

INDITHERM CONCRETE CURING BLANKETS

DATA & SPECIFICATION SHEET

General Description and Benefits

Inditherm Concrete Curing Blankets are a revolutionary new system providing protection to early age concrete, preventing damage from freezing and ensuring development of adequate strength^[1](ACI 306.1). They use Inditherm's patented, low voltage carbon polymer technology (CPT) to provide the heating. The use of the blankets enable concreting practices to be undertaken in cold ambient conditions, allowing strength development and durability to satisfy service requirements.

Cold weather has been defined as, "a period when, for more than three consecutive days, the following conditions exist":

- The average daily air temperature is less than 5°C (40°F).
- The air temperature is not greater than 10°C (50°F) for more than one half of any 24hr period^[2].

Currently, when a day is deemed a "cold weather day", concreting operations have to be ceased or adequate procedures to protect the concrete have to be put in place. Implications of concreting during periods as defined above result in the following complications:

- The degree of saturation of the concrete falls below critical level.
- The concrete freezes before a minimum strength of 3.5MPa has been achieved.
- The hydration reaction of the concrete stops and the concrete does not gain strength

If frost protection measures are not put in place, drastic measures such as the removal and replacing the cast concrete may be required.

The Inditherm Concrete Curing Blankets can overcome this by maintaining the temperature of the cast concrete at early ages or by raising the core temperature of the newly-cast element to accelerate the rate of strength development of the concrete.

Existing methods are extremely antiquated and generally consume vast quantities of fuel. Traditionally, rather than providing heat directly to the concrete, the ambient in which the concreting is to take place is increased using hot air, and open flame blowers, within a purpose-built temporary enclosure.

Inditherm Concrete Curing Blankets are re-usable, provide even temperature over their entire area and operating at low voltages provide extremely energy efficient heating suitable for on-site application.

Advantages of the Inditherm Curing Blankets

- Increase the core temperature of the concrete, not only ensuring the concrete does not freeze, but also accelerating the rate of strength development.
- Are reusable, so are highly cost effective over time.
- Are easy to manoeuvre into place.
- Eliminates stoppages in concrete procedures as result of cold weather.
- Reduces the risk of carbonation to early age concrete (which can arise from using open flame burners).
- Eliminates the need to erect temporary enclosures.
- Reduces fuel consumption compared to other heating systems.
- Reduces site health & safety risks, compared to alternative methods.
- **Reduces delays and project duration.**

[1.] ACI 306R-88 ACI Committee Document 306. Cold Weather Concreting

[2.] ACI 306.1-90 ACI Committee Document 306. Standard Specification for Cold weather Concreting.

[3.] Carino, Nicholas, J. ., Winter 1984, "The Maturity Method-Theory and Application," Cement, Concrete, and Aggregates, V.6,No.2, pp. 61-73.

Specification

Inditherm Concrete Curing Systems provide optimum performance by combining the following elements:

- The Inditherm heating material** is based upon the patented CPT and is configured to provide the heating performance required. It may simply be required to stop the early age concrete from freezing or to raise the core temperature of the concrete, dramatically accelerating the hydration reaction of the cement, thereby increasing the rate of strength development of the concrete.


- Outer protection** to the blankets is provided by HF welded, heavy duty, impermeable PVC cover available in various colour options. All seams are RF welded and cable input through IP 67 Cable glands. The PVC material is easily repaired using a patch sealed using a hand held warm air heat gun.


- Insulation** is bonded onto the CPT and is a closed-cell, PU mounted foam that prevents absorption of water in the unlikely event that the curing blankets are accidentally pierced or damaged.
- Control units** are manufactured to BS EN60439-4:1991 for on-site electrical distribution and are typically powered from 415/230/115 Volts mains in-put, stepped down to 50 Volts. The control unit enclosures are at minimum IP55 rated, with a lockable internal door with a display & operation interface, and an external door, conforming to BS436, for protection during on-site use. The panels have power-on LED indication and a mains isolator switch.


- The operation of each blanket can be monitored by individual blanket operation LEDs. All power outlets to blankets are protected by DIN-rail mounted circuit breakers, appropriate for the size of each blanket. Panel wiring is in accordance with BS6231. The size of the panels varies, depending on the size of the Curing Blankets and the number of outputs required.
- The control units are rated to SELV (Separated Extra Low Voltage), not normally exceeding 50V, and use an electrically separated earth. A single fault condition will therefore not cause an electric shock. The control units are mounted on a frame with certified lifting eyes for easy transportation around site.
- Cables and Connectors.** The Inditherm Blankets section are powered through multi-core screened (S-Y) cables conforming to BS 7671: 2001. The size and number of cable cores are a factor of the blanket size and the distance between the blankets and the control units. The extension lead connectors are multi-pin 32A, specified to the appropriate standard for the operating voltage of the blankets and the appropriate IP rating.



Installation and Storage

The Inditherm Concrete Curing Blankets can be laid on concrete after a minimum of two hours after casting. This initial delay reduces the risk of damaging the finish to the concrete and inducing internal stresses within the crystalline structure of the hydrating concrete. The blankets are designed to operate up to a maximum temperature of 50°C, gradually increasing and then maintaining the core temperature of the element throughout.



The blankets are stored in rolls and can be rolled out when required. Once the curing period or required concrete strength has been achieved, they can easily be rolled back up for storing or transfer to an adjacent pour site.

The strength of the cured concrete element can be determined by the testing of cubes heated to the same heating profile, by predetermined tables specific to the concrete mix tested at the curing temperature or by using the Maturity Method^[3].

Performance

The following graphs below show the performance of Inditherm Curing Blankets used to line a foundation excavation prior to the casting of foundations.

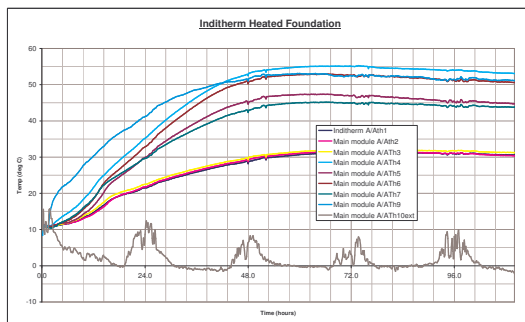


Figure 1

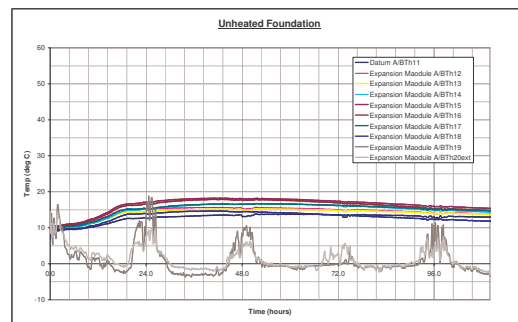


Figure 2

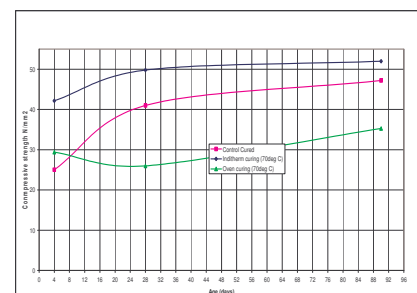
Figure 1 shows the effectiveness of the Inditherm technology to heat concrete a foundation at early ages by lining the foundation excavation prior to casting. Two identical foundations were cast at the same time, adjacent to each other. Figure 1 shows that the excavation lined with the Inditherm technology warmed the concrete foundation throughout to temperatures up to 50°C. In comparison, Figure 2 shows that without heating, the concrete did not reach 20°C throughout.

By raising the core temperature of concrete elements, the rate of strength development can be increased and the stoppages caused by cold weather eliminated. Overall, this results in project time savings. The impact of such time savings can reduce project durations where the duration of a works shut-down period is restricted by time and or cost, or there are penalties for late project completion.

Additional Uses

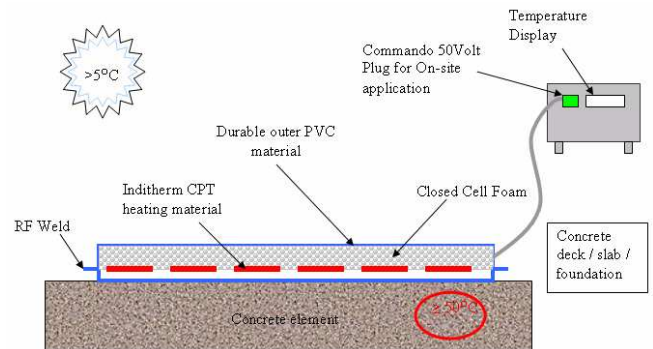
Inditherm Heated Curing Blankets have a number of alternative uses:

- **Ground Heating.** Because concrete should not be poured on frozen ground, the Blankets can be used to heat the ground prior to casting.
- **Preheating Formwork and Falsework.** Heated Blankets can be used to preheat concrete formwork and falsework to prevent temperature shock.
- **De-icing of Aggregates.** Although the use of frozen aggregates for concrete batching is acceptable, there must be no lumps of ice. Inditherm Curing Blankets are an ideal way of ensuring aggregates are ice-free prior to use.
- **Pre-cast Concrete.** Inditherm heating can be used to accelerate the manufacture of concrete elements in pre-cast units, replacing existing, antiquated steam practices. By using Inditherm, concrete cures far more rapidly and trials have shown that **28 day strength can be reached in as little as 4 days**. This has tremendous implications for reducing lead times in manufacturing, cutting energy costs and improving health & safety.



Summary of Advantages of Concrete Curing Blankets

- Allows concreting operations in low ambient temperature conditions.
- Allows earlier release of pre-stress.
- Reduced time to impose loading.
- Reduced stripping time of formwork and falsework.
- Allows more precise project scheduling, as concrete pours are more likely to take place.
- Reduced project stoppages and overall completion time.
- Simple operation.
- Low energy consumption.
- Safe low Voltage.
- Simple storage; re-usable.
- Elimination of temporary enclosures.
- Improved health and safety on site, through elimination of naked flame burners.
- No risk of carbonation to concrete - a consequence of using open flame burners.



All Inditherm Construction Products are manufactured to CE specification and are designed to be used in conjunction with current concrete standards, BS EN 206-1, and BS 8110. The Curing Blankets and control units conform to BS 7671.

About Inditherm plc

Formed in 1998, marketing a new polymer based heating system, Inditherm is established in numerous markets as a cost-effective provider of innovative solutions to difficult heating problems.

Applications include patient warming and muscle heat therapy within the medical sector, critical temperature management within industry, under pitch heating within sports stadia and as an accelerator for concrete curing in the construction market.

Inditherm Conductive Polymer Technology

Inditherm technology is based on a unique carbon-based polymer that generates uniform heat across its entire surface when energised by a low voltage power source.

The Inditherm conductive polymer technology (CPT) has fabric-like qualities and flexibility that enable it to be used on pipes and on most industrial components, including items with shapes that are normally difficult to heat. In addition, it is ideal for heating large, flat areas.

The Inditherm polymer will be encapsulated in an appropriate, insulated outer cover, depending upon the application. Heated pads can be made to a suitable length to fit between brackets, flanges, etc.

Inditherm Construction Development Partners

Inditherm Construction has developed their specialist products in conjunction with the Centre for Infrastructure Management at Sheffield Hallam University, who have provided cutting edge academic support and the use of their specialist testing facilities.



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