

THIN FILM CERAMIC THERMAL COATING

CHARCOAT CTI

REFLECTIVE CERAMIC THERMAL
INSULATION COATING FOR THE PROTECTION
OF VARIOUS SUBSTRATES



CHARCOAT

GENERAL INFORMATION

CharCoat CTI is a new Highly Reflective Ceramic Thermal Insulation Coating that is sprayed direct to the substrate to provide superior insulation and reflectivity. Whether it be piping, tanks, transport, roofing or walls, the superior insulation properties of CharCoat CTI will protect your substrate and reduce energy loss, increase efficiency and prevent corrosion (CUI – Corrosion Under Insulation).

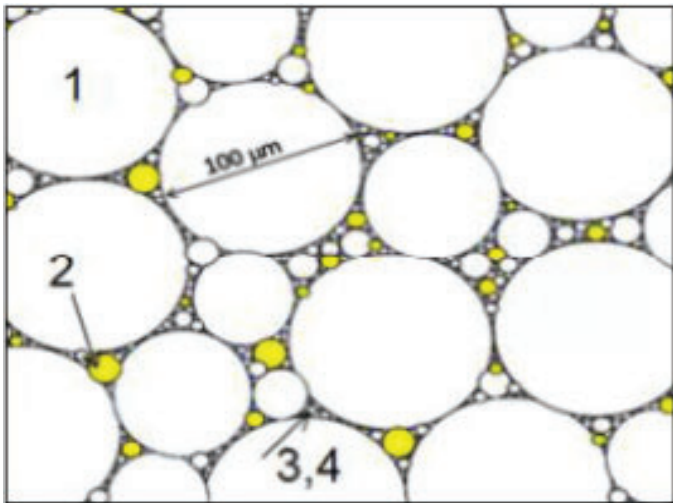
CharCoat CTI can help save on running costs due to less demand for heating and air conditioning. Condensation and radiation properties reduce maintenance. You can insulate even the hardest-to-reach areas. CharCoat CTI Ceramic Thermal Insulation can be applied at high temperatures up to 70°C– no need to stop production.

The CharCoat CTI range of thin-film insulation technology is designed to provide:

- Superior insulation
- Easy application (spray, roll or brush)
- Excellent durability
- Maximum return on investment

The CharCoat CTI products get their insulation properties from a range of different additives including Argon-filled glass microspheres (1), borosilicate microspheres (2) and pigments/carrier (3,4). The additives act to slow down the transfer of energy (heat) through the coating like a cross between double-glazing and regular insulation.

Because of the heat reflection properties, different thicknesses may be required depending on what you want to achieve.



Whilst the standards used to measure insulating materials are not designed for thin-film insulation (ASTM C518), a general comparison between CharCoat CTI and other common materials is shown below:

MATERIAL	THERMAL CONDUCTIVITY (W/mK)
CharCoat CTI	0.022
Fibre insulating board	~0.048
Glass wool insulation	~0.04
Gypsum Board	~0.17
PU Foam Insulation	~0.03
Magnesia Insulation 85%	~0.07
Rock Wool Insulation	~0.045

SPECIAL FEATURES

The CharCoat CTI products prevent condensation, radiant heat transfer, corrosion and water ingress whilst also providing insulation against heat transfer.

- No corrosion under insulation (CUI) issues
- Prevent condensation
- Reflect heat as well as slow down the transfer of heat
- Reduce energy loss, increase efficiency and prevent corrosion (amount depends on thickness)
- Insulate complicated or intricate items
- Insulate items that are already in service
- Easy to inspect for internal and external corrosion without having to remove the insulation
- Provides additional sound insulation
- Can be top-coated with a wide range of different products for colour and additional chemical resistance

This is a significant difference between CharCoat CTI and other 'insulating' products that are actually only heat reflective coatings. CharCoat CTI helps keep you warm in winter and cool in summer – it is true insulation. You will save dramatically on fuel and energy costs whether trying to keep things cool or warm.



PERFORMANCE COUNTS

The following examples of real-world tests are provided as good general examples of how the CharCoat CTI products can assist with your application.

Heated Pipes:



BEFORE COATING TEMPERATURE



AFTER COATING TEMPERATURE

Pipe surface temp was 130°C during application of CharCoat CTI. Multiple heavily diluted brush applications until bubbling stopped, then a regular brush application to give desired total thickness (~4mm).

Heat Flux Measurements:

The images below show a heat flux density measurement of a CharCoat CTI coated and uncoated section of the same pipe. Approximately 1mm thick coating, 63°C substrate, ~50% heat flux density reduction.

Other testing has shown up to 90% heat flux reduction (flow rate of heat through the coating) of 90% at 1mm thick.



UNCOATED PIPE



COATED PIPE

PERFORMANCE COUNTS

The application on a shipping container roof with 1mm DFT, and walls with 0.5mm DFT proved beyond a doubt to show the superiority of CharCoat CTI.



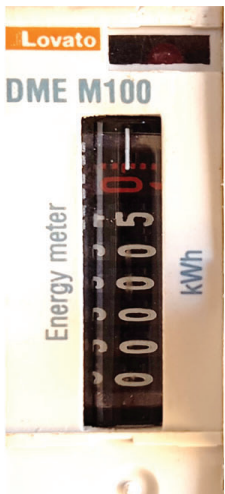
Identical containers along side each other. Identical A/C set to 22°C (cooling only). Measured power consumption and temperature (middle of roof externally and ~1.5m above ground in the center of the container). A/C was maintained for one day, then no A/C for a day.

The CharCoat CTI coated container was 14°C cooler internally without AC. Coated container used $\frac{1}{2}$ power to maintain target temp, the uncoated could not maintain target. The coated container barely went above ambient temperature even without AC. The uncoated internal temp went higher than the coated external temp without the AC. AC has to overcome much smaller temp gap for the coated container. Change in temp vs. time also less for coated due to the reduced heat flux density.

The energy savings shown are very real, and unlike reflective coatings CharCoat CTI can work on the inside or the outside.



Coated Container Before Test, 29.2°C>



<Uncoated Container Before Test, 36.0°C



After 1hr running:

- Uncoated used ~1 kWh to drop temp by 2.6°C
- Coated used ~0.5 kWh to drop the temp 4.9°C
- Nearly twice the cooling with half the power!

Coated Container After Test 24.3°C>



<Uncoated Container After Test, 33.4°C



PRODUCT TYPES

One of the additional benefits of the CharCoat CTI thin-film insulation is that they can be used to reduce thermal expansion of the underlying substrate. This is particularly important for long steel (or even concrete) elements because it can impart significant forces on structural members, fixings and their supports. For instance: large bridge sections, railway lines, pipelines and large span or long steel structures can all undergo significant stresses due to thermal expansion/contraction. Even when designed for the movement, over time the joints & fixings can get fatigued and the members that are resting on supports can get worn down from the constant abrasion against the supports.

CharCoat CTI insulation products can help to minimize the adverse effects of thermal expansion/contraction by minimizing the temperature swings of the material.

Please review the chart below to find the product you may require. Our 2 versions, CharCoat CTI and CTI-300 cover all ranges of thermal protection.



MATERIAL	SURFACE COMPATIBILITY	USES	SUBSTRATE TEMPERATURE IN SERVICE	AMBIENT APPLICATION TEMPERATURE	THICKNESS PER COAT	SUBSTRATE TEMPERATURE DURING APPLICATION	THEORETICAL CONSUMPTION	METHOD OF APPLICATION	FINISHING	NORMAL THICKNESS RANGE
CharCoat CTI	All type of surfaces (except - polyethylene)	General protection, insulation and waterproofing. Medium temp.	-40°C to +210°C (peak +250°C for 1 hrs)	+7°C to +45°C	0.5mm DFT	+7°C to +70°C	1.30L/m ² per 1mm DFT	Brush, roller, spatula, airless spray	Water born Paint, wallpaper, plaster, putty, etc	0.5 - 5mm
CharCoat CTI-300	Metal, brick, stone, wood, plastic, glass	High temp substrate insulation. Higher chemical resistance.	-40°C to +280°C (peak +300°C for 2 hrs)	+7°C to +70°C	0.5mm DFT	+7°C to +70°C	1.30L/m ² per 1mm DFT	Brush, roller, spatula, airless spray	Water born Paint, wallpaper, plaster, putty, etc	1 - 5mm

R-Values: Using SI units, the recommended R-Value is 1mm = RSI-1. This does not include any reflective benefits, it is purely based on heat flow through the coating itself. With reflective properties, the value quickly goes up past RSI-5. All products have effectively the same insulation values, the binders give the different temperature ranges, while the insulating fillers provide the insulating properties.

APPLICATION TYPES

Pipes and Tanks:

CharCoat CTI is perfect for insulating all sorts of pipes and tanks including those in:

Water—Keep water cool in hot climates, or prevent freezing in cold, improves efficiency of boilers and hot water systems, reduces thermal expansion;

Oil & Gas—Eliminate CUI (corrosion under insulation), reduce energy loss into the atmosphere and large financial savings on energy bills;

Chemical Processing—Eliminate CUI, reduce energy loss and save on energy bills;

Mineral Processing—Prevent cold-wall effects on internal tank coatings, eliminate cold wall effects, allow for easy inspection of plant, reduce energy usage by making it easier to maintain optimal temps;

Power Generation—Prevent loss of valuable heat energy when transferring steam, water, etc. Improve efficiency of boilers, economisers, etc. while also making the workplace safer by reducing contact temperatures.



Notes:

Refer to page 4 for temperature limits of individual products.

A chemical resistant top coat may be applied to further protect the coating in particularly aggressive environments.

The measured surface temperature is not proportional to heat loss (i.e. you can touch a coated surface that measures >100°C without getting burnt because the heat flow is very slow).

AVERAGE SUBSTRATE TEMP (°C),	RECOMMENDED DFT (mm)	THEORETICAL CONSUMPTION (L/m ²)
-40 to -20	3	3.8
-20 to 0	1.5	1.9
0 to 50	0.5	0.65
50 to 100	1	1.3
100 to 150	1.5	1.9
150 to 175	2	2.5
175 to 200	3	3.8
200 to 300	4-5	5.2 – 6.5

PRODUCT SELECTION

Selection of the appropriate CharCoat CTI product for your application depends on the substrate and environment you are dealing with (refer to the product table for the required product). As a guide, our minimum thickness recommendations above are based on normal temperature differentials and reduction in heat flux (kW/m²) by approximately 90-95%, noting that thickness can be designed to suit cost-benefit requirements of the application.



APPLICATION TYPES

Containers, Demountable Buildings & Transport:

Normal insulation methods for transporting temperature sensitive goods are bulky and heavy. CharCoat CTI thin-film insulation systems on the other hand are light weight and maximize the usable space within the vehicle, container or structure.

The CharCoat CTI products prevent condensation, radiant heat transfer, corrosion and water ingress whilst also providing insulation against heat transfer. This is a significant difference between CharCoat CTI and other so called 'insulating' products that are actually only heat reflective coatings. CharCoat CTI helps keep you warm in winter and cool in summer—it is true insulation.

You will save dramatically on fuel and energy costs whether trying to keep things cool or hot.



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APPLICATION TYPE	RECOMMENDED Min DFT (mm)	THEORETICAL CONSUMPTION (L/m ²)
Freezer, Rooms, Trucks, etc.	2	2.5
Refrigerated Rooms, Trucks, etc.	1.5	1.9
Storage Containers General	0.5 Walls, 1 Roof	0.65 Walls, 1.3 Roof
Demountable Buildings	0.5 Walls, 1 Roof	0.65 Walls, 1.3 Roof
Temperature Sensitive Liquid Tankers	1+	1.3+
Bitumen Trucks (External Surface)	1.5	1.9

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In general though, for this type of application you will be using either CTI or Metal variants. Typical applications & Thicknesses are given in the table above.



APPLICATION TYPES

Commercial & Residential:

CharCoat CTI is a very simple way to add non-flammable insulation to new or existing commercial or residential buildings. Common uses includes:

- Workshops and processing plant internal or external lining to improve working conditions,
- Warehouses and other steel clad buildings to maintain desirable internal temperatures with minimal A/C,
- Food processing and storage sheds to maintain optimal temperatures,
- Insulation of container homes to improve available internal space,
- Coating to reduce mold and mildew by preventing condensation,
- Internal or external coating of walls to improve thermal efficiency and improve acoustic insulation,
- Roof Coating to waterproof, prevent corrosion and provide insulation (thermal and acoustic).



Notes:

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APPLICATION TYPE	RECOMMENDED Min DFT (mm)	THEORETICAL CONSUMPTION (L/m ²)
Metal Clad Sheds for Roof Storage	1.5	1.9
Warehouses, Containers, & Workshops	0.5 Walls, 1 Roof	0.65 Walls, 1.3 Roof
Cold Storage Sheds (Refrigerated)	1.0 Walls, 1.0 Roof	1.3 Walls, 1.3 Roof
Condensation Prevention	1+	1.3+
Roof Waterproofing (External)	1+	1.3+
Internal Walls for Sound & Thermal	0.5 (better for sound)	0.65

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In general though, for this type of application you will be using either CTI or Metal variants. Typical applications & Thicknesses are given in the table above.



APPLICATION TYPES

Steel Members and Cladding:

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Selection of the appropriate ChaCoat CTI product for your application depends on the substrate and environment you are dealing with (refer to the table for the required product).

In general though, for this type of application you will be using either CTI or Metal variants. Typical applications & thicknesses are given in the table above.

APPLICATION TYPE	RECOMMENDED Min DFT (mm)	THEORETICAL CONSUMPTION (L/m ²)
Railway Lines & Crane Beams (foot & web)	0.5	0.65
Steel Bridge Girders & other structural members	0.5 - 1.5 depending on temperature range	0.65 to 1.9
Large Sheds / Cladding Runs	0.5 - 1.5 depending on temperature range	0.65 to 1.9
Pipelines (reduce thermal gradient only)	0.5	0.65



APPLICATION INFORMATION

CharCoat CTI products are designed for ease of application as well as excellent performance. Whilst they can be applied with brush, roller or trowel, we recommend spray application wherever practical. The Graco Ultramax II 795 airless sprayer or equivalent/better is recommended. Tip sizes will vary depending on the intricacy of the surface. Common tip sizes are 225, 325, 523 and 519. We do not recommend going lower than a 17thou tip.

Larger tips are fine provided the layers are built in no more than 700microns wet (without dilution). Application pressure should be between 500-1200psi. Any more and the microbeads may be damaged which can cause cracking of the coating. For optimal curing, allow 24hrs between coats.

A primer layer is recommended—a diluted version of the CharCoat CTI product (watery without separation) for well prepared substrates.

APPLICATION INFORMATION

For application at less than 90°C minimal dilution is recommended for the main coats. For applications above 90°C the product should be diluted between 40-50% with potable water and applied in thin layers until the bubbling has stopped, then regular application can proceed to desired thickness. Photos to the right show a 130°C T-section during and after application.



Filters should be removed from the gun and spray machine, and in cases where the material may have formed a crust around the edges of the bucket it should be strained through a filter sock to remove any particles that may clog the tip. A 30 mesh machine filter can also be used in some cases if the crusty material is minimal.



Disclaimer: The above data, particularly the recommendations for the application and use of CharCoat Passive Fire Protection products are based on the manufacturer's knowledge and experience. Due to different materials and conditions of application, which are beyond our control, we recommend in any case to carry out sufficient tests in order to ensure that CharCoat Passive Fire Protection products are suitable for the intended purpose and applications. Therefore, any liability for such recommendations or any oral advice is expressly excluded unless we have acted willfully or by gross negligence. It is always the responsibility of the installer / purchaser to guarantee correct preparation, DFT (CharCoat Coatings) and thickness (CharCoat Firestop Products) of all CharCoat Passive Fire Protection products. CharCoat Passive Fire Protection is not liable for installation or faulty installation. It is always the responsibility of the installer / purchaser to guarantee and certify the installation of materials.



CHARCOAT

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