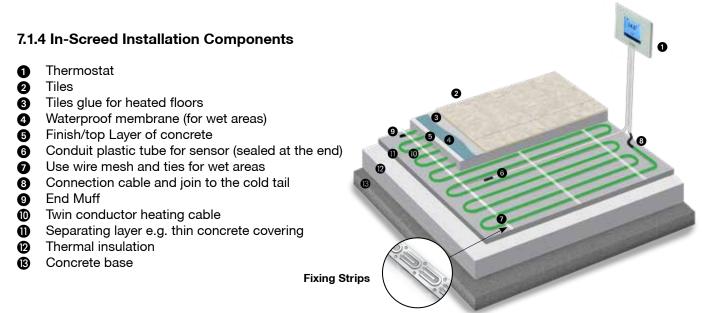
For In-Screed heating cables installed over a bare concrete floor or similar, the maximum 200mm spacing (see "Heating Cable Spacing" table on page 9) is obtained by using fixing strips or by attaching the cables to a light steel mesh with ties or clips. Additionally, the installation should rest on a clean concrete slab, free from sharp objects, and be covered with a minimum of 20mm screed. Most floor coverings are suitable, such as marble, ceramic tiles, slate, carpet or timber. However, certain floor surfaces have specific requirements from their manufacturers.

#### Note:

A sketch or photograph record of the installation must show the approximate location of the heating cable(s), the sensor conduit(s), the active and the neutral terminations. A copy should remain with the installation for the benefit of future owner/occupiers. This can be used to locate the heating cables for any future work or for later modifications to floor/layout construction.

#### 7.1.3 In-Screed Example for a Dry Area





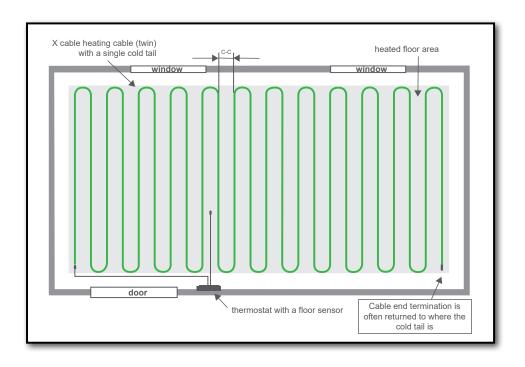


#### 7.2 In-Slab

### 7.2.1. In-Slab Installer Summary

The CT-30 cable is designed for in-slab under floor heating and is only used in-slab floor heating.

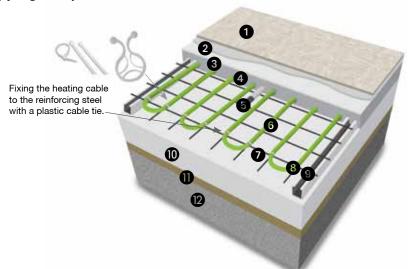
- 1. The heating cables are designed to be installed onto L72/ L82/ L92/ SL102 (F72-F92) steel reinforcing mesh, to allow for nominal 200mm spacing of the heating cable(s). They should be attached to the top structural reinforcement steel for the slab. If this is not possible, use a separate layer of light gauge reinforcing mesh. The cables require a minimum concrete cover of 25 with a maximum cover of 75mm of concrete. The variation in cable height in the slab should not exceed 20mm otherwise there might be variable temperatures felt across the floor. The cables are attached to the reinforcing steel using clips or tie wires that do not damage the cable sheath. The spacing of these cable fixings should not exceed 600 mm.
- 2. Occasionally it may be necessary to place a length of cable onto an area of mesh where the C-C fixing at 200 mm spacing is too wide to use up the calculated cable length. In such cases no more than one double run (2 x 100mm) may be laid and then revert back to the full 200 mm spacing. Closer spacing is acceptable only where the cable loading, in W/m², is to be higher, such as for bathrooms. (refer to the table in section 7.4 Heating Cable Selection and Spacing).
- 3. Where cables need to be run between the reinforcing mesh grid spacing available, light gauge steel rods, typically 6 mm in diameter, with sufficient rigidity to support the weight of a person, should be fastened alongside the cable runs to enable the fixing and the support of the cables.
- Cables should not pass through expansion/control joints. It is the responsibility of the builder to clearly mark the location of expansion joints, walls, and all plumbing & joinery fixtures prior to installation.
- 5. A sketch or photograph record of the installation must show the approximate location of the heating cable(s), the sensor conduit(s), the active and the neutral terminations. A copy should remain with the installation for the benefit of future owners/occupiers. This can be used to locate the heating cables for any future work or for later modifications to floor/layout construction.





#### 7.2.2 In-Slab Installation Method (In a Topping Slab)

- Flooring
- 2 Adhesive
- 3 Damp proofing (wet room), primer
- Finish/top layer of concrete
- 6 Conduit tube for floor sensor
- 6 Heating cable
- Reinforcing mesh
- Twist fastening
- Spacer for reinforcing mesh
- Thermal insulation
- Levelling layer
- Concrete base



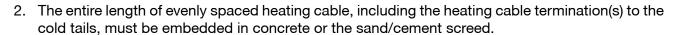
## 7.3 Cable Laying

Where even spacing is not practical, then heating cable runs can have a variable spacing, as shown in this example. However, the heating cables are not permitted to be closer to each other than the minimum spacing for the cable for that installation construction method (refer table in the Heating Cable Spacing Section)

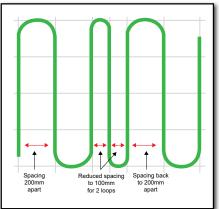
#### How to lay the heating cables:

 Refer to the preceding sections for details on laying. Note that the recommended cable spacing, floor thicknesses and thermal insulation are all important to achieve a warm floor

with even distribution of heat, and to provide comfortable temperature on the floor surface that operates economically. The floor surface temperature variation should not exceed 1.5°C.



- 3. Heating cable spacing shall be as even as practical across the entire heated area, with reference to the design power requirements and maximum cable loading.
- 4. Heating cables should be laid so as to avoid walls, water pipes, drains, baths, toilets, vanities, wardrobes, built-ins, fixtures, etc., and where it is known that permanent structures are to be installed above the finished floor, or where the floor is likely to be penetrated by nails, door stops, or other fixings.
- 5. Generally, cable should be no closer than 50mm to any wall or fixed item (refer table in the heating Cable Selection and Spacing section)
- 6. Heating cables must be gently but securely fixed in place to that there is no possibility of the cable being moved, deformed, or the other sheath being indented in any way during installation or construction.
- 7. To avoid accidental damage, the cables should be covered as soon as possible with the concrete/screed or mortar bed. The cover needs to ensure that there are no air pocket voids near the heating cables. It must not contain any sharp stones or other objects.





#### 7.4 Cable Connection

- 1. All power connections to floor heating cables must be by permanent wiring (i.e. no plug/socket connections) and the connection must be done by a licensed electrician. The cables have an earth braid/shield and every end of all cold tails must be connected to the installation earth.
- 2. All heating cables must be protected by a Residual Current Device (RCD).
- 3. For loads where Contactors are required, the cold tails should terminate in a wall box above the floor level and in reasonable close proximity to where they exit from the floor. If the thermostats supplied are capable of switching the load, the cold tails should be taken directly to the thermostat position.

#### Note:

It is important to check the type of rating of the thermostat being used to determine if control wiring with a contactor is required. All Xthenmostat<sup>™</sup> require a contactor if the load is greater than 2,700 watts or 12A (75% of 15 Amps). Contactors are usually located in a switchboard so additional wiring runs may be required.

## **8 THERMOSTATS**

There is a range of programmable and manual thermostats available to choose from. Most installations have the programmable type wall-mounted in-room thermostats. The manual thermostats are for simpler installations and are recommended to be installed where a Home Automation / Building Management System controls when the heating is required.

Both of the programmable Xthermostat<sup>™</sup> TS500 and TS600 (coming soon) have a 5-year warranty. They are intuitive, wall mounted semi-recessed, floor/ceiling and room sensing thermostats with intelligent timer functions that are simple to use.

TS500 is programmed through its backlit touch sensitive screen. TS600 (coming soon) uses Wi-Fi access and the App (iOS and Android) for programming, and can be controlled from anywhere the mobile device has Wi-Fi or data access. This thermostat also has a touch screen for basic in-room functions.

We would like to assist you to determine which thermostat is the most appropriate for your installation. You can give us a call, or information on the range of thermostats can be seen on our website at https://www.devexsystems.com.au/thermostat/.

## 9 WARRANTY

## 9.1 General

The 20 year warranty is valid providing the Installation Guide has been followed. This includes the costs for the installation and floor materials such as damage to bricklaying and tiles. The full service 20 year warranty implies that upon a warranty request, Devex Systems undertakes the responsibility to correct the defect free of change or offer product replacement during the warranty period. In addition, Devex Systems will cover all reasonable costs associate with the replacement of any heating system element and floor cover restoration costs.

Please refer to our Warranty statement for full details.



# 10 OTHER HEATING APPLICATIONS

There are many applications for heating cables of various types that we can supply, for example,

- Heating of seats in spas and outdoor areas with cold climates;
- Heating of playing fields with natural or artificial grass;
- Soil warming in greenhouses;
- Heating of agricultural premises;
- Frost protection of floors and foundations of freezers and ice stadiums, including threshold and door heating.
- Condensation protection under cold store floors;
- Ice protection and snow melting for roofs, gutters and drainage systems;
- Ice and snow melting on ground i.e. roads, pavements, pedestrian walkways, bridges;
- Protection against freezing and for temperature maintenance of pipelines, tanks and other industrial applications;
- As well as other heating solutions.

Apart from electric underfloor heating solutions, Devex supplies and installs hydronic (water based) under floor heating. We also have a range of overhead electric and gas radiant heating products and HVAC solutions.



Devex Systems specialises in heating solutions for new or existing buildings in residential, commercial and industrial environments.

For more information, please contact us at: 1800 636 091 or info@devexsystems.com.au www.devexsystems.com.au

## **NEW SOUTH WALES**

5/83 Bassett Street MONA VALE NSW 2103 PO Box 707 MONA VALE NSW 1660 Phone: 1800 636 091 | Fax: 02 9997 7852

Email: info@devexsystems.com.au

#### **TASMANIA**

Suite 3, 35 Melville Street HOBART TAS 7000 Phone: 1800 636 091 Fax: 03 6273 9120

Email: tas@devexsystems.com.au

#### **VICTORIA**

PO Box 24 OFFICER VIC 3809 Phone: 1800 636 091 Fax: 03 5986 7399

Email: vic@devexsystems.com.au







