

Carbotherm® 3300

Users Guide

The following is a user's guide for the proper specification, use, and application of Carbotherm 3300. This insulative acrylic has several primary uses as detailed below.

Protection of Workers From Hot Surfaces

Carbotherm 3300 provides an outstanding thermal barrier to protect workers from burns. Due to the unique formulation, Carbotherm 3300 dramatically reduces the heat transfer (heat flux) from steel substrates. It is generally accepted that skin cells are damaged (1st degree burns) when the live cells located slightly below the skin's surface are exposed to temperatures above 60°C for more than 5 seconds. By applying 3300 at the proper thickness will ensure a sufficient barrier is in place to protect workers from hot surfaces. The following chart is provided based on the work done as presented in NACE Paper (Determination of Skin Burn Temperature Limits for Insulative Coatings Used for Personnel Protection; Howard Mitschke; Corrosion 2012) using a thermesthesiometer (TM) in accordance with ASTM C1055, C1057 and ISO 13732-1. Standard modeling of burn temperatures are invalid for thin film insulative coatings and explains why the TM yields valid data.

Recommendations: The thickness recommendations below cover ambient temperatures up to 38°C (101°F) for the substrate temperatures given. The thicknesses represent a sufficient thermal barrier to prevent 1st degree burns on bare skin when exposed for no longer than 5 seconds.

<u>Substrate Temperature</u>	<u>Thickness of Carbotherm 3300</u>
150°F (65°C)	20 mils (0.5 mm)
200°F (93°C)	40 mils (1.0 mm)
250°F (121°C)	40 mils (1.0 mm)
300°F (149°C)	60 mils (1.5 mm)
350°F (177°C)	80 mils (2.0 mm)

Reduce the Effects of Solar Radiation on Steel Substrates

Exposed steel can often reach temperatures above 140°F(60°C) in the mid day sun. Pressure vessels or storage tanks that contain volatile materials can cause those vessels or tanks to release pressure during sunny days. The amount of volatiles can be surprisingly large and can significantly contribute to plant volatile emissions. Carbotherm 3300 is outstanding in preventing dramatic temperature increases on steel substrates exposed to thermal (sun) radiation. Substrates protected with Carbotherm 3300 can often stay cooler than bare steel by some 25-30 degrees. Recommendations for bare steel surfaces using Carbotherm 3300 is listed below.

Recommendations:

40 mils (1.0 mm) are normally sufficient to help reduce steel substrate temperatures from solar radiation. Additional thickness of Carbotherm 3300 may be used and will further reduce the temperature differential but only by a few degrees. The temperature differential becomes increasingly smaller with additional insulation thickness.



Carbotherm® 3300

Users Guide

Curbing CUI (Corrosion Under Insulation)

Standard insulation types (calcium silicate, rock wool, etc) do not bond to the substrate they are placed over. Metal jacketing installed over this insulation most often fails in its attempt to keep moisture out. Water eventually finds its way unimpeded to the steel substrate, picks up contaminants (chlorides and sulfates) along the way, and initiates and accelerates corrosion. Constant wet/dry and thermal cycling makes standard insulation ineffective and costs industry millions of dollars each year in corrosion related issues. Because Carbotherm 3300 uses a corrosion resistant primer specially chosen to resist CUI; coupled with the inherent “direct-to-substrate” bonding (unlike standard insulation) serves to provide excellent corrosion protection for these applications by minimizing water entry to the steel substrate. Furthermore the product can be easily removed for substrate inspection and then easily repaired for quick “back-in-service” capability.

Provide Insulation to Vessel and Piping

The insulative properties of Carbotherm 3300 are excellent. Its thermal conductivity value is exceptionally low and similar to calcium silicate or fiberglass insulation. However the required film thickness needed for its use as a insulative barrier (to keep heat in) would have to be “inches” thick and therefore uneconomical for its use in that manner. However Carbotherm 3300 is a liquid applied insulative coating and can therefore be used where conventional materials cannot be used due to complex geometries or excessive labor costs or both. While each application is unique, the effectiveness of any insulation is dependent on many conditions including air flow and other ambient conditions; object geometries; vertical or horizontal configurations; and the like. In laboratory testing on 4” square piping, Carbotherm 3300 applied in thicknesses up to 200 mils (5 mm) showed 25-30% efficiencies over hot surfaces compared to bare steel with no insulation. The chart below shows thicknesses tested for hot surfaces and the resultant efficiencies compared to bare steel.

Recommendations:

<i>Substrate Temperature</i>	<i>Carbotherm 3300 Thickness</i>	<i>Efficiency</i>
250°F (121°C)	100 mils (2.5 mm)	11%
250°F (121°C)	150 mils (3.7 mm)	26%
250°F (121°C)	200 mils (5.0 mm)	30%

Provide Sound Dampening in Noisy Work Areas

Excessive noise in mechanical rooms, engine rooms, and the like are often magnified in rooms where steel and metal walls and bulkheads are common, such as on-board ships. The low density of Carbotherm 3300 can “deaden” sound waves from bouncing around the work space and dampen the noise level. Depending on the geometry of the room and the extent of use; Carbotherm 3300 can reduce the noise levels by at least 5 decibels.

Recommendation: One or two coats of Carbotherm 3300 at 20-25 mils (0.5 mm)/coat is usually sufficient to sound dampen a room or work space.



Carbotherm® 3300

Users Guide

Application Guidelines and Tips

The following is provided to aid the user in the proper use, mixing, and application of Carbotherm 3300. More detailed application instructions are provided on the product data sheet. The following highlights and emphasizes tips which have proven useful to users.

Typical Application Method: The product is best applied through a standard airless spray set-up for both ease of use and production. For smaller areas or for touch-up the material may be applied by brush or even trowel (flat surfaces). Brush or trowel application can result in uneven dry film thicknesses. Specific equipment, pressures, tip sizes, etc are provided on the data sheet for Carbotherm 3300.

Do's

1. Do remove the diffuser from the spray tip or use a spray tip without a diffuser.
2. Do remove all filters from the pump, lines, and spray gun.
3. Do use minimum 3/8" material line.
4. Do use material at temperatures higher than 50°F(10°C).
5. Do use over appropriate primer.
6. Do topcoat when exposed to excessive moisture conditions.

Don't's

1. Do not thin material.
2. Do not exceed 2500 psi material pressure when spraying.
3. Do not allow to freeze.
4. Do not over shear material when mixing. Use a paddle-type drywall mixer in reverse.
5. Do not apply more than 25 mils/coat.
6. Do not recoat too early. Topcoating too quickly can result in trapping water in the film resulting in blisters. If blisters occur, simply cut out the blister and reapply material to repair the area.

Carbotherm® 3300

Users Guide

Troubleshooting Problems

Carbotherm 3300 is a very easy product to apply. It has very good film build properties and will dry to touch rather quickly. As such, there is a tendency to want to recoat the material too soon or apply it too thick per coat. Doing so will increase the potential for blister formation when the substrate it is being applied to goes into elevated temperature service (above 200°F). The information below explains this phenomenon, what causes it and how to prevent it.

Q: Why do blisters form?

A: The primary cause for blister formation is water trapped in the film trying to get out. This is most often observed during rapid start-ups where the substrate temperature rises quickly. Water trapped in the film turns to steam and forms a blister trying to leave the film. Slower, more gradual temperature increases, if controlled, will minimize the blister formation.

Q: Where does the water come from?

A: Carbotherm 3300 is a water-based formulation; so the primary source of water is inherent in the product. However, if Carbotherm 3300 is left exposed (untopcoated) in a wet environment it can absorb water in its film, which can also lead to blistering under rapid temperature excursions.

Q: How do I get the water out and keep it out?

A: Preventing the water from being retained in the film is the best method to solve the blister formation phenomenon. Do not apply the material too thick per coat (no more than 25 mils/coat) and do not apply the material too soon between coats. Applying the material with good air movement across the film and/or applying the material to warm surfaces or hot operating equipment (up to 300°F) will dramatically aid in water release from the film. Hot surfaces will drive water out of the film and air movement will pull water out of the film. When applying over hot surfaces, take care to apply the material in thinner coats to avoid skinning over and trapping water during application. Blisters could form immediately and is an indication that the film thickness being applied is more than the coating can handle given the specific surface temperature. Simply back off on the thickness per spray pass and allow the water to evaporate.

Q: What are the best conditions to apply Carbotherm 3300?

A: Any condition that will facilitate the water to leave the film is best when applying Carbotherm 3300. These include:

- Warmer ambient temperatures are better than cooler temperatures
- Lower humidity is better than higher humidity
- Good ventilation is better than poor air movement
- Warm or hot substrates are better than cold substrates
- Applying thinner coats will be better than thicker coats when the conditions mentioned above are less than ideal

