

HEATING FOR NATURAL GRASS PITCHES

DATA & SPECIFICATION SHEET

System Overview

Inditherm's pitch heating system is a unique combination of effective performance, low energy consumption and flexible control that can be configured for any stadium or training pitch environment. Using the Company's patented, carbon-based conductive polymer technology (CPT) as the heat source, the heating elements are inserted into sealed pads that are laid in a matrix underneath the playing surface, producing a highly effective heating system with no hot spots.

Powered by a low voltage (50V) supply, the system is very safe and because of its excellent heat transfer characteristics, is able to achieve significant energy savings over alternative systems, such as hot water and electrical cables.

The Inditherm heating pads are laid about 30cm below the surface and are arranged in "zones" that can be individually controlled, giving users a high degree of flexibility and control, plus additional energy savings.



Main Benefits

Inditherm pitch heating systems have a number of major benefits and several advantages over traditional heating systems, such as hot water/glycol or electric cables:

- The temperature is even over the entire surface of the pads, with no hot spots that could damage the grass roots.
- Energy consumption is a fraction of that required for competing systems; savings can be as much as €1,500 per day per pitch, leading to significant cost savings over a season.
- Users have a high level of control over the system, with the ability to switch on individual heating "zones" under the pitch. This is useful in overcoming the effects of "stand shadow" and enhances the energy saving benefits of the system.
- The system can be controlled automatically, manually or remotely, as desired.
- There is no need for a large plant room, with pumps and boilers to maintain, along with the need for special permits. Maintenance requirements are minimal.
- Because of the even temperature distribution, the pads can be run at a lower temperature than water pipes or cables, reducing energy consumption and eliminating the danger of grass root damage.
- Unlike cables and water pipes, the pads cannot "float" towards the surface over time.
- There is no danger of water leaks.
- Operating at low voltage (50V), the system is very safe.

System Description

Inditherm's pitch heating system consists of four main elements:

1. **Heating pads** that are arranged in a matrix under the pitch. The size and spacing of the pads will vary, depending upon the individual requirements of the user and also to suit the unique needs of each location. Pads are generally grouped into heating "zones".
2. **Under-pitch terminal boxes and cables** that connect the heating pads to the power supply.
3. **Pitch-side junction boxes** into which the cables from each zone are connected. There is generally one box per zone supplying power at 50Vac to the heating pads.
4. **Main control panel(s)**, which supply power either at 400Vac mains voltage or at 50Vac to the pitch-side junction boxes.

The system is suitable for both natural grass and synthetic pitches but the configurations are quite different. This data sheet therefore concentrates on grass pitches only.

There are a range of configuration options:

- The pads can be oriented either goal-line to goal-line or touch-line to touch-line. Pad spacing will vary, depending upon the anticipated worst-case ambient conditions.
- The pitch side junction boxes can be located along either the touch-lines or the goal-lines.
- The 400V/50Vac transformers can be located either in the pitch side junction boxes (as shown below) or in the main control panel.
- The pads are arranged in zones, the main purpose of which is to overcome the effects of stand shadow. Each configuration is custom designed to provide the optimum solution.

A typical system arrangement with 8 zones is shown in Figure 1 below.

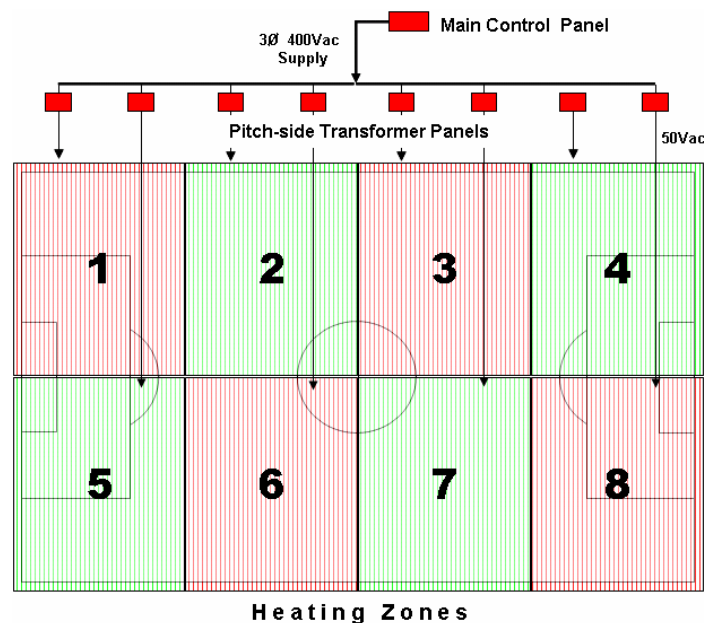


Figure 1 – Typical arrangement of an Inditherm pitch heating system

Temperature Control

Inditherm’s pitch heating systems provide significant benefits over the alternatives, especially the ability for users to gain much better control over the pitch conditions when a fully automated system with telemetry is installed.

System control is normally provided by a comprehensive programmable automatic controller linked to air and ground temperature sensors. Alternatively, manual control is available.

The heating system is operated in independently controllable “zones”. This gives users the ability to heat only those parts of the pitch that need it. For example, stand shadow cast by a stadium roof may cause part of the surface to be frozen, whilst the remainder is playable. Alternatively, where the available electrical power is restricted, for example just before a match, the system can be programmed to rotate the operation of the heating zones, such that only a proportion of the pads are operational at any one time.

The temperature of the Inditherm pads is set to give a root zone temperature of between 10°C and 18°C, ensuring that the surface remains frost free, whilst avoiding any danger of root burn.

Heating Pads

The heating pads consist of Inditherm CPT bonded onto closed cell foam insulation and encased in a waterproof, welded outer cover to ensure long term protection of the electrical heaters. The pads typically measure 50cm wide by 10m long and are arranged in a matrix underneath the pitch. Pad length is varied to optimise the layout under the pitch.

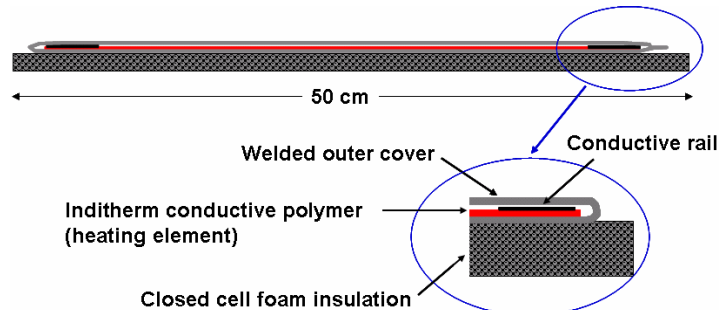


Figure 2 – Cross section of an Inditherm heating pad

The Inditherm pads are arranged in a matrix laid on top of the gravel drainage layer and are then covered with sand and growing medium to a depth of 25cm to 30cm. The pads are spaced to optimise energy consumption and to avoid affecting the drainage of the pitch. The actual pad spacing will depend upon the anticipated ambient conditions during the winter and can vary from 50cm to 80cm.

Pad orientation can either be goal-line to goal-line or touch-line to touch-line, and will generally be oriented to align with the pitch drainage system. Orientation will also affect the number of pads. For example, under a standard 105m x 68m UEFA pitch with a 1m run-off area (total area 7,490m²), if the spacing were 60cm, there would be around 640 pads.

A typical cross section is shown in Figure 3.

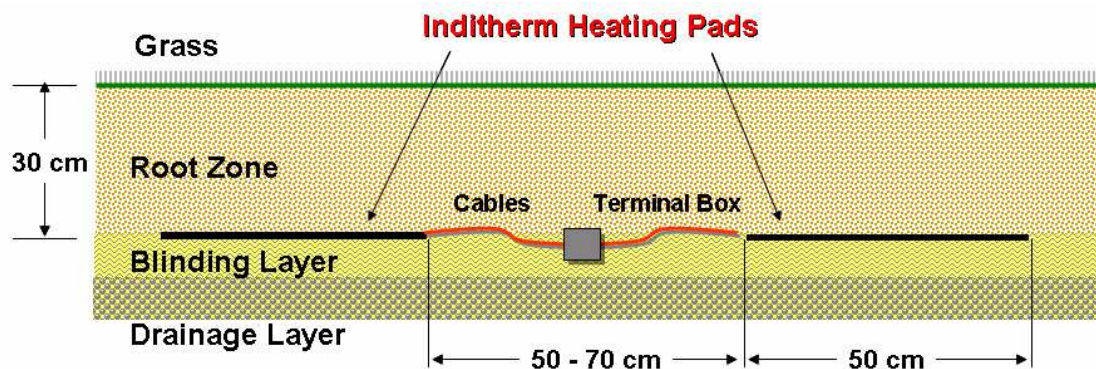


Figure 3 – Typical configuration of Inditherm heating pads under a grass pitch

Although the surface immediately above the pads will defrost first, the heat is transferred laterally through the sand root zone and soon defrosts the entire surface. Comprehensive field tests have shown that there is no discernable negative effect on pitch drainage.

The heating pads operate at 50V and comply with IEE SELV (safe, extra low voltage) requirements.

The heating pads are connected together in groups of four and wired into small IP rated terminal boxes located on the drainage layer adjacent to the pads, as shown in Figure 4. Cables run from the under-pitch terminal boxes to junction boxes at the pitch side.

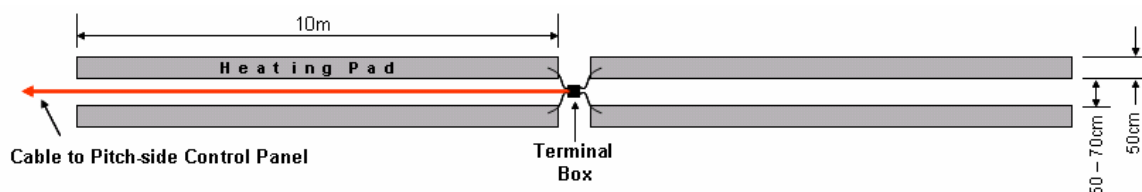


Figure 4 – Typical heating pad arrangement

Power Supply

There are two basic configurations for the power supply:

1. The pitch side junction boxes can house the transformers that take the 400Vac mains voltage from the central control room down to the 50Vac required by the heating system.
2. The transformers are located in one or more control rooms located under the stadium structure or, in the case of training pitches, adjacent to the field. Cables feed power to the pitch-side junction boxes at 50Vac.



Connecting pads to a terminal box

The pitch-side junction boxes can either be mounted above or below ground level, depending upon the user's requirements. Each junction box supplies an independently controllable heating zone. There are normally 8 zones per pitch but this may vary depending upon the pitch or stadium design.

In stadia, the mains control panel is normally located under the stands and at training pitches close to the playing area.

The total space taken up by the control and power system is small compared to hot water systems that require large boiler rooms. The Chelsea system, which fed three pitches, can be seen here. And because there are no moving parts like pumps, there are minimal maintenance requirements.



Typical pitch-side junction box



Photo courtesy Chelsea FC

The control panels at Chelsea Training Academy (supplying 3 training pitches)

The three heated pitches covering 25,000m² at the Chelsea Football Club Training Academy in Cobham, England



Energy Savings

The typical energy savings over alternative systems can be considerable, especially over a winter season. Typical energy consumptions of competing systems are shown in Table 1 below. These data are based upon field experience. Actual power consumptions will vary, depending upon the anticipated average ambient conditions and the local cost of energy.

Heating System	Range	Power kW	Rate	Cost		Difference
			€/kWh	€/hr	€/day	€/day
Inditherm		250	0.070	18	420	
Water	Min	1,300	0.035	46	1,176	756
	Pump	50	0.070	4		
	Max	2,000	0.035	70	1,974	1,554
	Pump	175	0.070	12		
Cable	Min	600	0.070	42	1,008	588
	Max	1,000	0.070	70	1,680	

Table 1 – Cost penalties of using alternative pitch heating systems

Over a typical cold season, this can result in significant savings, especially on training grounds that are run continuously during cold weather. The typical range of savings is shown in Chart 1 below.

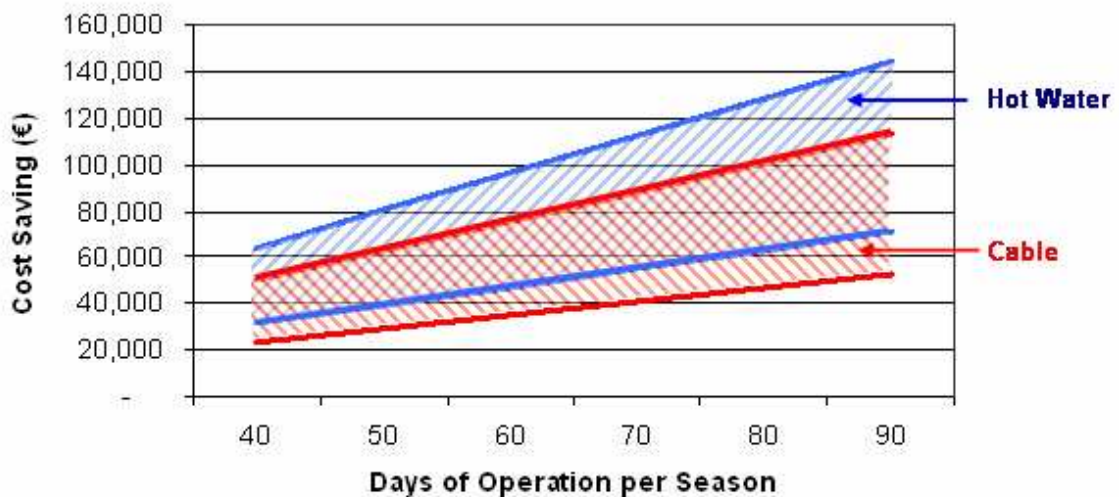


Chart 1 – Annual savings by using Inditherm versus alternative pitch heating systems



Photo courtesy Falkirk Stadium

Specification

Heating Pad Dimensions :	Typically 10m x 50cm x 1cm; pad length varies to suit application and pitch size
Heating Pad Spacing:	50cm – 70cm
Heating Pad Depth:	25cm – 30cm
Heating Pad Insulation:	Closed cell polyurethane foam or geotextile (synthetic pitches)
Heating Pad Outer Material:	Water resistant PVC or similar material with hot welded seams
Typical Heated Area:	Standard UEFA pitch of 68m x 105m with a 1m run-off area around the entire perimeter covering 7,490m ²
Number of Heating Pads:	Typically varies from 600 to 700, depending upon pad length, pad spacing, pad orientation and pitch size
Heating Pad Power Consumption:	500W - 600W
Heating Pad Supply:	50Vac 50Hz
Under Pitch Terminal Boxes:	IP Rated; one for every 4 pads laid at pad level
Under-Pitch Cables:	4 core cable laid at pad level
Mains Voltage:	400Vac 50Hz
Transformer (Central Option):	300kVA - 350kVA; 415/50Vac located in mains control room within 30yds of the pitch side
Transformer (Distributed Option):	8 x 40kVA; 400/50Vac within IP rated housings, one per heating zone, mounted under the stadium seats or underground near the pitch side.
Temperature Control:	Air and ground temperature sensors
Root Zone Temperature:	10°C - 18°C

Frequently Asked Questions

Why is zoning the pitch useful?

The zones are designed to enable users to heat only those areas of the pitch that require heating, for example where stand shadow results in delayed thawing. This gives significantly more control to the ground staff, as well as significantly reducing the energy consumption.

Is Inditherm reliable and durable? How long will it survive underground?

Inditherm's CPT has been in operation in a variety of challenging environments for many years. The welded outer material used in the heating pads is extremely robust and proven to last for decades.

Will the pads inhibit pitch drainage?

Comprehensive field and laboratory tests have shown that the heating pads have a negligible effect on pitch drainage.

How much maintenance is required?

Because the Inditherm system is virtually solid state, maintenance requirements are minimal. Ground staff simply need to be trained on how to operate the system.

Should we use manual or automatic control?

Because weather patterns can be very unpredictable, Inditherm recommends that users opt for a fully automated system using ground and air temperature sensors. This reduces the chance of the system not switching on soon enough during a cold spell. It also reduces energy costs, as the sand root zone acts as an excellent heat sink.

Can the Inditherm system be retrofitted under an existing pitch?

Yes. It necessitates removing the turf and root zone but this provides operators with an opportunity to re-establish a really good new surface. Even water and cable systems require the turf to be removed, as mowing them in through the grass usually leaves ridges in the surface.

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